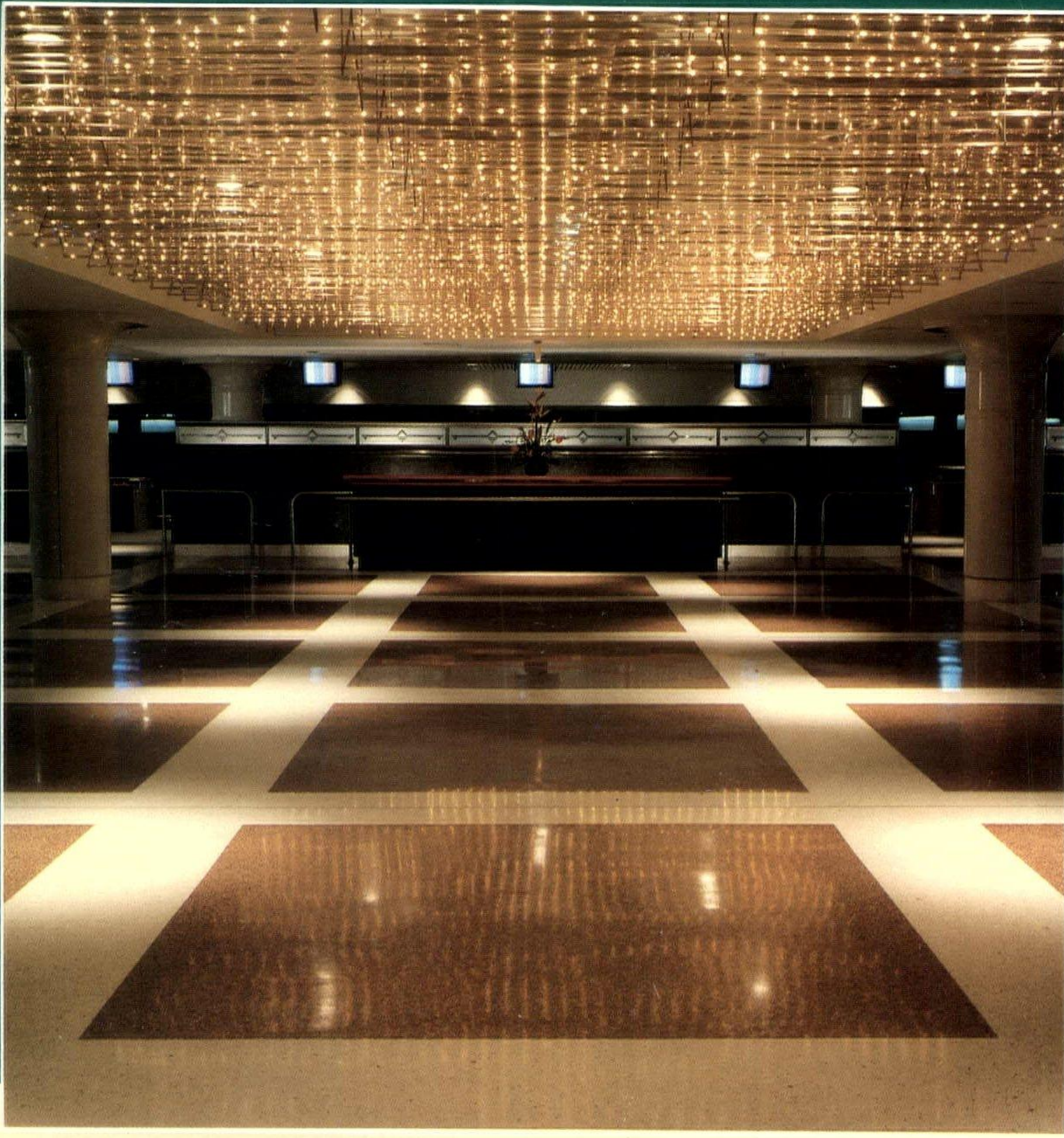
ARCHITECTURAL LIGHTING



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IES
SOUTHEAST FLORIDA SECTION

Circle 2

Letters to the Editor

Efforts overlooked

The November 1986 issue of *Architectural Lighting* included an article featuring the sculpture "Lupus" at the Lotus Development Corporation headquarters in Cambridge, Massachusetts.

As the architects of record for this project, we are sensitive to any publication associated with it. I am therefore compelled to cite a misnomer in the credits accompanying the text. Though the Lotus Development Corporation occupies the complex housing "Lupus," Lotus is not the client who underwrote the creation of the sculpture or its lighting design. That distinction belongs to Cabot, Cabot and Forbes of Boston, who were developers for the building. David Carter, who served as project manager, demonstrated the faith and vision to engage John Raimondi and Horton•Lees Lighting Design in a joint effort to create a lighting scheme for Mr. Raimondi's sculpture. Any success that evolved was a direct result of Cabot, Cabot and Forbes sponsorship. Efforts such as Mr. Carter's too often go unnoticed. They should not go unmentioned.

The Stubbins Associates, Inc.
James F. Beyer, Associate

AL covers many projects, and many people are involved in any successful project. So, inevitably, we will overlook an important contributor from time to time. We are committed to accuracy and welcome letters such as the one above.

The Editor

Keep in touch

We want *Architectural Lighting* to be your forum for lighting issues of all kinds and invite your letters on subjects of interest to our readers.

Address your letters to Charles Linn, Editor, *Architectural Lighting*, 320 North A Street, Springfield, OR 97477.

ARCHITECTURAL LIGHTING

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BPA membership applied for September 1986.

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LIGHTING

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ARCHITECTURAL LIGHTING
February 1987
Volume 1, Number 2

Cover Story

Articles

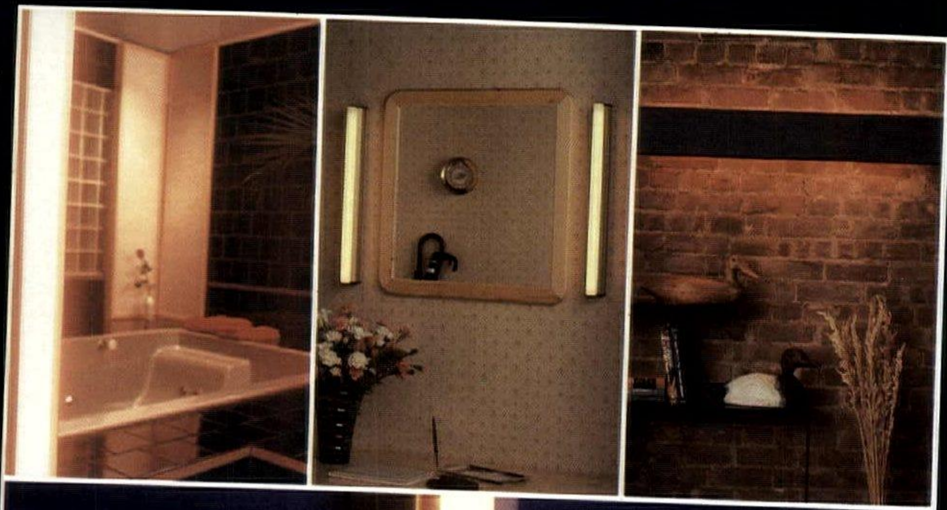
Statements

Columns

Departments

LINCANDESCENTS

masterful strokes of incandescent warmth convert ambience into ambiance



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From the Editor

Nobody needs to be told how to use a magazine — you read it. True enough. But this magazine was founded on the philosophy that it must be more than pretty or entertaining — it is designed to be a useful tool for you, the design professional.

Before our first issue was published, we often undertook the arduous task of describing our vision of the magazine-to-be and how readers, advertisers, potential contributors, and authors could use it. That was necessary at the time. What is exciting now is feeling that we have produced a useful product. Now that our third issue is in your hands, we don't have to describe how we hope you'll be able to use a potential magazine. You have the real thing.

How to Use This Magazine

Read it. Here's why. Every article in this magazine sets out to impart practical information. Stuff you can use to solve problems in your work. We pursue our articles from this point of view: if something is done on a project, there must be a good reason for it. We set out to explore and explain those reasons, so you can make similar judgments on your projects.

Respond to it. Reader communication is our lifeline to the professions. If you'd like us to address a certain topic, drop us a line or give us a call. If you have questions about an article we've run, ask us. Most of our authors are happy to respond. If we've made an error, we'd like the opportunity to put it right. If you think you have a better solution to a problem we've addressed, or a good solution to one we haven't addressed, get in touch. We'd like to talk about it.

Check the Manufacturer Credits. If you see something you'd like to use in one of your projects, check for information in the Manufacturer Credits on the last page of each issue. We put a great deal of effort into this section every month because we know that being able to locate the manufacturer of an item pictured in an article can often make a big difference in your work.

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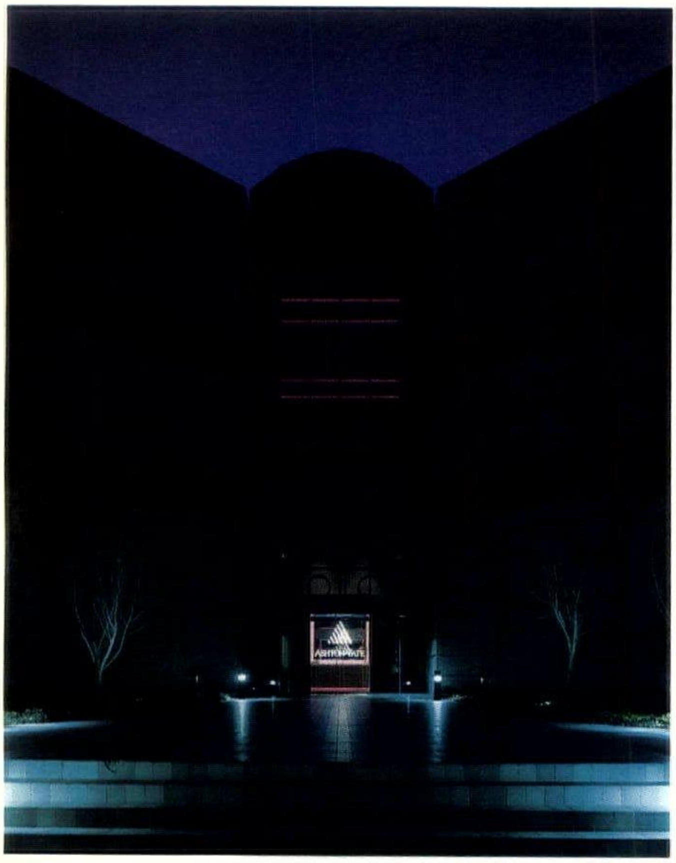
Charles Linn, AIA

Neon goes high-tech — from boardroom to corporate image



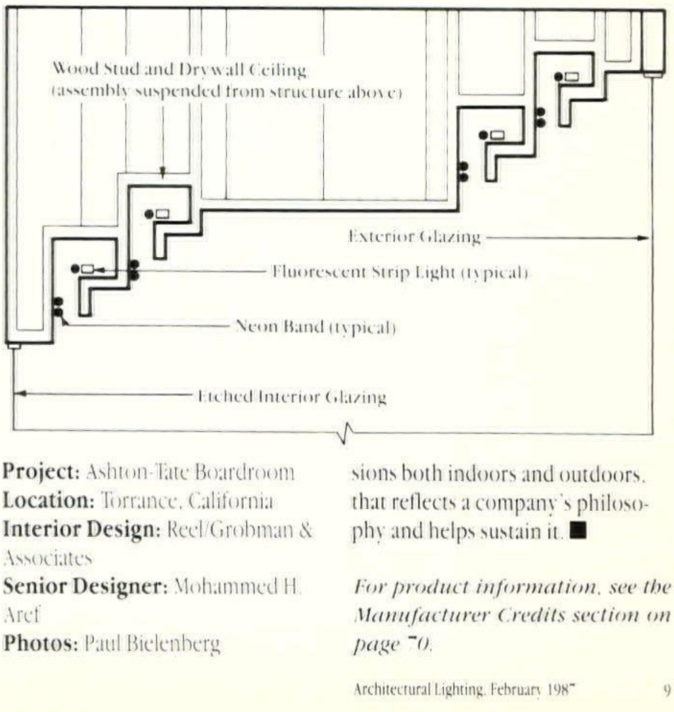
Like many of California's computer-related industries, Ashton-Tate sprang from rather humble beginnings but soon found its 450-employee company outgrowing an ad hoc arrangement of cubicles. So the company asked Reel/Grobman & Associates to design a new headquarters that would promote communication and team interactions and reinforce the company's high-tech image.

The clients chose senior designer Mohammed H. Aref's open office design that specified one conference room for every 10 employees. These rooms are set off with full-height glass partitions with etched bands that repeat the company's logo and allow sunlight to filter into the central work areas.

The designers took a dramatic approach in the company's third-floor boardroom, which features a series of stepped, drywall soffits that reach a full height of 16 feet. Four bands of fuschia-toned neon lights, each 25 feet long, are carefully placed; their soft glow shows through the etched glass partition between the corridor and the boardroom. Thus, the four neon bands are visible from the front courtyard entryway; at night, they can be seen even from nearby freeways.

Additional lighting in the boardroom includes recessed continuous fluorescent luminaires adjacent to the neon lights that provide soft indirect light, accentuating the architectural steps of the ceiling. Deeply recessed incandescent ceiling luminaires feature upper reflectors chosen to avoid creating hot spots on the boardroom table.

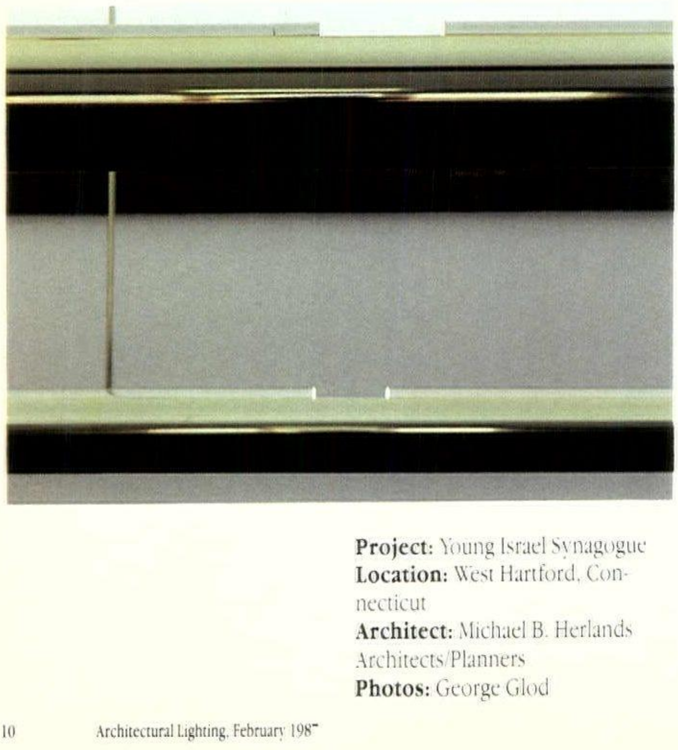
The use of neon in the Ashton-Tate boardroom is a bold office design statement that creates a serene and spacious feeling and becomes a signature for a rapidly growing and fast-paced computer software firm. No less an accomplishment is the achievement, by careful planning, of an integral lighting effect that has repercussions both indoors and outdoors, that reflects a company's philosophy and helps sustain it. ■



Project: Ashton-Tate Boardroom
Location: Torrance, California
Interior Design: Reel/Grobman & Associates
Senior Designer: Mohammed H. Aref
Photos: Paul Bielenberg

For product information, see the Manufacturer Credits section on page 70.

Tube-mounted metal halides set devotional mood in synagogue



Project: Young Israel Synagogue
Location: West Hartford, Connecticut
Architect: Michael B. Herlands Architects/Planners
Photos: George Glod

Fire had severely damaged the interior of the Young Israel Synagogue when architect Michael Herlands was given the assignment of refurbishing the synagogue. One of the most useful tools at his disposal, Herlands found, was light: "I wanted to change the building subtly. I wanted it simple, without gingerbread, so that the room would not distract the congregation from their reason for being there."

In this respect, Herlands faced several design challenges. The synagogue's roof line has a tall peak in the center, with two flat areas at either side, a configuration similar to an A-frame atop a flat roof. Indirect light would accent the sloped ceiling and make it appear even higher, which the designer saw as undesirable.

To direct attention away from the ceiling area, Herlands commissioned a six-foot-diameter round stained-glass window that softens the starkness of the large blank rear wall. To solve the immediate lighting problem — providing enough light for reading during a service without making the light source obtrusive — Herlands selected a polished brass tubular lighting system that both provides a graphic element and illumination via metal halide lamps.

The standard diameter for the brass luminaires is 8 inches, but the designer secured 12-inch tubes in 8-foot lengths, each fitted with a dozen 150-watt metal halide lamps. Five 8-foot sections were connected to create the two 40-foot-long sections installed at either side of the stained-glass window, thus accentuating the stained glass as the focal point of the room.

Wood beams in the ceiling were left exposed, but other areas of the ceiling and walls were covered with insulation and plasterboard, then sprayed with sand paint. This finish yields a surface smoother than that of acoustical tile and allows the luminaires to create a halo effect over the entire sanctuary. "I used metal halide instead of fluorescent because it brings a different tone or softness and allowed us to provide the amount of light needed in the space," Herlands says.

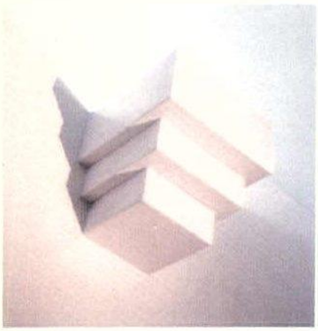
An additional bonus is the low maintenance requirements of metal halide lamps. The interior of the synagogue is lighted by 120 such lamps. Herlands observes, "I don't expect the lamps will need to be changed for at least two years — or even longer — because they are not used constantly."

An additional design consideration was the need in an orthodox sanctuary to provide separate seating sections for men and women. Herlands located the men's section in the center, under the vaulted space; the women's area is a raised platform, gently sloped to provide unrestricted views of the altar and the ark. A brass rail, echoing the gold tone of the luminaires, separates the two sections.

Herlands feels that the coordinated color scheme of the synagogue works to good advantage, but the key, he says, is lighting: "The light from the metal halide lamps is warm, not glaring. A person walking into the sanctuary has a comfortable feeling; the starkness that used to be there has completely disappeared." ■

For product information, see the Manufacturer Credits section on page 70.

Champagne Taste shows in upscale men's clothing store



Project: C.T. Man
Location: Sonoma, California
Interior Architecture: Stephanie Cissno, Light Source
Lighting Designer: Randall Whitehead
Photos: Ken Martina and Betty Schumacher

Customers entering the C.T. Man clothing store in Sonoma are never blinded by the light. To the contrary, the first thing they may notice is the smart clothing on display. That's just how lighting specialist Randall Whitehead planned it.

Whitehead and his colleagues at Light Source designed the lighting for Champagne Taste, purveyors of fine clothing for women. The owners approached Light Source again after they leased an old feed store to convert to C.T. Man, an upscale men's clothing store. The structure was in disrepair, but the landlord agreed to refurbish it to the architectural specifications. Whitehead, in short, had a free hand — along with a tight schedule and a limited budget.

First, the laminated beams along the flat portion of the ceiling were fitted with troughs and lined with fluorescents, using energy-saving warm white (3000 degrees Kelvin) lamps, overlapped to eliminate dark spots. Part of the structure had been a hayloft; it was left open and was bottom-lighted to add visual interest and to increase the sense of height.

Next, the entire floor plan was set up on a diagonal, which permitted a variety of creative innovations. The display windows and floor mannequins were illuminated with 6-volt, 16-watt integral transformer track systems using MR # 16-type lamps that are rated for 10,000 hours. Significantly, these luminaires are fitted with honeycomb louvers that eliminate glare; in this way, attention is drawn to the clothing, not to the track lighting system.

The diagonal design was established in part by shelving and hanging units, all of which have integral lighting to reduce shadows. Toplighting in these units gives additional fill light.

The tops of the taller side units feature ziggurat detailing for additional visual interest. Bare fluorescent lights behind the ziggurats provide backlighting for added dramatic impact. Much of the area behind the units is used for storage, and the bare lamps provide excellent task lighting there.

Some of the area behind the clothing units is devoted to dressing rooms. These are illuminated with custom wall sconces that repeat the ziggurat theme. They are fitted with two 9-watt compact fluorescent lamps and an asymmetric forward reflector.

A unique aspect of C.T. Man's lighting scheme is the use of colored tube sleeves that produce subtle, colored backlighting effects. Pink, blue, and yellow sleeves are kept on the premises.

The entire shop, including display lighting, was illuminated at an average reading of 80 footcandles and uses 3.3 watts per square foot. Whitehead is justifiably proud that the project was completed ahead of schedule and under budget. More important, however, he can be proud of a lighting scheme that throws light on C.T. Man's clothing without distracting a customer's attention. ■

For product information, see the Manufacturer Credits section on page 70.

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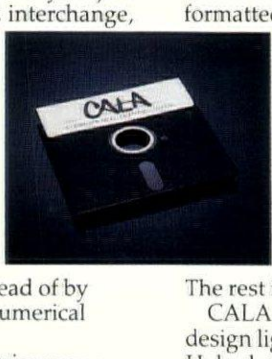

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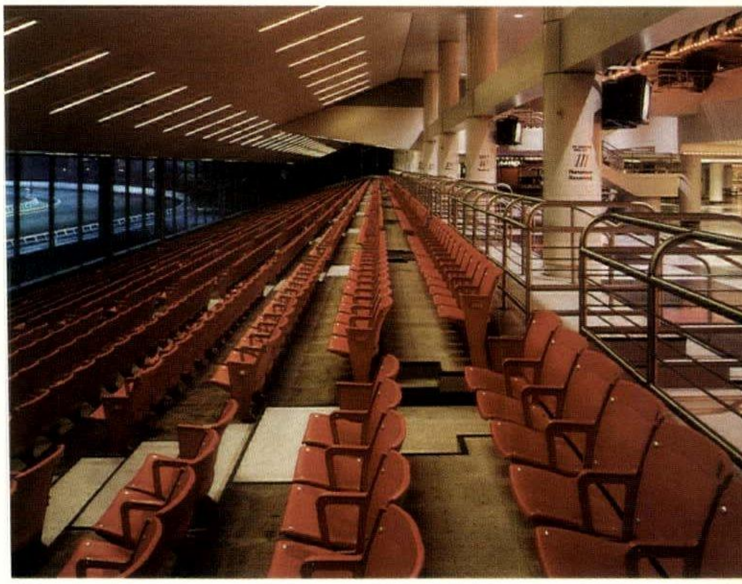
CALA will provide graphics and calculate data on every major type of lighting application, though not all at once.

Circle 5

Light leads the way for horse racing's new image

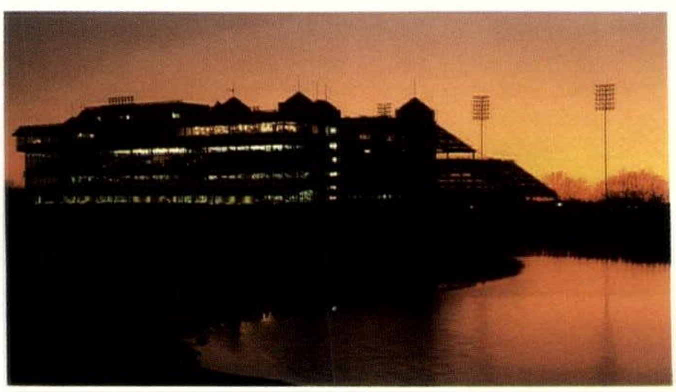
ARTICLE BY
CHARLES LINN, AIA

PHOTOGRAPHS BY
TOM CRANE



When people think of horse racing, they may think of the racing facilities commonly portrayed on the late show — large open-air grandstands full of swearing, fedora-hatted cigar-chewing bettors standing elbow to elbow on blackened concrete floors covered with discarded racing forms and bits of tickets that didn't win, place, or show.

The original Garden State Park bore no resemblance to the seamy racetracks of the movies. Built in the 1940s just outside Philadelphia, it was a landmark in Cherry Hill, New Jersey, until it was destroyed by fire in 1977. The track's new owner, International Thoroughbred Breeders, Inc., decided to turn adversity into opportunity. A new facility could rise, phoenix-like, on the old site; but it would be more than a replacement. They would commission a new facility that could remake the face of the horse racing industry. It would not only attract a new generation of racing fans but also would compete with the new upscale Atlantic City casinos. Designing such a facility was the challenge of veteran track



Project: Garden State Park
Location: Cherry Hill, New Jersey
Client: International Thoroughbred Breeders, Inc.
Architects: Ewing Cole Krause, sports facilities division of Ewing Cole Cherry Parsky, Philadelphia, PA
Project Director: Robert J. Krause
Grandstand-Clubhouse Designer: John B. Di Ilio
Crystal Paddock Designers: John B. Di Ilio and Robert J. Krause
Interior Designer: Deborah P. Knast
Interior Consultant: Richard Muchnik
Lighting Designers: Alfred R. Borden, IALD, and Lawrence Bartlett, IES

Views of the Phoenix level (facing page) and Clubhouse level (above).

architect Robert Krause, president of Ewing Cole Krause, and the project designer, John Di Ilio.

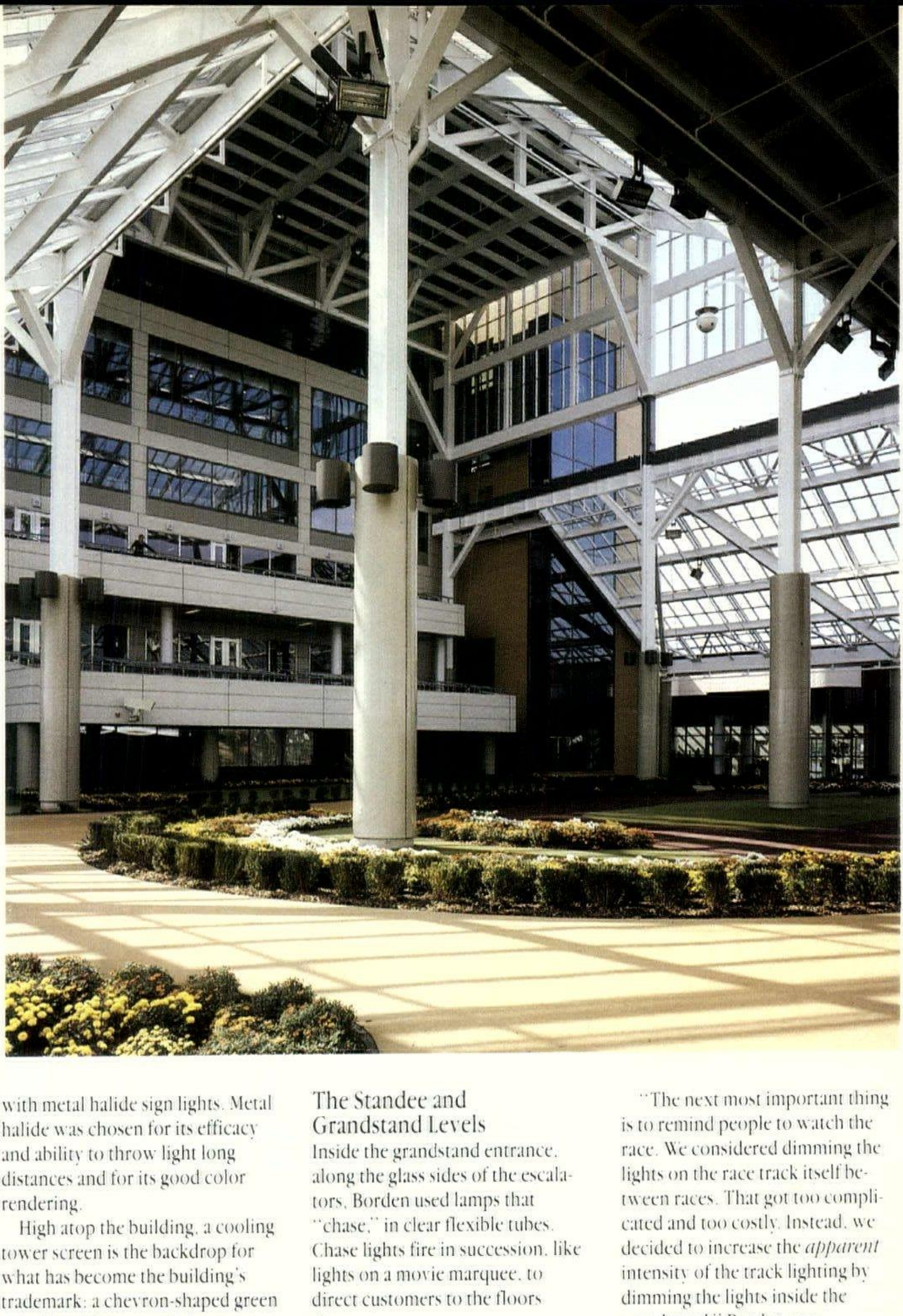
"It's been known for a while that horse racing has to market to new fans to remain economically viable. And now, it has to compete with Atlantic City, which is only 50 miles away," says Krause. "We knew that the image established by the architecture of the new Garden State Park complex would have to be very strong to succeed in those objectives and that both the exterior and interior lighting would play a key part in establishing that image.

"With few exceptions this is basically a night operation," says Krause. "The building is a place of public assembly, a place of entertainment. Because it is in a very visible location in Cherry Hill, the building has to become a dominant part of the vista — it has to be able to attract attention to itself at night. But it also has to advertise itself as a friendly place for recreation. Looking at both the form of the building and how the form would look illuminated from various locations began to help us establish our design concepts," Krause says.

"The original structure was a rambling Georgian affair, with red brick and white wooden clapboard siding and spires of a colonial character," says Di Ilio. "The new building, as it evolved, has the same red brick and white horizontal metal panels to evoke recollections of the old building at highway scale. The materials, the spires, the flags, and the use of layers of vertical planes all attempt to capture that rambling country-fair feel of the original. For some who weren't familiar with the original, the building may evoke images of Camelot, Disneyland, or some kind of magic kingdom. We know it is crucial to create a memorable image that is friendly and inviting and that people can easily see will be a fun place to go for an evening to find out about racing. That's important to get a new market — families and urban professionals — off the highway and in here to see what's going on."

As is the case in retail architecture, this project needed to communicate a sense of activity to the outside in order to attract patrons to the inside. The architects knew that making portions of the building transparent at night would communicate activity to motorists on the highway and a sense of direction to patrons walking toward the building from their cars. Light floods the exterior from glass atria over the clubhouse and grandstand entrances and from the large glass roof over the Crystal Paddock, where the Thoroughbred horses are saddled and walked for patrons' viewing just before they're taken to the starting gate.

"We knew that we wanted a lot of glass, so that light from the interior would get outside the building," said Krause. "Thus we can achieve the look of a glittery palace, which is difficult to do without a tremendous amount of exterior floodlighting. You can't put a bunch of floodlights out in the parking lot because people bump into them and trip over them. So we achieved the effect by using the light and activity visible through the glass from the interior



of the building."

Lighting designer Al Borden echoes Krause's sentiments. "We were trying to emphasize the depth and perspective of the building; and to do that, we used a lot of contrasting light levels. The brightest lights on the entry face of the building are concentrated on the glass atria over the clubhouse and grandstand entrances. The structure of these has been outlined with incandescent light strings. The stair towers that flank the atria entryways are built of darker red brick and deliberately left as darker silhouettes to emphasize the sense of entrance," Borden explains.

Where they were floodlighting the lighter planes, such as the fronts of the spires, Borden says they decided not to try to achieve the even wash usually used on such surfaces. They positioned the fixtures to provide graduated light — lighter at the bottom to darker at the top. The top of each beam of light overlaps the bottom of the next beam up. "So you get a pleasingly irregular pattern of light over the great white planes," Borden says. "This is to exaggerate the sense of the height of the spires."

Behind the spires, a two-story wall of windows and white metal panels is illuminated at a much lower level to exaggerate the depth and horizontal layering of the planes of the building as they recede.

Most of the exterior floodlighting on the building is accomplished with metal halide sign lights. Metal halide was chosen for its efficacy and ability to throw light long distances and for its good color rendering.

High atop the building, a cooling tower screen is the backdrop for what has become the building's trademark: a chevron-shaped green neon band that extends between the two spires. "You can see it for miles," says Di Ilio. "And the peak of that green neon band is aligned with the finish line. So we're bringing the race out and incorporating it into the front of the building."

Arriving at the building, patrons head for one of two different downlit canopies, depending on where they plan to spend their evening at the races. Those who purchase tickets for general admission seating and standing-room-only, known as "standees," enter under the larger canopy and take escalators to their floors. Patrons bound for the plush Phoenix level take elevators from a smaller canopied entrance at the north.

The Standee and Grandstand Levels

Inside the grandstand entrance, along the glass sides of the escalators, Borden used lamps that "chase," in clear flexible tubes. Chase lights fire in succession, like lights on a movie marquee, to direct customers to the floors above.

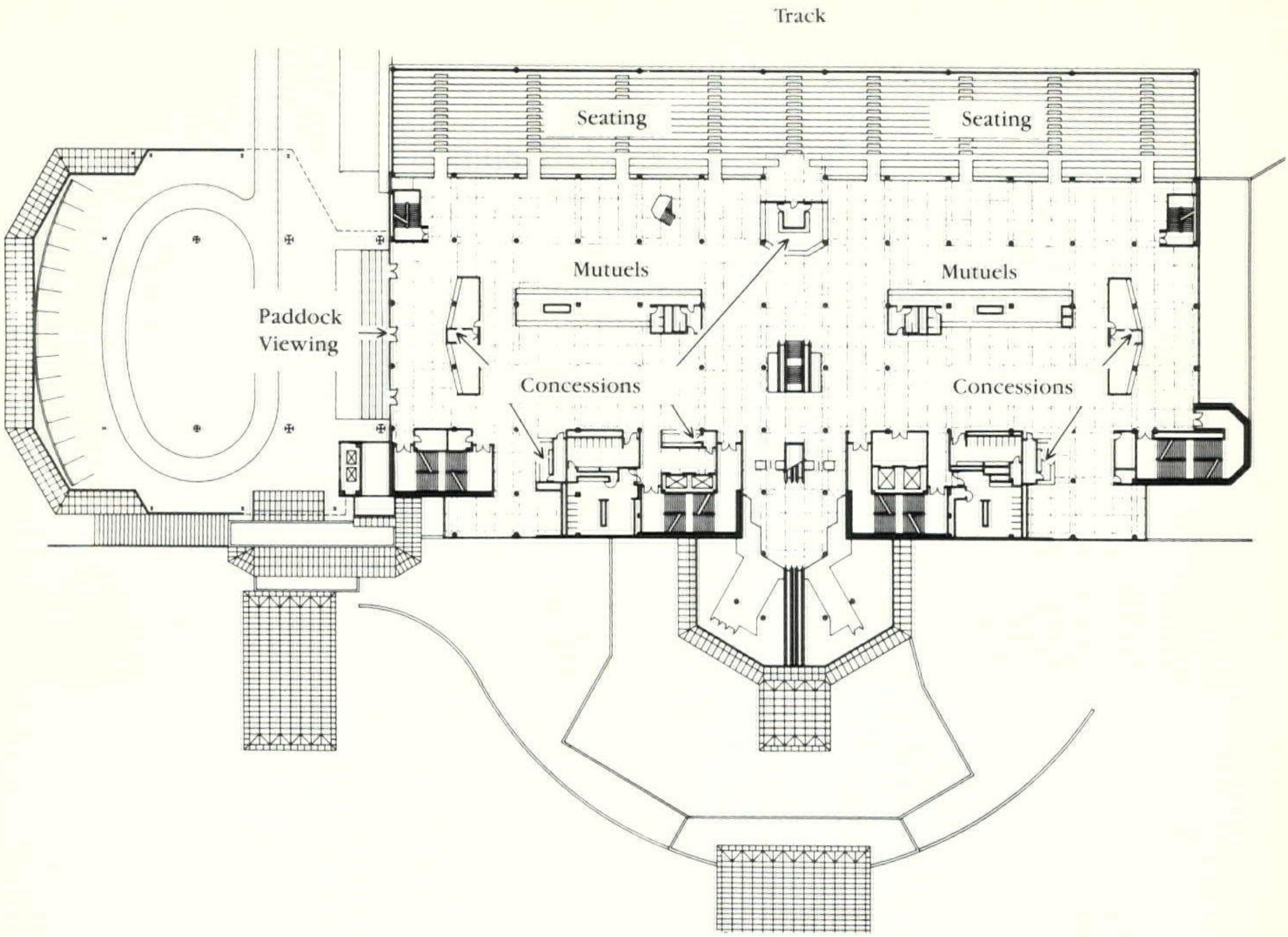
"Once you've gotten people into the grandstand and standee levels," says Borden, "and they're standing around handicapping or looking at one of the television monitors or watching the horses, you want to get them moving over to the mutuel lines. You want to keep reminding them that there's a race coming up, and it's time to place a bet." So, there also are chasing light strings running toward the betting windows on these floors.

"We're directing the bettors right over to these lines," Borden says. The mutuel counters are the brightest areas on the floor, about 70 footcandles, while the circulation space around them is about 15 footcandles.

"The next most important thing is to remind people to watch the race. We considered dimming the lights on the race track itself between races. That got too complicated and too costly. Instead, we decided to increase the *apparent* intensity of the track lighting by dimming the lights inside the grandstand," Borden says.

"The horses come to the starting gate, the bugle is blown, and the fade begins." The chasing over the mutuel lines freezes, and the wall washing behind the mutuel counters dims. The lighting over the grandstand seating and the standee areas (baffled recessed fluorescent) dims to about 40 percent, and the race begins. The lighting directly over the mutuel lines is not dimmed, but is kept at a consistent level. "Some bettors stay on the lines all the time," Borden says, "and we don't want them to lose their reading lights.

"The corollary benefit to all of this is that when the light is lower the glass wall between the spectators and the track becomes more



Interior views of Crystal Paddock (above and facing page).

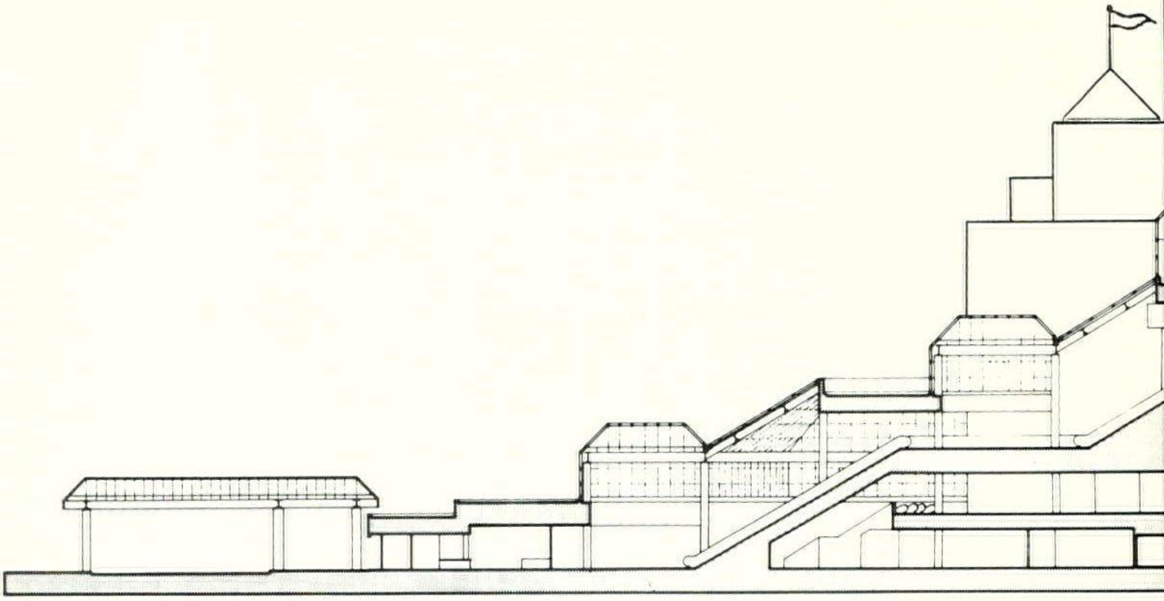
transparent. The glare on the television monitors is controlled by placement of lighting and louvers, and the monitors are easier to see.

"We settled on the idea that the simple statement is usually the best statement," says Borden. "You can't really create a crescendo with the lighting. The crescendo is created by the race itself. Our aim was to direct attention to the most important activity occurring at the time. After each race is over, the light strings at the mutuel lines start chasing again, the other lights come up, and the whole process repeats itself."

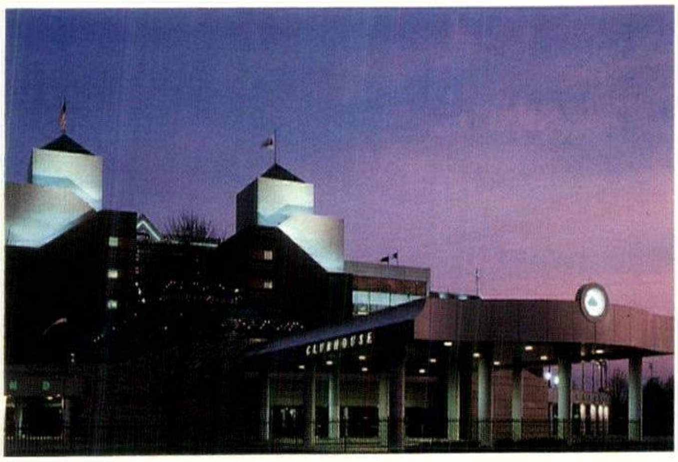
The Clubhouse and Phoenix Levels

On the more exclusive upper levels, the finish materials are richer, and the lighting is more subtle. Unlike the baffled direct fluorescent lighting used on the floors below, light in the upper levels is reflected off polished materials, making the incandescent spot light more indirect and task-oriented.

Patrons entering the Clubhouse



Section through main entry to Grandstand-Clubhouse.



level by escalator walk over a grid of polished terrazzo under a chrome metal pan ceiling lined with light tubes (see cover). Intersections of the terrazzo grid have been emphasized by recessed PAR 38 downlights. Glass block mutuel counters are illuminated from behind by low voltage incandescent "peanut" lamps placed on grout lines, rimming the blocks with light.

The coffered bays over the mutuel lines at this level have polished chrome metal pan ceilings. The sides of the coffers are lined with concealed fluorescent strips custom designed by Borden. The fluorescents project light downward through 4-inch-wide baffles, and sideways to the coffer side through narrow vertical slots 2 inches on center and 10 inches high. These slots are reflected in the ceiling, giving the bays an illusion of additional height.

At the Phoenix level, floors and some walls are done in polished white-veined black marble; ceilings are polished brass. Custom-made polished-brass table fixtures, fitted with compact fluorescent lamps, are used in the bar and restaurant areas as well as at the mutuel lines.

"The Phoenix is a big place, but we intended to create a setting quieter and more intimate in scale than is on the other floors — sort of a refuge from the craziness that's going on elsewhere. We did that by using light in a much more controlled way. The flashiness comes from light reflecting off the materials, rather than from making the lights themselves do the flashing," says Borden. "The lights on these two floors dim at post time, just the way they do on the other floors, but the effect is much more subtle. The lighting is certainly a lot more subtle to begin with."

Twin brass lamps frame each mutuel window opening at the Phoenix level. "We wanted to give this counter an ambience very similar to what you'd find in a traditional bank," Di Ilio notes. "It scales down the size of the operation, at least subliminally. It gives patrons a feeling of individual attention, security, and the feeling that their transactions have a great deal of stability. Going up to the counter is a very important decision for the people on this level, and we want to be as inviting as possible."

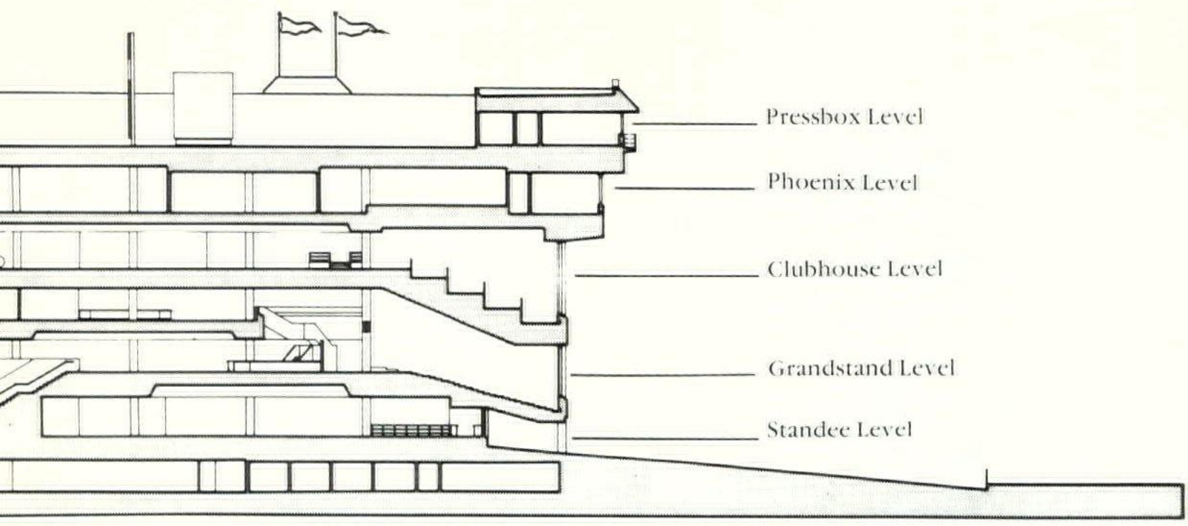
The Crystal Paddock

The Crystal Paddock is a five-story glass arena where viewers from every spectator floor in the building can see prerace action. The direct view from each floor is a unique feature of Garden State Park that allows bettors to view the horses as they are saddled and led around the walking ring one last time before the race begins.

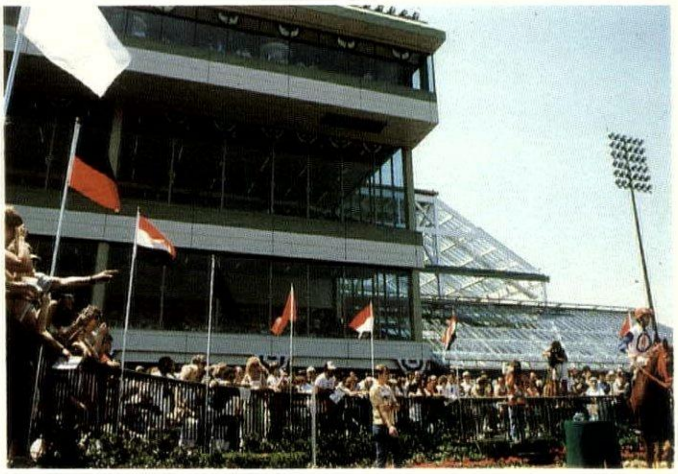
The walking ring is lit to an average of 50 footcandles with metal halide floodlights for television. The general illumination comes indirectly from four 400-watt canned metal halide uplights surrounding each support column.

Racetrack Lighting

"The track lighting is innovative and a little different from most of the things being done that year," says track lighting designer Larry Bartlett. "We had an opportunity to



LARRY BARTLETT



start from scratch, which isn't normal in this business. Usually you're retrofitting an existing application.

"We wanted to come up with the most efficient, most economical system we could; so we selected a metal halide lamp and fixture combination that would give us extremely precise optical control. Using a computer design program, we set out to minimize the number of fixtures and to maximize pole spacing. That seems like a pretty obvious approach, but you have to know something about Thoroughbreds to understand its limitations," Bartlett says.

"These horses have problems with depth perception, so when they see a shadow on the track, they may perceive it as a hole, and try to jump over it. In a race, that could be a disastrous situation for everyone. So, we have to keep the brightness-contrast ratios between the light and shadows very low — about two to one," says Bartlett.

When the race starts, there are about 100 footcandles at the starting gate. As the horses pull away toward the first turn, the light level gradually drops until it reaches about 50 footcandles at the backstretch. This increases the perceived distance between the spectators and the horses and increases tension at a point in the race when great acceleration can occur and a lot of positions in the race can change. As the horses get closer to the finish line, and the excitement in the stands is starting to build, the horses become brighter and brighter.

As the horses enter the home stretch, additional instant-restrike metal halide lamps come up (in just 15–20 seconds) to add 125 footcandles to the 100 footcandles already illuminating that part of the track. The intense illumination is needed for the finish-line photos that are made at the end of each race.

"The fact that the horses appear to be farther away than they really are on the backstretch makes them appear to be coming around to the homestretch faster than they really are," says Al Borden. "The sense of drama and theatricality is reinforced by the pre-post dimming and freezing of the chase lights on the inside. When the photo-finish lights come on in the last few seconds of the race, it's truly a spectacular finish."

What is truly significant about the lighting at Garden State Park is the degree to which it has been organized to enhance and help complete a complicated series of activities — without becoming overwhelming. From giving the building a strong nighttime identity to providing security and a sense of entry in a vast complex, to orchestrating the betting and racing cycle, every step is carefully calculated by the Ewing Cole Krause design team to make the lighting come out a winner. ■

For product information, see the Manufacturer Credits section on page 70.


HOW TO MAKE A
BRILLIANT REDUCTION.
(ACTUAL SIZE 39-WATT FLUORESCENT)
A REGISTERED TRADEMARK OF GENERAL ELECTRIC COMPANY. C-623

Let there be light: A design for meditation

Stephen P. Schuber

Stephen P. Schuber is contributing editor for Architectural Lighting.

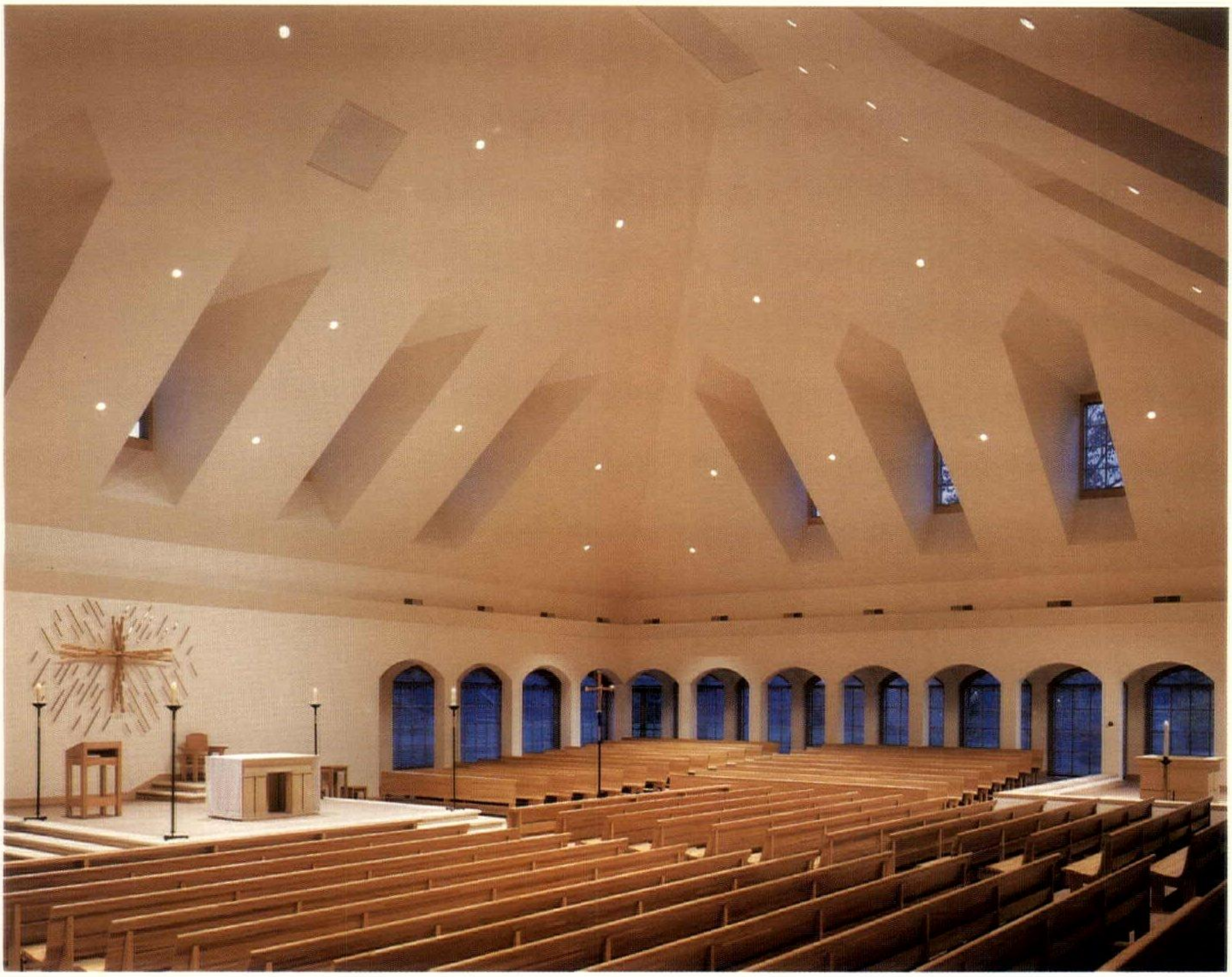
Project: Our Lady of Grace Church
Location: Edina, Minnesota
Architects: Hammel Green and Abrahamson, Inc., Minneapolis
Lighting Designer: Carol Chaffee, IALD, HGA Lighting Design
Photos: Koyama Photography

Houses of worship hold a special place in the history of architecture: for centuries, these marvelous structures displayed to the public the best of the architects' skills. In lending their craft to fulfilling spiritual needs, architects ministered both to individuals and to society as a whole. At the same time, architects had opportunities for subtle manipulations of volume, light, and shadow to produce contemplative moods befitting these edifices.

Concerns such as these preoccupied architects at Hammel Green and Abrahamson, Inc. as they were designing Our Lady of Grace Church for a Catholic congregation in Edina, Minnesota, a western suburb of Minneapolis.

Unlike many of its older counterparts, this church is simply detailed and devoid of colored glass and ornament. Entry to the worship space is through arched wooden doors that lead into a single-story ambulatory, the outside of which contains expansive clear glass windows. An arched colonnade defines the perimeter of the worship space and opens it to the surrounding natural environment through the clear glass windows in the ambulatory. At the same time, the seating gathers the congregation around three sides of the altar, creating a sense of community and unity of spirit.

As people enter the worship space, their eyes are drawn upward by the vaulted ceiling, with its deeply cut dormers and open cupola. That space thus becomes a vast, open theater for the interplay of light and shadow. Dynamically changing daylight fills the space. Reflected light plays with shafts of sunlight or a passing cloud to create visual texture. The articulation of the surfaces with natural light takes

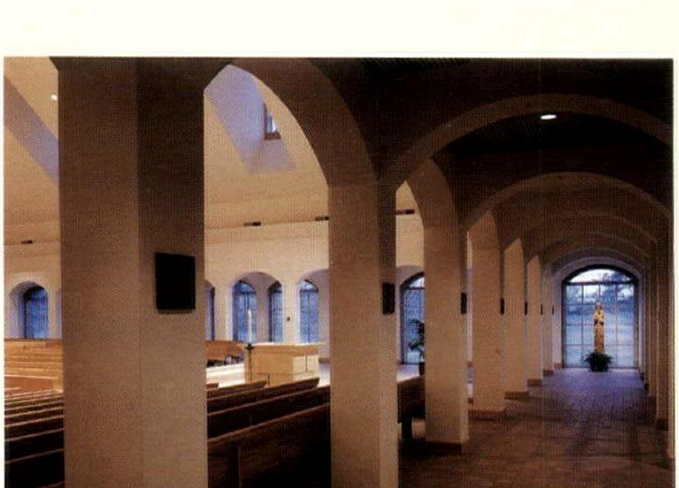


Sanctuary with downlights lit.

emphasis off the individual, creating an impression of privacy and introspection. Below, the interior finishes warm the luminous environment.

Lighting designer Carol Chaffee reports that philosophical concerns were foremost, noting that "it was our task to develop an architectural lighting system that would complement the variability and color of natural light and reinforce the impressions it creates, but also enhance the human experience with controlled environments for focused attention or contemplation." The parish building committee also requested that the lighting be designed for ease and flexibility of use, as well as permit shifting of visual emphasis to various areas in the church. As a result, the lighting design was selective illumination of vertical and horizontal surfaces with varying intensities of light.

Tungsten halogen light sources were selected because they can be easily controlled and provide good lumen maintenance, dimming capability, high color temperature, and excellent color rendering. The tungsten halogen source is used in three systems: recessed downlighting, uplighting integrated in a cove



surrounding the worship space, and accent lighting.

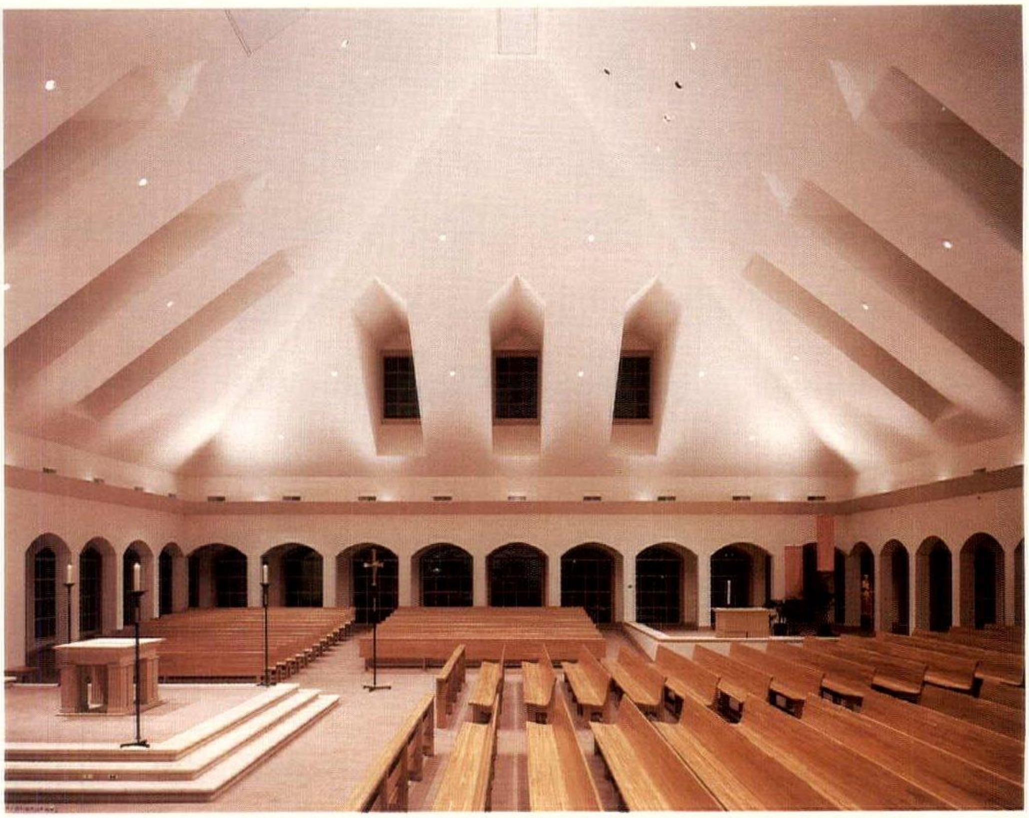
The downlighting system consists of ellipsoidal reflector luminaires fitted for the 9/12 ceiling slope. These luminaires provide 45-degree and 60-degree beam distributions and use both 250-watt and 500-watt frosted T 4 lamps. Each luminaire has a matching 5-inch aperture.

To achieve a soft wash of illumination on the ceiling, narrow-distribution reflector assemblies with 500-watt T 3 lamps are mounted inside the cove around the perimeter of the worship space. Light thus is directed up and across to the opposite ceiling. Accent luminaires use 250-watt PAR 38 quartz lamps in narrow spot and flood configurations. Finally, incandescent downlights with wide-beam distributions are used in the arched ambulatory to frame the worship space in soft light.

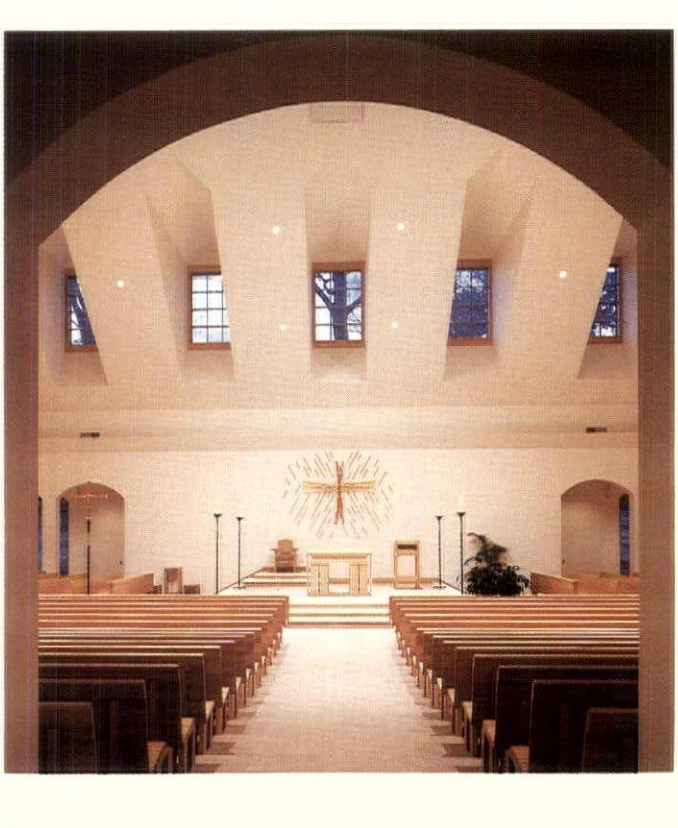
All the lighting is controlled by a computer-based preset dimming system, which permits creating various zones of downlighting, uplighting, and accent lighting. These zones can be manipulated independently or in combination to create a variety of scenes and focal emphases. For example, horizontal surface illumination by closely spaced narrow-beam downlighting over the altar, baptismal font, and choir areas allows the celebrants and their activities to be visually prominent.

Accent lighting highlights the altar, the chair, the lectern, and the cross. Seating areas are illuminated to a lower level by downlights with broader distribution.

The carefully controlled lighting environment, in short, permits flexible adjustment as the need arises. During the day, the lighting serves to draw attention to one particular area. At dawn and dusk, the subdued mauve sky tones soften ceiling angles, and the luminaires become starlike, creating a special environment for meditation. At night, the lighting emphasizes the altar, but can be shifted to other areas or changed to raise light levels to highlight the seating areas and promote social interaction. When the ceiling is bathed by uplighting, the background assumes greater importance. While downlights accentuate a certain area, the ceiling can be softly illuminated to create a sense of intimacy for reverent attention.



Sanctuary at night.



The lighting system at Our Lady of Grace Church allows the parish to achieve specific effects, from softened focus to high drama to joyous celebration. The simple detailing of this Catholic church is not typical of its kind, nor is the lighting. Its exceptional integration into the architecture allows light to enhance the human and symbolic experience. ■

For product information, see the Manufacturer Credits section on page 70.

To create successful custom fixtures, understand manufacturer

Stephen W. Cole

Stephen Cole is president of C. W. Cole & Company, Inc.

You have an idea for lighting a space. You know what effect you're after and the source that will require, but fixture selection is a problem. Fixture design is recognized as a vital project element, so decisions cannot be made casually.

Today, many manufacturers direct innovative design attention to even standard products. In many cases, however, a standard product — no matter how desirable — is simply not what a lighting designer wants to use on a particular job. Apparently a need will always exist for custom designs: sometimes because of demands for style, mounting, or finish, sometimes for a characteristic unique to a particular project, or simply because of the ever-important ego factor involved in creating an architectural statement.

Familiarity with manufacturing criteria can help designers avoid unnecessary costs, delays, and problems.

The custom fixture manufacturer, working in conjunction with the lighting designer, must meld a designer's requirements with its ability to make an appropriate fixture. Manufacturers have their own considerations when they look at new designs. A designer's familiarity with manufacturing criteria at the earliest possible stage in the development can avoid unnecessary costs, delays, problems, and even embarrassment. Conscientious manufacturers truly want to make fixtures that will meet all expectations, and they can be expected to provide information freely toward that goal.

A Coordinated Effort

Coordination with a suitable manufacturer at an early stage of design is of great benefit. The designer should have a reasonably firm concept of the general style, dimensions, light source, materials, and finish before contacting a manufacturer. But, it is unwise to be totally committed before obtaining some manufacturer input.

No doubt the first thing any manufacturer will want to know is the quantity to be fabricated. Quantity determines not only the availability of components and the method of manufacture, but may also influence the company's willingness to undertake a project. Larger quantities do not necessarily increase a manufacturer's enthusiasm; each will no doubt have a preferred quantity range.

Difficulties may arise from some specification requirements. Custom designs are usually required in such a limited quantity that extensive development — such as that expected of a standard production fixture — is impractical. Some relatively foolproof rules of thumb can help you minimize the potential for problems.

Specifications and Safety

Manufacturers are concerned with safety and acceptability by inspectors. Probably the source of potential difficulty least recognized by designers is the heat problem. Our industry is skilled and talented at predicting optical properties, but heat characteristics cannot be as easily determined. Nearly every component of a fixture and its surrounding mounting surfaces can cause a problem at some temperature level.

Clearly, a surface fixture with free airflow has little likelihood of presenting a design problem. Recessed incandescent and high intensity discharge (HID) designs are most likely to cause difficulties; even a thermally protected HID ballast may not solve them. A protected ballast effectively eliminates fire danger, but a cycling ballast will not please clients. Fixtures with thermally protected fluorescent ballasts are easily fitted into most mounting conditions, as are those with the low-wattage ballasts not available thermally protected.

A fairly safe approach to custom design is to begin with the known properties of a standard fixture and modify it as necessary for a certain project's unique requirements.

Incandescent fixtures have been the subject of extensive regulation and are best used in custom designs where the source can be safely separated from mounting surfaces. Ceiling designs using incandescent sources are best when pendant-mounted or otherwise dropped from the ceiling surface. Similarly, wall sconces are generally safe designs with incandescent lamps. Thermally protected HID sources fall somewhere between incandescent and flourescent in ease of fitting.

Another fairly safe route for custom design is to begin with the known properties of a standard fixture and modify it as necessary for the unique requirements of a certain project. This way, while optical performance and laboratory listings are kept intact, appearance can be customized. If the standard fixture manufacturer does no custom work, numerous manufacturers are available to work with another's basic fixture.

Keep It Simple

A straightforward design is another way to minimize difficulties. Too much precision fitting of components, concealing of fastenings for maintenance, and skimping on mounting — among other possibilities — can backfire. A designer certainly can have a preferred Plan A, but in the face of complications, should be prepared to accept a Plan B.

Without a full working sample that tests fit, stresses, heat characteristics, accessibility, and other factors, a manufacturer will sometimes have to make changes on the production floor as the need arises. A sample is one choice, of course, but eventually someone has to pay for it; the cost of a sample can be significantly higher than the cost for production fixtures. Allowing some adjustability in the location of the lamp, reflector, or mounting can better ensure satisfactory results. Adjustability, however, adds somewhat to cost and also sets up conditions for future maintenance workers to incorrectly relocate the elements.

The cost of a sample can be significantly higher than the cost for production fixtures.

Finish specifications should be as precise as possible; an ambiguous finish specification gives a manufacturer insufficient information for selecting either suitable materials or manufacturing processes. Plated and polished finishes, in particular, must be specified at the outset. Matching color alloys may not be available in certain materials — in particular, brass alloy sheet, tubing, and pipe. Plating or otherwise

Continued on page 51

Four light levels illuminate corporate boardroom

Georg Stahl

Georg Stahl holds an architectural engineering degree and a master's degree in architecture. He is a principal designer at Griswold, Heckel & Kelly Associates, Inc., Chicago.

Ameritech is one of the regional communications companies created by the 1984 breakup of the Bell System. Headquartered in Chicago, Ameritech owns the Bell companies serving Illinois, Indiana, Michigan, Ohio, and Wisconsin and several other communications-related subsidiaries. To make itself known as a new company with its own identity, Ameritech immediately wanted to establish a corporate headquarters. The company hired Griswold, Heckel & Kelly Associates, Inc., as space planner and interior designer.

Project: Corporate headquarters boardroom
Location: Chicago, Illinois
Client: Ameritech
Lighting and Interior Designer: Georg Stahl
Architect: Griswold, Heckel & Kelly
Electrical Engineer: Rick Meyers of Schmidt, Garden & Erikson
Photos: Georg Stahl and Bruce Van Inwegen

During the preliminary design phase, Griswold, Heckel & Kelly formulated a plan for the new corporate boardroom and contracted with the New York–based Wilke Organization, an audiovisual consultant. Wilke's involvement during this phase of the project benefited not only the audiovisual program but also the subsequent lighting design of the boardroom.

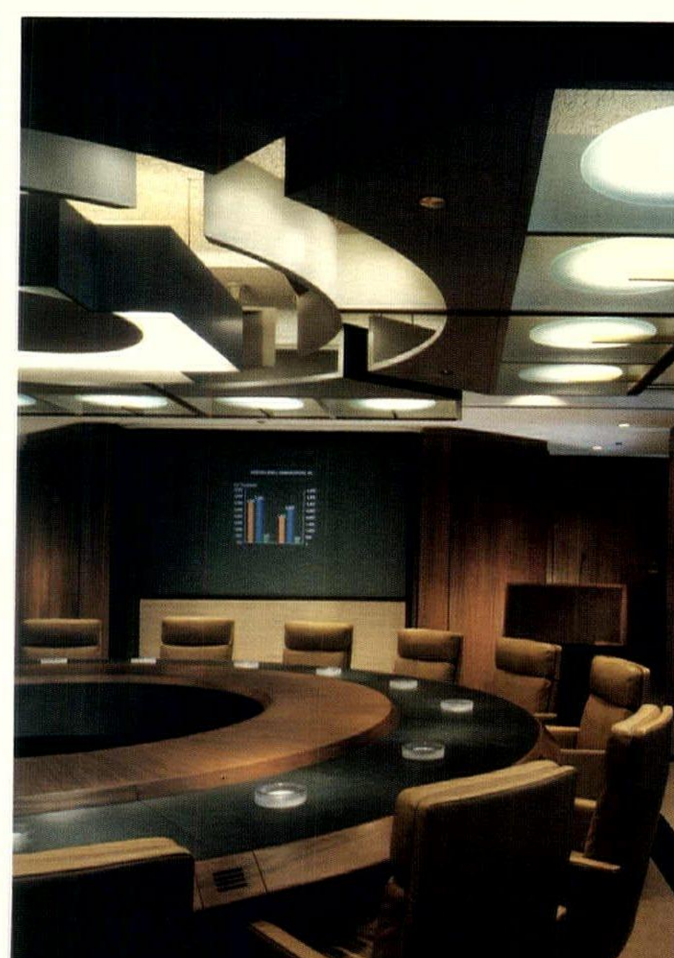
Wilke's research showed that effective integration of audiovisual presentations and board meeting procedures depends largely on a well-designed lighting system. The consulting firm suggested installing a central, preset dimmer-control system that permits four different light-level settings: pre- and post-conference illumination, conference illumination, projection illumination, and normal illumination for maintenance and other uses of the boardroom. All four settings can be activated from the chairman's position, from the lectern, at the entrance, and from the desk of the secretary to the board.

The boardroom lighting was consciously designed as a continuation of the room's architecture. The shape of the five-part suspended lacquered-wood structure was developed as a reflection of the floor plan. Circles and squares were intertwined in a configuration that, when translated into solids and voids — open and closed parts — resulted in a three-dimensional, sculpture-like structure.

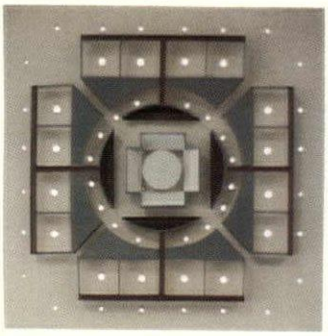
Luminaires — some recessed, some surface-mounted, and some mounted inside the structure — direct, reflect, and diffuse the structure's light sources. At each light level, the appearance of the structure changes as the lit and unlit parts appear to advance and recede through the intricate interplay of light and shadow, of solids and voids.

A scale model that simulated the major light effects in the boardroom was used to demonstrate the proposed lighting solution. Models are particularly useful for structures with a high degree of spatial complexity. They can confirm the designer's intent and communicate this intent to clients.

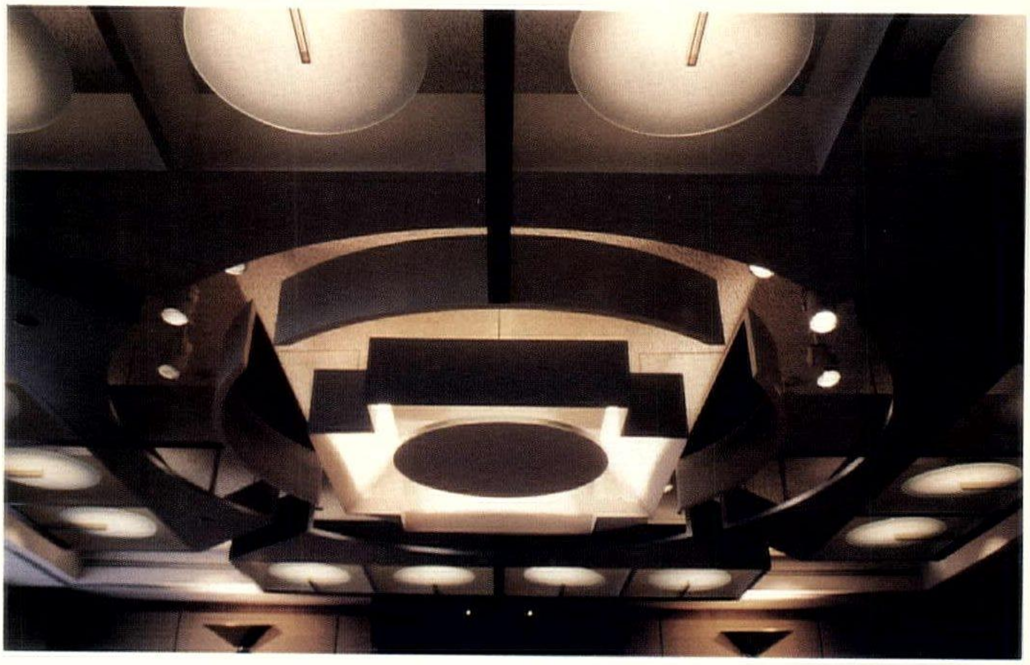
Although it may seem that the functional aspect of the design was



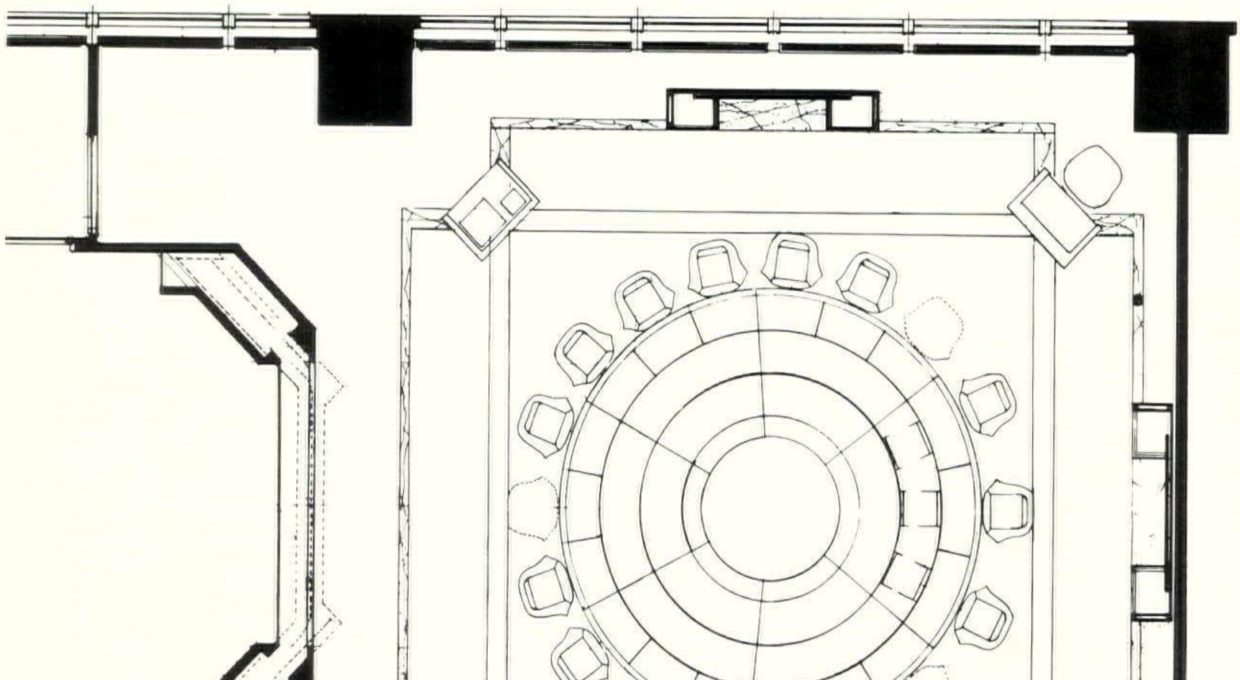
BRUCE VAN INWEGEN

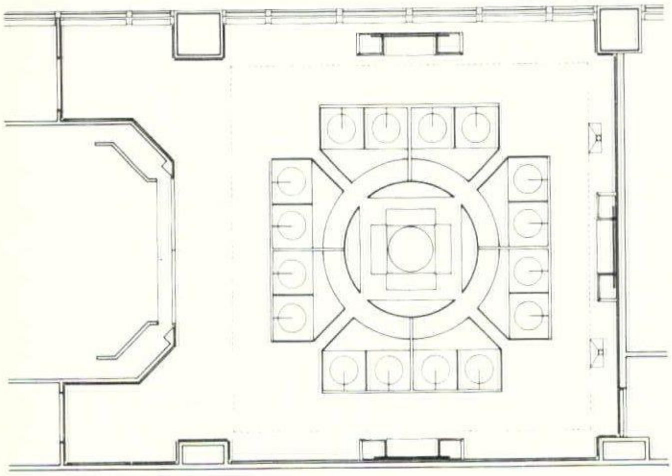


A scale model demonstrated the lighting structure for the client.



subordinated for theatrical effect, the opposite is the case. At the pre- and postconference illumination level, recessed incandescent downlights provide downlighting equal in brightness to the recessed





Sixteen sandblasted glass disks rest on bronze brackets along the perimeter of the five-part lighting structure. Each of the four lacquered-wood elements and the central reflector assembly are independently suspended. Lacquered display porticos accent the boardroom's walls.

Luminaire and lamp details

Luminaire	Lamp
Downlight with multigroove baffle and minimum-width flange	100-watt A 19
Low-voltage downlight with spread lens	12-volt, 50-watt MR 16 EXN
Spotlight with ½-inch cube louver	12-volt, 25-watt tungsten halogen PAR 36
Fixed wall washer	150-watt tungsten halogen T 4
Low-voltage floodlight with single 48-millimeter concave lens and remote transformer	12-volt, 25-watt, 50-candlepower miniature incandescent

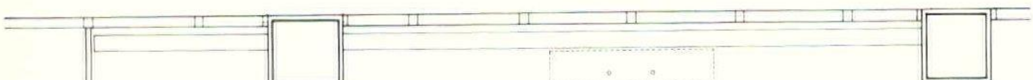
downlighting in the anteroom. Torcheres to the left and right of the chairman provide accent lighting, and low-voltage, single-lens floodlights highlight the green marble shelves in the portico boxes.

Conference illumination is functionally the most complex setting. A ring of angled spotlights — the number of lights corresponding with the number of seats — functions as a continuous task light and permits easy reading and writing. Recessed MR 16 downlights beam circles of light onto sandblasted glass disks without overspill. The resulting diffused lighting eliminates facial shadows.

The recessed incandescent downlights are balanced at a level designed to provide enough background lighting to eliminate a dark void. To prevent the appearance of a black hole in the center of the table, four concealed wall washers beam light to angled reflector boards that diffuse the light and bounce it perpendicular to its original direction.

At the projection illumination level, the entire system is dimmed to a brightness level that permits optimum viewing of rear screen projections.

The accompanying table shows average footcandle readings for each of the light sources for all four settings. The readings represent only quantitative, numeric values; the qualitative, unmeasurable aspects of the lighting are of primary importance to the designer.



A central dimmer system adjusts light levels by controlling (1) incandescent downlights, (2) low-voltage MR 16 downlights, (3) low-voltage PAR 36 spotlights, (4) tungsten halogen wall washers, and (5) low-voltage incandescent floodlights.

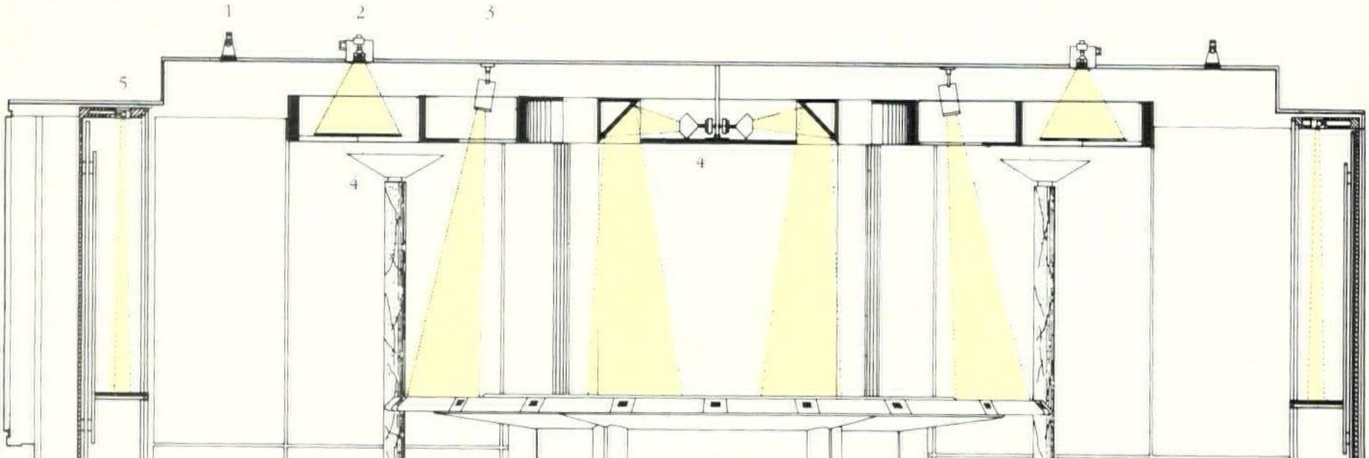
Footcandle readings for the four light levels				
	Average footcandles*			
Light source	Normal	Pre- and post-conference	Conference	Projection
Recessed incandescent downlights (6 fixtures near entrance)	18–20	5	5	3
Recessed incandescent downlights (24 fixtures around table)	20–25	1	2	1
Recessed low-voltage MR 16 downlights	25	3–4	10	1
Surface-mounted low-voltage PAR 36 spotlights	25	2	25	1
Tungsten halogen wall washers (4 fixtures within structure)	2	1	2–3	1
Tungsten halogen wall washers (2 fixtures in torchères)	<1	<1	<1	<1
Low-voltage incandescent floodlights in portico boxes	<1	<1	<1	<1

*Readings were made approximately 42 inches above the floor, directly under the light source, using a footcandle meter with color and cosine correction.

Light sources with readings of one to two footcandles are clearly perceptible; they glow. Although no measurable readings could be made of the torchères or the low-voltage floodlights, the reflected light they produce greatly affects the overall ambience of the boardroom. And, although footcandle readings are approximately equal for the incandescent downlights and the low-voltage MR 16 downlights at the normal setting, the light qualities are markedly different. The baffled incandescents beam direct light into the room, while the MR 16s illuminate sandblasted glass disks that diffuse light.

Ameritech's boardroom lighting demonstrates the potential of suspended structures that integrate special lighting into the interior architecture and complement that architecture. Continual observation of light and lighting and conscious use of the imagination form the basis for developing solutions to challenging and intricate lighting problems. ■

For product information, see the Manufacturer Credits section on page 70.



Section shows mountings of (1) incandescent downlights, (2) low-voltage MR 16 downlights, (3) low-voltage PAR 36 spotlights, (4) tungsten halogen wall washers mounted within the lighting structure and in torchères, and (5) low-voltage incandescent floodlights.

Down the tubes: Solar light goes indoors

Stephen P. Schuber

Stephen P. Schuber is contributing editor of Architectural Lighting.

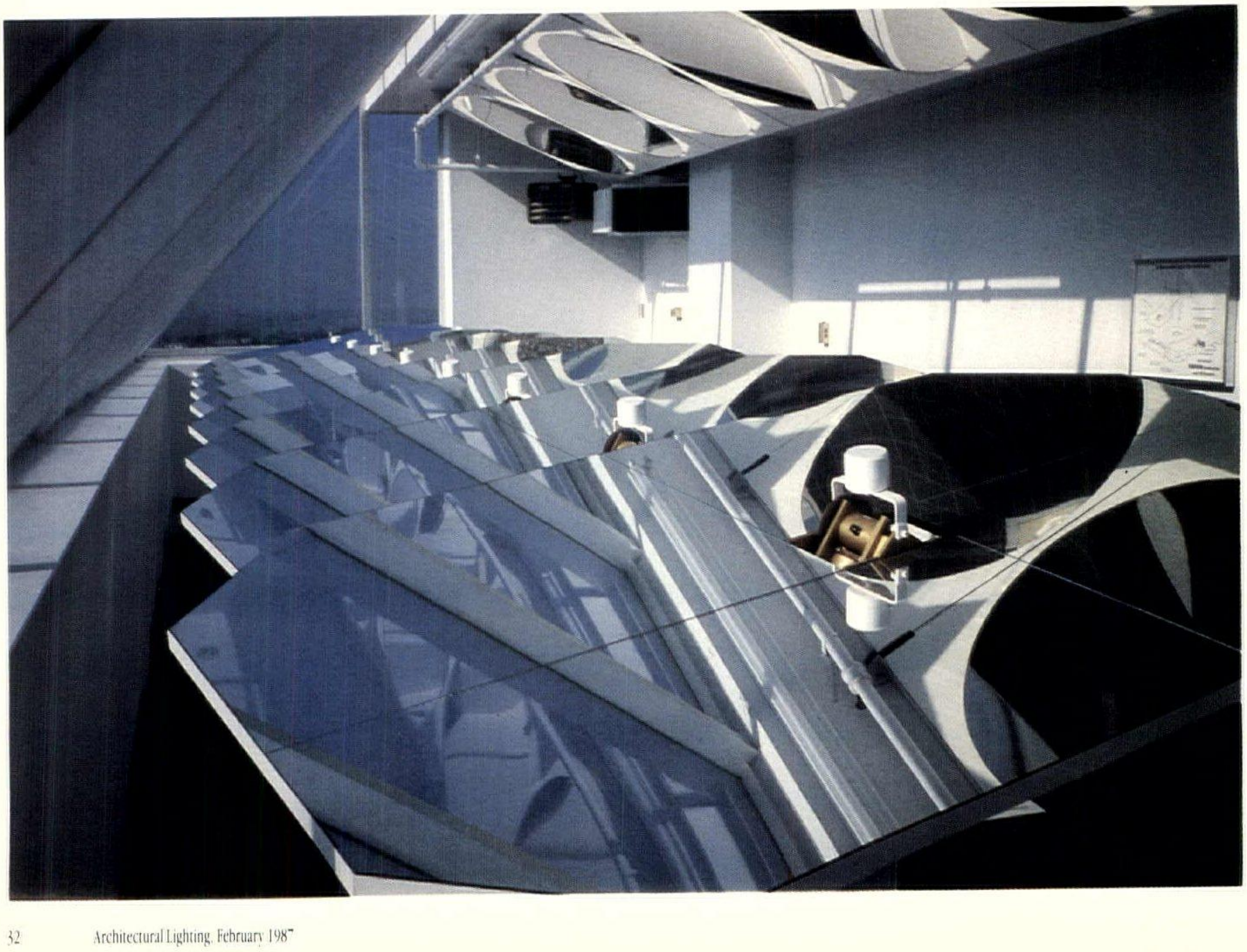
When they were consulting with the designers and developers of the Victoria Park Place office complex, officials of the Canadian Telecommunications Group, Inc. (CTG) were given several options to consider, not the least of which was the lighting of the office space they would occupy. The developers, Konvey Construction Company Ltd., were in touch with TIR Systems Ltd. The Vancouver, British Columbia, firm had developed a light-conducting system with the potential to diffuse sunlight evenly throughout core office spaces. CTG president and chief executive officer Edward H. Lavin, Jr., says, "We're a high-tech company with a commitment to innovation. We looked carefully at the solar lighting system and kept an open mind about trying something completely different."

Project: Victoria Park Place
Location: Toronto, Canada
Lighting Designer: TIR Systems Ltd.
Client: CTG, Inc.
Developer: Konvey Construction Company Limited
Photos: TIR Systems Ltd.

TIR's light-conducting systems may have been "something completely different," but the basic technology dates to 1980, when TIR president Lorne Whitehead was conducting research at the University of British Columbia. Whitehead found that nearly total internal reflection — as is the case with optic fibers — results when a hollow, square pipe is lined with precisely placed longitudinal prismatic surfaces. This creates, in essence, a light-transmitting pipe. For this discovery, Whitehead received a special citation in 1982 from the Illuminating Engineering Society and the 1984 E.C. Manning Award.

Light that strikes the prism light guides, which are molded from clear acrylic, can be carried long distances and distributed evenly. Light leakage is controlled by highly reflective covers that can, for example, direct light downward or sideways through a diffusing lens. A similarly reflective end mirror also aids in even light distribution. The light pipe functions best when light strikes the prism light guides at less than the critical angle of 27.6 degrees from their axes, with the result that the system's luminaire can be fitted with a variety of light sources, including clear metal halide, high pressure sodium, compact source iodide, and incandescent lamps. An innovation at Victoria Park Place was to use the sun.

Canada's first commercial solar light system uses eight sun-tracking heliostats to illuminate 2000 square feet of core offices on the top floor of Victoria Park Place. TIR estimates

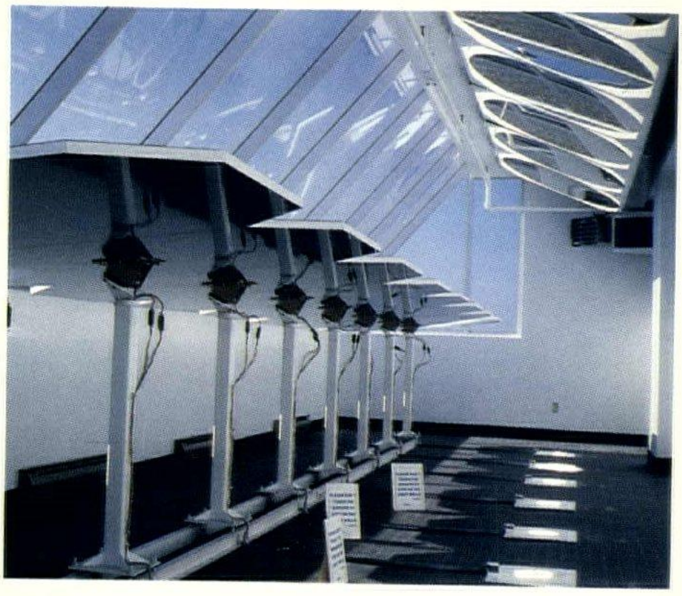


that, with a wider conduit, the light pipe could be used for as many as 10 floors of a building. The heliostats are essentially heavily silvered flat mirrors that measure 47 inches by 72 inches and are 2 millimeters thick. They are arranged in a straight line in a solarium, on four-foot centers. A computer system calculates the position of the sun to ensure maximum capture of sunlight and controls the two-axis drive units.

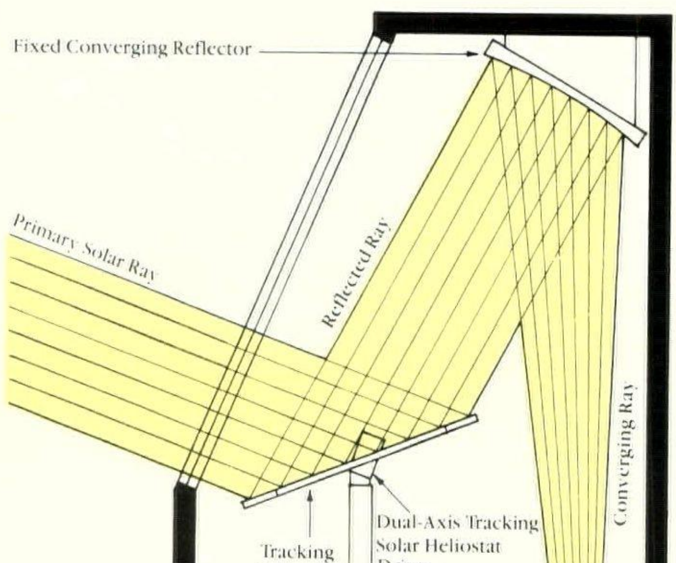
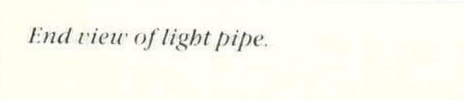
The heliostats direct light up and northward to parabolic focusing mirrors that are 94.5 percent reflective and have a focal length of 119 inches. The focusing mirrors, in turn, direct the light toward roof apertures that have cross sections of approximately 60 square inches and are sealed with 98.5 percent transmitting, antireflecting glass (there is no air exchange between the solarium and office spaces). The apertures also contain photocells that communicate light levels to the computer.

Below each aperture, a defocusing mirrored elbow directs light into the prism light conduits, which are 24 inches wide by 8.5 inches high by 25 feet long. The light tubes, with diffusing lenses, are mounted in a standard two-foot grid T-bar ceiling.

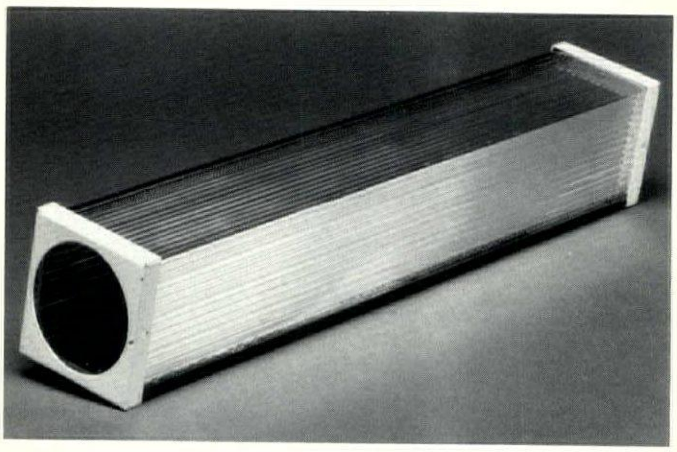
In addition to using sunlight, the prism light guides can be illuminated by one or two 400-watt high-color-quality metal halide luminaires. When the photodetectors below the roof apertures register a light level that is two-thirds or less of full daytime sunlight, one of the luminaires is switched on. During periods of heavy cloud cover or at



Solarium with heliostats.

Schematic of the solar light pipe at Victoria Park Place.



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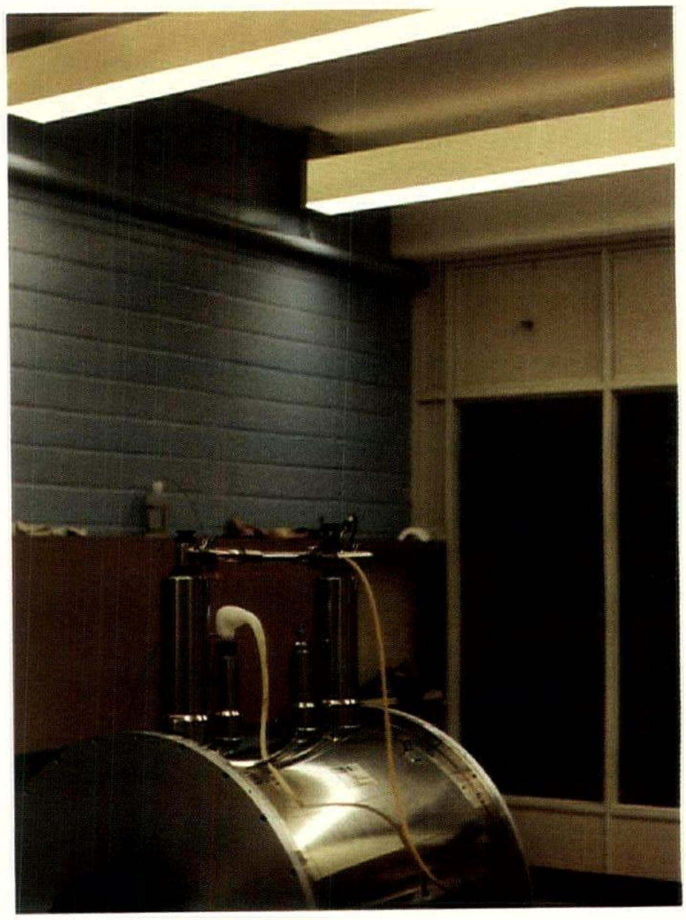
End view of light pipe.

Interior of CTG offices.



Magnetic resonance imaging room.

night, the computer activates both metal halides. In addition to its other functions, the computer also collects data about the efficiency of the system.

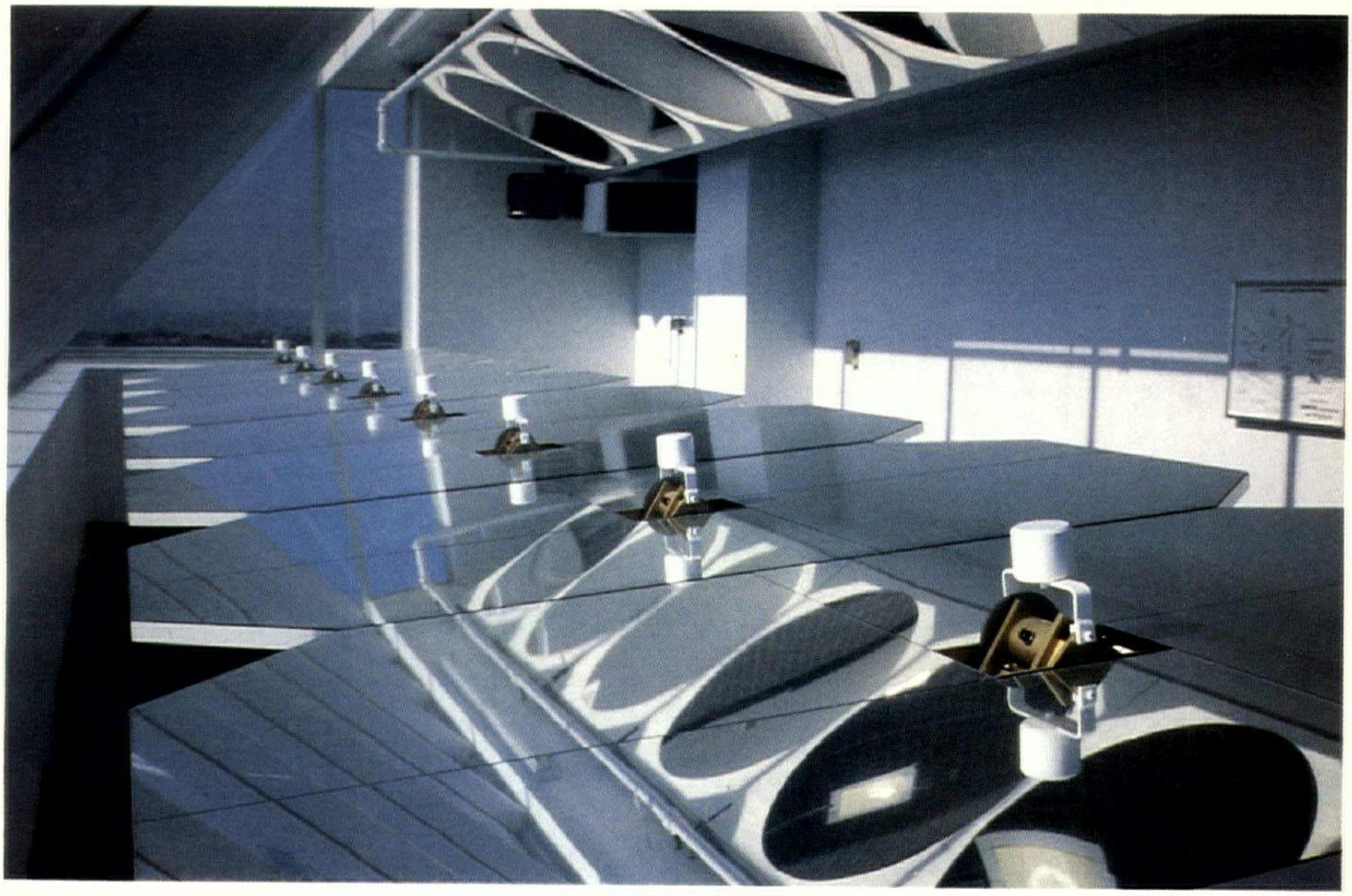
TIR officials point out other advantages and applications of the prism light guides. The conduits use remote light sources — high-intensity discharge lamps, for example — chosen to provide better efficiency and better color rendering than fluorescent tubes. Because the light sources can be isolated, waste heat can be controlled and the lamp location specified to permit easier replacement and maintenance. What is more, the system's electrical parts can be isolated from potentially hazardous environments, such as grain elevators, chemical solvent storage areas, petrochemical plants, and so on. Another application is lighting rooms in which strong magnetic currents are generated, such as those required for diagnostic magnetic resonance imaging. In these rooms, the use of metal must be totally avoided.

For decorative, attention-getting displays like the 50-foot-tall entrance to the elevated monorail at Expo '86 in Vancouver, shafts of evenly dispersed, colored light can be provided by fitting a luminaire with colored PAR lamps. The light can be controlled in three ways: electronic dimmers and a small microprocessor; rotating filter wheels with different colored gels; or solenoid-operated dichroic filters in front of white light sources. In yet another application, an 80-foot-tall atrium is illuminated by two light pipes, each with one 400-watt metal halide lamp in the top floor ceiling space of the building, permitting easy maintenance.

As is the case with many new and innovative products, the endurance, efficiency, and cost-effectiveness of prism light guides have yet to be demonstrated conclusively. The Department of Energy, Mines, and Resources Canada was sufficiently interested to provide a grant of $200,000 (Canadian) for the installation of the system at Victoria Park Place, and the 3M Corporation has invested $250,000 (U.S.) for further development of the light pipe technology.

Conclusive cost-effectiveness data for the light pipe system have not yet been generated by the computer monitoring system at Victoria Park Place. What has been demonstrated, however, is that the system delivers pleasing amounts of sunlight to core office areas: each heliostat and light pipe can illuminate 250 square feet of office space at a peak level of 120 footcandles (average illumination is 90 footcandles).

Workers in the CTG offices are pleased with the sunlight they receive, and it is generally agreed that sunlight offers psychological advantages by comparison with electric light sources. Such preferences, however, are extremely difficult to quantify for accounting departments, which keep a keen eye on the bottom line. Further, the story on the bottom line is confounded by the paradox that often faces new technologies: the initial cost of the light pipe system would be significantly lower if there were greater demand for the product, which would permit the cost savings of mass production. But greater demand will not arise until the light pipe gains a larger share of

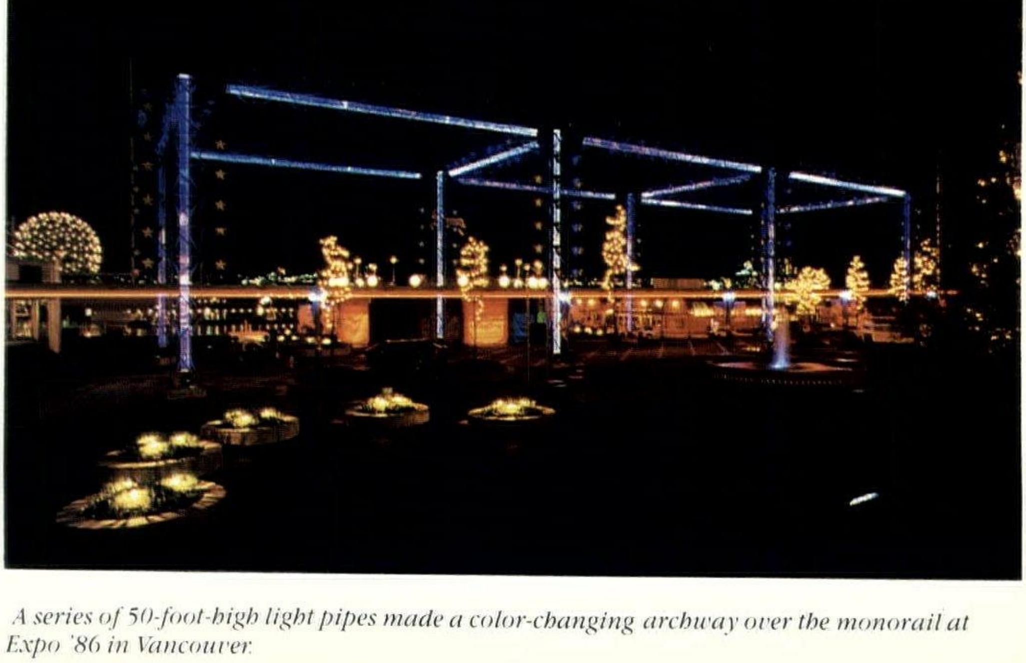


Solarium with heliostats.

the market; this may not happen until more light pipe systems are installed and the price consequently drops somewhat.

Still, the promise of indoor sunlight remains enticing. For his part, CTG president Lavin has no regrets about deciding to install the prism light guides: "The results are favorable; it's a glare-free, even, and natural light." John R. Hawley, a principal of Konvey Construction, calls it "an investment in the future." ■

For product information, see the Manufacturer Credits section on page 70.



A series of 50-foot-high light pipes made a color-changing archway over the monorail at Expo '86 in Vancouver.

Neon: A hands-on craft with its own vocabulary

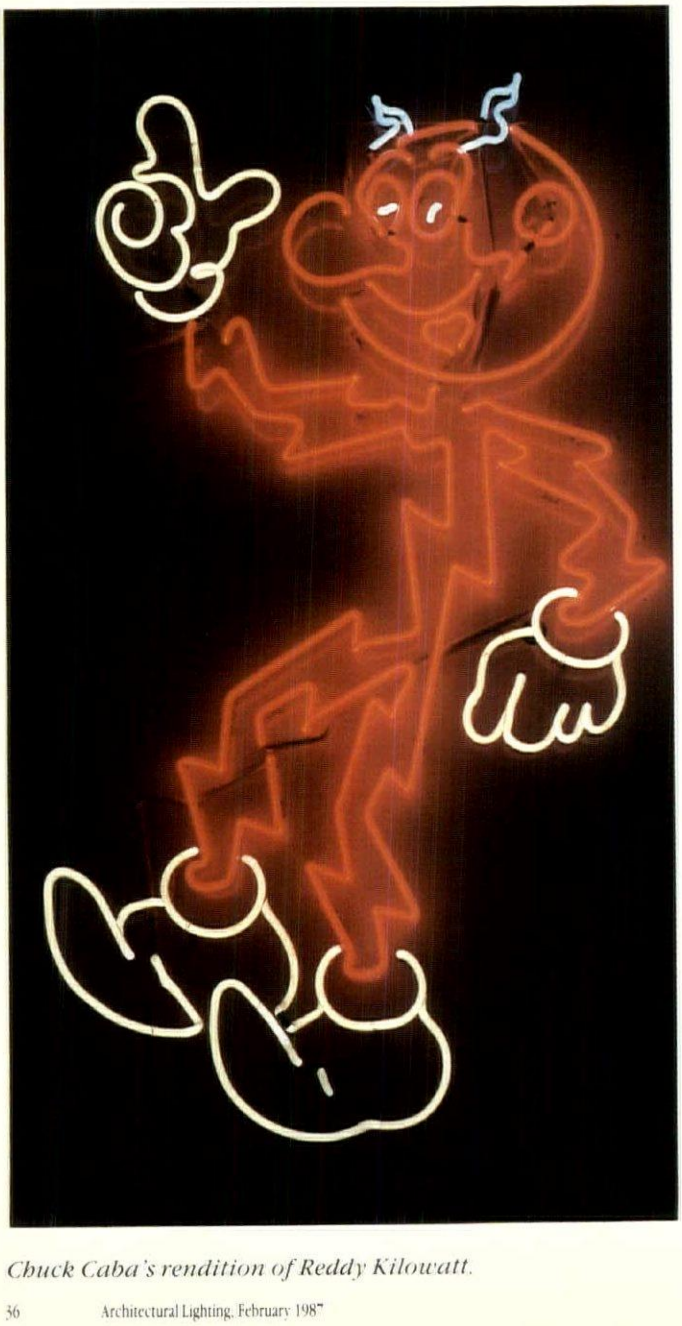
Neon is one of the most flexible light sources available to designers. Exposed neon can draw fluid lines of colored light, tracing a logo or sketching an abstract design. Concealed, neon can suffuse a whole room with light, or it can accent a few chosen highlights. Subtle or outrageous, delicate or dominant, neon offers creative possibilities that intrigue the imagination.

Creative impulses may be stalled, however, when designers attempt to transform their imaginative ideas into reality. Neon architectural lighting is entirely custom fabricated, and most projects are made by local businesses that make advertising signs. The trade is accustomed to dealing directly with end users. At many sign companies, specifications are almost unheard of. Designers may find themselves unnecessarily limited by conventional practices that have little relevance to architectural work.

Gareth Fenley

Gareth Fenley is assistant editor of Architectural Lighting.

Photos: Lee Eide



Chuck Caba's rendition of Reddy Kilowatt.

Rocket's trail shows off lightning effects created by filling the tube with crushed glass.

This article, the first in a two-part series, introduces the basic techniques of neon lighting and the vocabulary used by those who make it. The second part will examine applications that demonstrate how informed, imaginative designers can take neon beyond its traditional limits.

Still the Same

Neon fabricators today use essentially the same techniques as those who created the first commercial neon project in 1912. Skilled workers still hand-shape the glass tubing of every neon lamp, whether its destination is a cove light, a theater marquee, a backlit plastic sign, or a window advertisement for beer.

Although several scientists experimented with luminous tubes before the turn of the century, neon lighting was commercially introduced and popularized by the

Frenchman Georges Claude. His lamps, like those of today, produced light by passing a high-voltage current through a glass tube filled with neon or argon gas. In 1915, Claude's patent on a durable electrode established his monopoly in the industry, which lasted for almost 20 years.

Claude saw the new light source as superior to incandescent lighting for general illumination, but neon made its commercial debut as a barbershop sign. It immediately flourished as an advertising medium. During the 1920s and 1930s, creative and lavish use of neon — including some decorative architectural lighting — appeared throughout Europe and the United States.

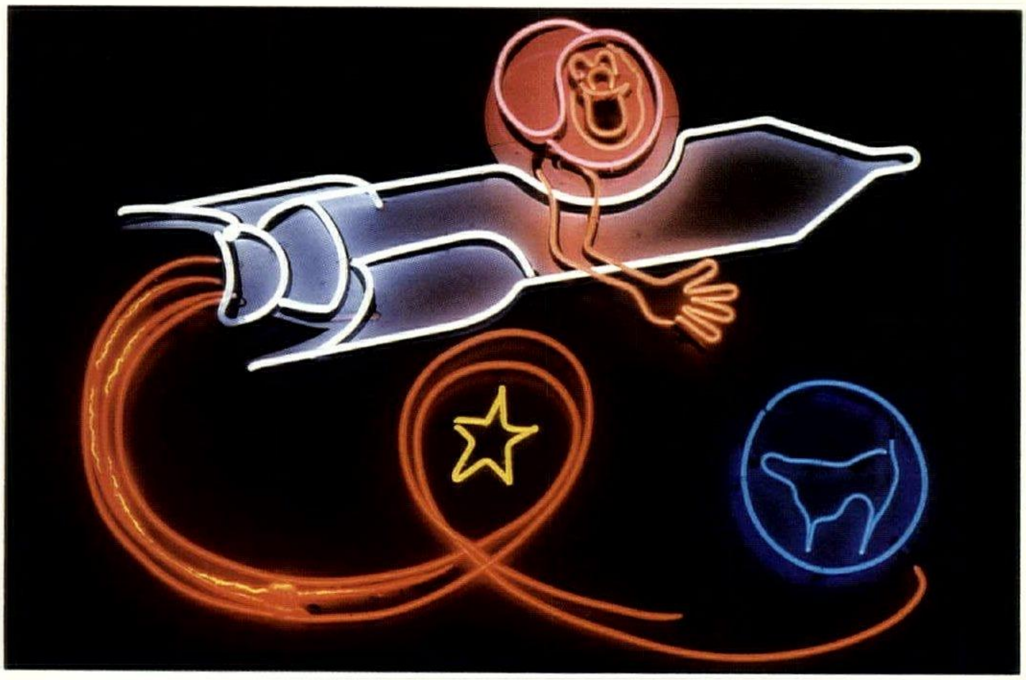
During World War II, the U.S. neon business lost its vigor. Many skilled lamp makers, known as tube benders or glass benders, lost or left their jobs. Most moved on to other careers without training new workers to replace them.

In the 1950s and 1960s, plastic signs lit by hidden fluorescent lamps gained the upper hand over neon. But while well-made and creative neon advertising declined, artists and architects began to investigate the medium. In the 1960s and 1970s, galleries exhibited neon sculpture, and designers experimented with neon architectural lighting. Today, neon is gaining acceptance as an exterior and interior lighting medium.

The resurgence of interest in neon has revitalized the industry. For the first time in perhaps 40 years, the number of skilled tube benders in the neon trade is rising instead of falling. Designers' rediscovery of neon opens up exciting possibilities — and new problems in technical communication.

Developing a Vocabulary

"An architect who calls someone out of the yellow pages immediately upon having an idea of using neon — but hasn't drawn it out and doesn't know enough about the medium to speak the same language with the person at the other end — might be told that it's impossible," warns Rudi Stern of Let There Be



Astronaut by Chuck Caba.

Neon, a studio in New York City. "The architect might be given a price that's outrageously high, or that's too low to do a good and neat job."

Only a few design firms in the country have enough experience with the medium to write neon specifications, says Stern. He recommends that designers enter the field by finding someone knowledgeable to guide them through a few projects while they "develop their own vocabulary. Then they can get exactly what they want."

Neon has not traditionally been specified in general contract documents. Owners, designers, or general contractors usually negotiate directly with local sign companies to design and price neon installations. Although a few creative neon studios are appearing on the east and west coasts, the great majority of neon projects are built by sign companies.

A few companies manufacture *cold cathode* lighting, a version of neon lighting (generically, *neon* refers to lighting with either neon or argon gas). Cold cathode operates at a higher current and uses larger diameter tubes. Neon typically uses 30 milliamperes or less, while cold cathode uses 120 or 200 milliamperes. Cold cathode manufacturers promote their products to architects and encourage specification of cold cathode systems.

The Neon Trade

Few, if any, sign companies deal exclusively in neon; most produce a variety of electrical signs. Some companies fabricate no neon lamps at all, but send tube bending work on contract to a wholesaler.

Sign shops that fabricate neon typically serve a limited area. The fragile glass lamps do not travel well, and local variations in electrical codes, sign ordinances, and installation customs make local expertise imperative. Four representative roles are encountered at most sign companies in the United States: sales agent, layout maker, tube bender, and installer.

The sales agent sells the job and agrees on a design with the customer. The layout maker diagrams the necessary lamps, transformer locations, wiring, and mounting arrangements for the installation. Paper patterns are made to fit the customer's design. Carbon paper transfers the patterns in reverse to sheets of asbestos or heat-resistant cloth. These templates must withstand the heat of melted glass during lamp fabrication. Novel three-dimensional projects require a full-sized wire frame.

The tube bender fabricates the required lamps according to the layout maker's instructions. Portable signs are finished in the shop, complete with supportive materials. On custom installations, the installer or service person goes to the job site and installs the lamps, transformers, and electrical wiring to building code requirements.

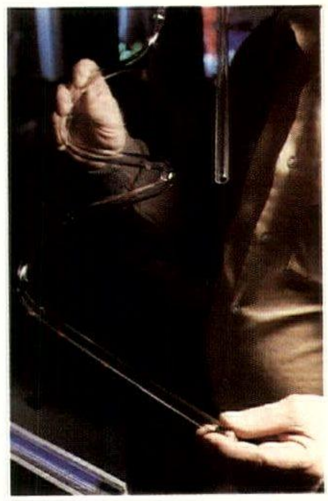
Hands On

The heart of the neon craft is the shaping of glass tubes by hand into forms that satisfy the designer's imagination. There is little room for imaginative design in the routine of the average tube bender, however; the craft requires a strictly logical fabrication process to meet precise instructions.

"Normally, if you're working for somebody, they hand you a pattern

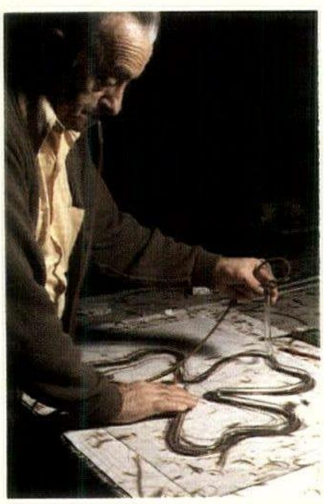
Chuck Caba twirls a clear glass tube in a cross-fire.

Flattening a bend against a pattern.



Lowering the tube over a ribbon burner. Red marks show which sections to heat for a gentle curve.

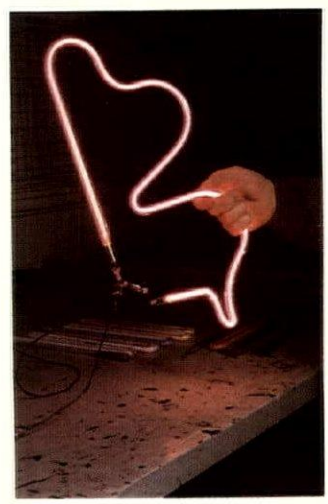
Shaping a bend just seconds after heating the glass.



A blow tube keeps the glass from collapsing during sharp bends.

Attaching an electrode with a hand torch and an electrode holder.

Bombarding the empty lamp with a 15,000-volt charge. A thin glass tube connects the lamp to the gas manifold.



Filled with neon, sealed, and lit, the new lamp appears pinkish. As it ages, its color deepens to orange-red.

that the salesman and customer have agreed upon. All you do is make the glass; you don't have to design it," says Chuck Caba, instructor at the Neon Art and Tube Bending School in Portland, Oregon. At 56, he is young for a seasoned tube bender; the average age of experienced benders in the United States today is 60. Caba demonstrates lamp fabrication in the accompanying series of photographs.

To create a neon lamp, the tube bender first selects a glass tube of suitable diameter and color. *Clear* or *translucent glass* will allow the color of the glowing gas to shine through. Lighted neon is red; argon, which is usually mixed with a dose of mercury vapor to improve conductivity, is blue.

Coated glass tubes, which usually appear white when unlit, are internally coated with a phosphor that yields specific colors when filled with either of the conductive gasses. *Noviol glass*, an expensive imported type that produces "exotic" colors, is colored and may also be coated.

The glass tubes are supplied in 4-foot lengths. Longer runs are formed by splicing tubes. Ordinarily, no more than 8 to 10 feet of tubing are spliced together for safe, simple handling.

The tube bender lays the heat-resistant pattern out on a table. He or she places the tube on the pattern, judges where to begin the first bend, and marks the tube with chalk or pencil to indicate which section to heat.

Tube bending is hands-on work: benders always work without gloves because the feel of the glass guides them. The bender holds the glass tube over a gas flame, rotating it so that the walls of the tube are evenly heated. The moment the glass feels liquid, the bender begins to shape the glass in mid-air, then transfers the tube to the pattern. The final shape of the bend can be adjusted for a few seconds after the glass leaves the fire.

Three types of gas-jet burners, called *fires*, are used to heat the tube. A ribbon burner has a line of flame of adjustable length; it is used to heat sections of tubing from a few inches to a foot or more long. The cross-fire, a stationary assembly of gas jets aimed at a single point, heats the tubing for sharp turns. A lightweight hand torch helps to splice tubes together and attach electrodes.

Once a bend is made, it cannot be changed. If the bender makes a mistake, the remedy is to cut out the error, splice on a new section of tubing, and attempt the bend again.

A splice usually leaves a visible thickening at the junction of the glass tubes; in the best work, it can be absolutely smooth. A good layout places splices and electrodes where they do not interrupt crucial design elements. In signage in particular, it is often possible to locate splices in tube sections that will be blacked out with paint.

In coated tubing, the melting of tube ends to make the splice eliminates a bit of phosphorescent powder, so red or blue will shine through the small transparent section. A skilled tube bender can minimize the size of the splice so that the interruption is inconspicuous.

When the glass tubing has been shaped, the tube bender splices electrodes to the ends of the unit. Each electrode is made of metal encased within glass, with two lead wires emerging from the end.

Gassing the Tube

The final steps in lamp fabrication are crucial to performance. A well-made lamp can last for 30 years or more. A poorly made lamp may blacken, flicker, or burn out within weeks or months.

First, the unit is spliced with a 5-millimeter glass tube to the *manifold*, a system of glass tubes, stopcocks, and gas flasks that hold neon and argon. This airtight attachment is called *tubulation*. The 5-millimeter tube may be attached to an electrode or to the main body of the lamp in an inconspicuous spot.

Once the lamp is sealed onto the manifold, the bender turns on a vacuum pump. The bender uses a glass stopcock on the manifold to open the passage between pump and lamp, thus evacuating the unit. When a gauge indicates that the air pressure within the lamp is sufficiently low, the bender closes the stopcock, making an airtight seal.

Next, electrical leads from the *bombarder*, a high-voltage transformer, are clipped onto the unit. Using the stopcock and the transformer switch in a carefully timed sequence, the bender establishes a high-voltage discharge within the tube. *Bombardment* sterilizes the tube by generating heat as electricity passes through the remaining air in the lamp. An experienced bender judges the duration of this step by eye. The electrodes glow cherry-red; a piece of newspaper placed on the tube chars at the moment the proper temperature is reached to remove impurities that would shorten lamp life. Overheating damages the electrodes.

After bombardment, the tube is evacuated for about five minutes. Then, using glass stopcocks, the bender measures out an appropriate amount of neon or argon with a gauge and releases it into the tube. With a hand torch, the bender melts the tubulation glass and seals it off while gently pulling the lamp away, a process known as *tipping off*.

Finally, the lamp is run at normal or slightly above-normal amperage for anywhere from 15 minutes to several hours. This step is called *aging* or *burning in*. If the fabrication process was flawed, the new lamp will fail to reach the proper color and will have to be checked for leaks and supplied with new electrodes, then tubulated, evacuated, bombarded, gassed, and aged again.

Caution: High Voltage

Neon lamps require high voltage and, therefore, transformers. Concealing transformers, preventing fire hazards, and controlling noise top the list of installation concerns.

The number of transformers required for an installation may vary from one to dozens. Each transformer powers a lamp or lamps wired in series. In a typical neon installation, one transformer will power up to 60 feet of tubing.

Neon transformers are available in a range of voltage and amperage ratings. The choice depends on the length and diameter of tubing to be powered. One recently introduced model incorporates a dimmer that provides continuously variable settings.

A transformer is housed in a transformer box or "can" that takes up quite a bit of space — 18 by 7 by 7 inches. Concealing the boxes sometimes demands ingenuity. Heat buildup tends to burn out transformers, but because Underwriters Laboratories does not approve ventilated boxes, it's wise to expose the boxes themselves to ventilation.

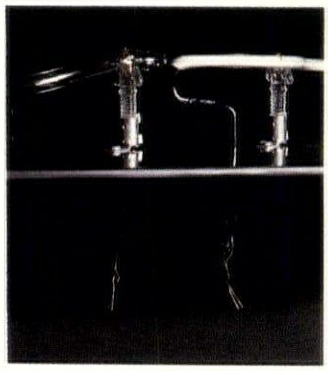
The potential fire danger of high-voltage wiring (also called *high-tension* or *secondary* wiring) has prompted building code restrictions that vary from city to city, county to county, and sometimes from one area of inspection to another. Local sign companies should be familiar with these rules and customs.

All transformers generate vibration that can produce noise. Modern models, however, generally are well soundproofed. Transformers may buzz if they are mounted on metal or loaded with too much tubing. Some noisy units are simply defective. These should be replaced at no charge by the installing company, which can return them to the wholesaler for exchange.

Poorly designed and installed wiring can cause premature lamp failure, component failure, and noise. Generally, high-voltage leads should be kept as short as possible. This is especially important in high-milliamperage cold cathode applications. Sign companies may recommend running a strip of neon lamps that doubles back on itself, bringing the ends close together, rather than running high-voltage wiring for the full length of a single line.

Mounting

Gas-filled neon lamps are lightweight and can be installed on virtually any interior or exterior surface. In the most common mounting arrangement, copper tie wires secure the lamps to slender glass tube supports mounted in metal bases.



Detail of an unfinished neon sculpture shows clear and coated glass on a plastic mounting board. Note black-out paint, glass tube supports in metal bases, copper tie wire, and electrodes passing through holes in surface.

For many installations, the installer bores holes in the mounting surface so that the lamp electrodes can penetrate to the transformer box or wiring on the other side. Glass or Pyrex bushings or housings prevent arcing. The PK

Getting to know neon

The schools and programs listed here have expressed interest in providing information and referrals to our readers. Other resources may be available; check with local designers, sign companies, and art instructors.

California

Academy of Art College
540 Powell Street
San Francisco, CA 94108
Contact: Ron Young, Director of Fine Arts
(415) 673-4200
The academy offers a 15-week, two-semester course in tube bending for artists and designers. Classes are held on weekends; community students are welcome.

Museum of Neon Art
704 Traction Avenue
Los Angeles, CA 90013
Contact: Mary Carter, Registrar
(213) 617-1580
Lili Lakich and Richard Jenkins teach eight-week classes in neon techniques for designers. The program includes a demonstration of tube bending and instruction in pattern drawing.

Neon Neon
270 Seventh Street
San Francisco, CA 94103
Contact: Josie Crawford
(415) 552-4163
Neon Neon, which includes a gallery and sign shop, offers evening seminars for architects and other design professionals. In addition, Michael Furey teaches an evening course in tube bending.

Neon Personalized Instruction
1045 17th Street
San Francisco, CA 94107
Contact: Lee Roy Champagne
(415) 626-4123
Champagne teaches tube bending to individual students and offers weekend workshops for groups of up to three design professionals.

Kansas

Neon Stuff
P.O. Box 1013
Salina, KS 67402
Contact: Fred Elliot
(913) 823-1609
The school offers vocational instruction in tube bending.

Minnesota

The American School of Neon
212 Third Avenue North
Minneapolis, MN 55401
Contact: Katherine Jones
(612) 338-5045
The school sponsors two neon lighting forums each year. These five-hour evening events introduce architects, engineers, interior designers, and other design professionals to the technical basics of neon lighting. The school also offers vocational instruction and has its own showroom.

Missouri

Paris School of Neon
122 West Fifth Street
Kansas City, MO 64105
Contact: Per Wallin
(816) 474-6366
Wallin is considering a seminar or class for local architects. The school offers vocational instruction in tube bending.

New Jersey

Neon Factory, Inc.
771-773 Edgar Road
Elizabeth, NJ 07202
Contact: Mike Fedor
(201) 355-1270
Fedor offers vocational instruction in tube bending.

New York

New York Experimental Glass Workshop
142 Mulberry Street
New York, NY 10013
Contact: Chris Freeman or Gerry Rose
(212) 966-1808
Freeman and Rose teach hands-on neon sculpture classes. Credit is available through the New School, NYU, and Parsons.

North Carolina

University of North Carolina
Art Department
Hanes Art Center, 079A UNC
115 South Columbia Street
Chapel Hill, NC 27514
Contact: Jerry Noe
(919) 962-2015
Noe teaches occasional courses on neon as an art medium.

Oregon

Neon Art and Tube Bending School
3130B Southeast Hawthorne
Portland, OR 97214
Contact: Chuck Caba
(503) 239-5309
The school offers vocational instruction in tube bending.

Rhode Island

Neo Tek
195 Fleetwood Drive
Saunderstown, RI 02874
Contact: Raymond Bryand
(401) 295-2829
Bryand offers vocational instruction in tube bending, including an eight-hour weekend course.

Texas

North Texas Neon School
9810 Highway 80 West
Fort Worth, TX 76116
Contact: Jake Groom
(817) 244-9975
The school offers vocational instruction in tube bending.

The Texas Neon Workshop
1416 West Alabama
Houston, TX 77006
Contact: Tim Walker
(713) 528-5922
The school offers vocational instruction in tube bending and has its own gallery.

Washington

Okumo Studio
1067 26th Avenue East
Seattle, WA 98112
Contact: Kenji Tachibana Okumo
(206) 325-2121
In addition to neon, the studio exhibits sculpture, graphic design, photography, and other creative arts. Okumo offers instruction in tube bending for artists and designers.

Wisconsin

Northern Wisconsin Neon Workshop
c/o Northern Advertising Company
P.O. Box 92
Antigo, WI 54409
Contact: Dean Blazek
(715) 623-3000
The workshop offers vocational instruction in tube bending. ■

housing — one or two glass cylinders enclosed in a metal box — is standard equipment when building walls are penetrated.

Costs

"Making neon is probably 70 percent labor. If I did a $1000 job, I'd probably have less than $300 in materials," says Chuck Caba. Price structures vary from shop to shop, of course. On projects requiring unusual components, materials costs may be higher. Some local codes stipulate the use of corrected power factor transformers, glass instead of plastic coverings for high-voltage wiring, and other components that add to cost.

Once neon is installed and paid for, operating and maintenance costs are typically minimal. Lamps may operate at 3 to 5 watts per lineal foot for 25,000 hours or more. "I don't know of any lighting medium ever devised that is as economical as neon," says Rudi Stern. "Every part of it is far from costly when you look at a life of 10, 20, 30, or 40 years."

When tubes finally dim or burn out, a tube bender can replace the electrodes and renew the luminous gas. "The biggest danger is from external force breakage — snowballs, beer bottles, baseballs, vandalism, hail," Caba says. The gas released from broken tubes is nonpoisonous.

Replacements for broken tubes must be custom fabricated. Some sign companies store customers' patterns for future use, but most discard them. Although building owners rarely keep the patterns themselves, having them on hand would reduce repair time and cost.

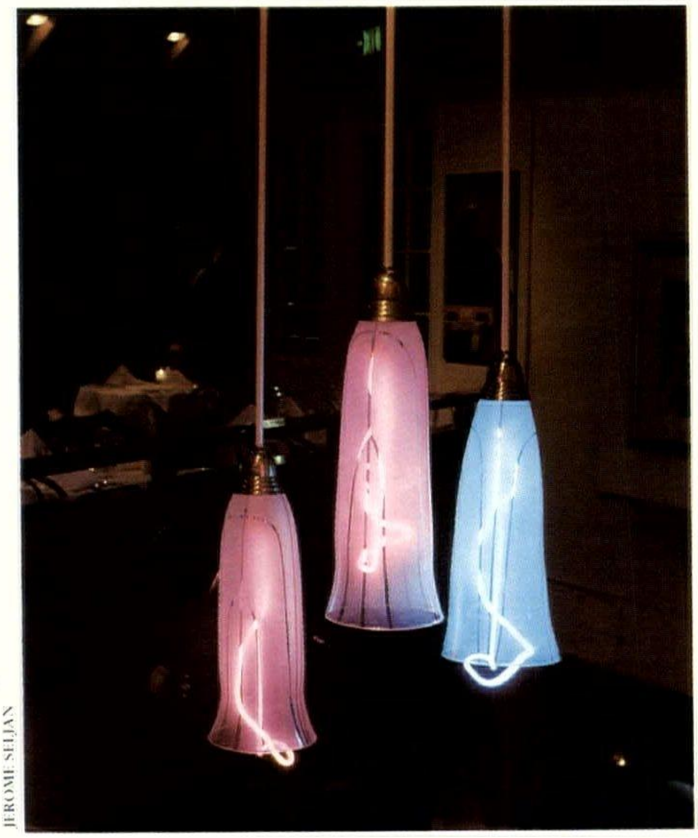
Lamps only a few days or weeks old that dim, darken, burn out, or flicker were probably poorly made or installed. If, for example, the tube bender did not keep the manifold stopcocks well-greased throughout the work day, air may have leaked in and contaminated the lamps made in the afternoon.

New Methods

The methods that neon shops rely upon for signage may be inappropriate for architectural work. Rudi Stern remarks, "If you're looking at a sign across the highway and a hole is 3 inches wide for a $^{1}/_{2}$-inch diameter tube, it doesn't really matter. But, of course, to the architect, it does. Some companies have leaped into the game too quickly and just don't know how to respond to that kind of detailing.

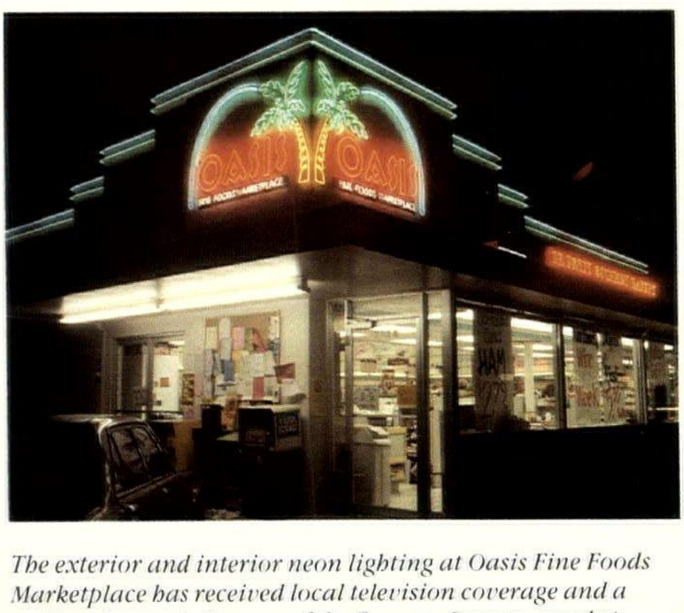
"Everyone is learning very fast," he adds. "There is probably a good company to make something in just about every city now." To find those companies, designers need to visit installations, examine the quality of work, question clients about performance, and develop their vocabularies.

"Neon can be delicate or it can be gross. You can't blame the medium for either one of those — or applaud the medium," says Stern. "There are good watercolors and bad watercolors, great bronze sculpture and dreadful bronze sculpture. The medium is in the hands of whoever uses it." ■



JEROME SELJAN

Hand-blown, etched glass bells enclose pink and turquoise neon tubes. A Seattle artist created the luminaires for Jo Federigo's Cafe and Bar, Eugene, Oregon.



The exterior and interior neon lighting at Oasis Fine Foods Marketplace has received local television coverage and a national award. Owners of the Eugene, Oregon, market believe it attracts customers. Ann Baucam Fulkerson designed the neon in cooperation with a local sign company.

For further reading on neon lighting:

Lakich, Lili. Neon Lovers Glow in the Dark. *Salt Lake City: Gibbs M. Smith, 1986.*

Miller, Samuel. Neon Techniques and Handling: Handbook of Neon Signs and Cold Cathode Lighting *(third edition). Cincinnati: Signs of the Times Publishing, 1977. The basic technical manual of the trade.*

Stern, Rudi. Let There Be Neon. *New York: Abrams, 1979. Contains illustrated technical chapter and glossary.*

Webb, Michael. The Magic of Neon *(second edition). Salt Lake City: Gibbs M. Smith, 1986.*

For product information, see the Manufacturer Credits section on page 70.

Indoor landscaping for healthy, beautiful workplaces

Christos C. Mpelkas

Christos Mpelkas is a photobiologist and manager of photobiological applications with GTE Electrical Products, U.S. Lighting Division, Danvers, Massachusetts.

Most people now spend their working hours indoors. Surveys suggest that transplanting an outdoor environment indoors produces healthier and more pleasant working conditions for office personnel. Interior landscaping is one way to meet people's need for an outdoor environment. Because interiors are designed for human comfort, not for interior landscaping, plants often fail to thrive in the environment in which they are placed. Plants in the offices, lobbies, and reception rooms of business firms, hotels, and institutions represent a large investment that should be protected.

Light's Value to Plants

Light is a major maintenance factor in interior landscaping; it supplies energy to plants. During photosynthesis, a key photoresponse, plants convert light energy to useful forms of chemical energy, notably carbohydrates. Light also directly controls other key photoresponses, chlorophyll synthesis, phototropism, photomorphogenic red-induction, and photomorphogenic far-red reversal. All of these photoresponses influence the plant's maintenance factors.

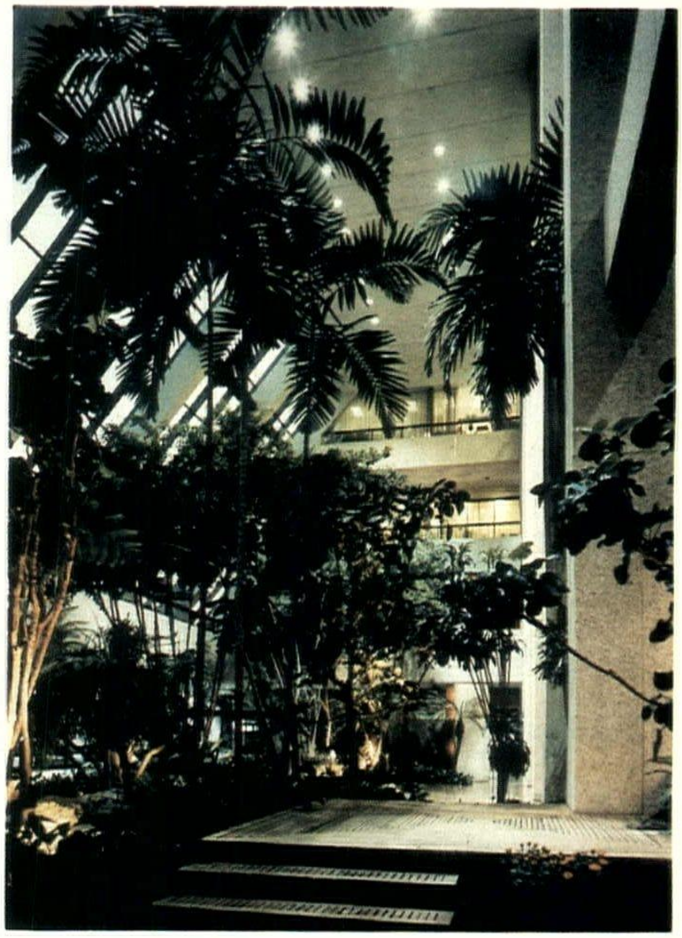
Normal activity by key plant maintenance factors depends upon both the intensity and the spectral quality of light. The intensity and spectral quality of sunlight varies considerably from hour to hour. To offset this deficiency, careful interior landscape architects and designers choose electric light sources to supplement sunlight.

To maintain all of the photoresponses needed for good maintenance, plants require the following wavelengths of the light spectrum: red (600–700 nanometers), far-red (700–800 nanometers), and blue (400–500 nanometers). A table of lamp characteristics explains the spectral emission of various light sources used in atria.

In Their Prime

Available light levels determine the types of plants that can be maintained in prime condition in an indoor space. The light level requirements table groups foliage plants into three light-level groups based on the footcandle measurements required to maintain them.

Plants also can be maintained in light levels higher than those indicated in the table, but they will fare poorly below those levels. An



Coated metal halide lamps are an important element in the maintenance of the indoor tropical garden in the Independent Life Insurance Company building in Jacksonville, Florida.

Characteristics of lamps for indoor plant lighting

Incandescent and tungsten halogen lamps
A high ratio of red to blue energy from these lamps causes long internodes developing spindly growth; they also produce high infrared energy, which increases the transpiration rate in foliage.

Fluorescent lamps
Cool white and warm white lamps are deficient in the red and far-red wavelengths. Standard and wide spectrum grow lamps provide a good balance in the red, far-red, and blue regions of the spectrum for optimum plant responses.

Mercury lamps
Bright white deluxe lamps provide the best light characteristics for plant growth.

Metal halide lamps
Coated metal halide lamps provide the best light characteristics (red, far-red, and blue wavelengths) of all high intensity discharge (HID) lamps. Especially suitable for totally enclosed growth areas, such as growth rooms and interior landscapes.

High pressure sodium lamps
HPS lamps distort colors of ornamental plants because of insufficient blue wavelength emission. They are suitable when used to supplement natural daylight, or in combination with the metal halide lamps, but cannot be used alone for interior plant lighting applications.

Low pressure sodium lamps
LPS lamps are poor sources for interior plant lighting applications because they are monochromatic sources. They emit light energy only in the yellow wavelength so color rendition is poor and the light requirements for the major photoresponses are not satisfied.

Ranges of light level requirements

Light levels	Examples
Low 100 to 150 fc	Philodendron, Golden Aglaonema, Corn Plant
Medium 150 to 250 fc	Asparagus Fern, Green Dracaena, Rubber Plant
High 250 to 350 fc	Ficus Benjamina, Norfolk Island Pine, Fan Palm

important consideration when determining light level requirements is to calculate the light intensity level times the duration. A plant responds to the total light per day in regulating its maintenance requirements. A sample formula is: *Total light per day = footcandles × hours of light per day*. That is, in a day with 12 hours of light, a plant in a location that provides 200 footcandles of light would get 2400 footcandle-hours of light.

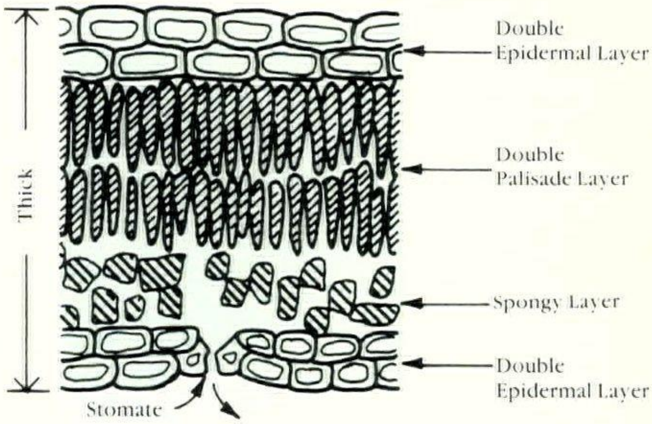
Photoperiods

A photoperiod is the relative length of the alternating periods of light and darkness as they affect the growth and maturity of plants. Length of exposure to light required often determines the developmental functioning of a plant.

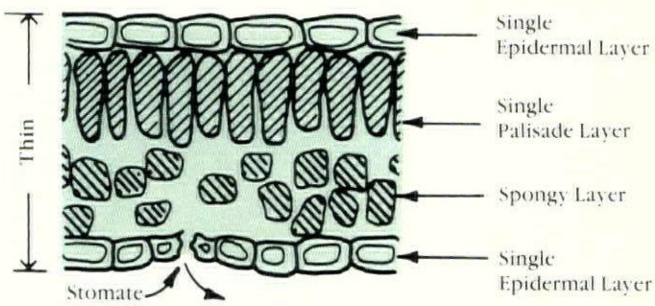
The photoperiod for normal maintenance of most interior plants is 12 to 16 hours of light — whether it is provided by daylight or electric light — and 8 to 12 hours of darkness every 24 hours to provide proper chlorophyll development.

Survival Indoors

To survive indoors, most tropical foliage plants must be acclimatized to the interior landscape environment. In this process, plants are exposed for several weeks — the time depends on the type and size of the plant — to lower light intensities so they can adapt to interior environments. During acclimatization, the plant sheds the leaves formed under natural environmental conditions with high sunlight intensities. The new leaves formed in the acclimatization process are usually thinner, larger, or longer and have a darker green color than the foliage developed under outdoor conditions. The reason for these changes in the structure of the foliage is that acclimatized leaves develop a single epidermal layer at both the top and bottom of the leaf and a single palisade layer, as shown in the drawings of leaves grown in full sunlight and in a shade house. The acclimatized leaf requires less light intensity to survive.



A leaf grown in full sunlight has double epidermal and palisade layers. It takes a higher light intensity to penetrate the internal region to maintain the plant's various photoresponses.



An acclimatized leaf is usually thinner and larger and has a dark green color, due to single layers of epidermal and palisade cells. This type of leaf requires less light intensity to survive in an interior landscape.

Plants can be acclimatized by reducing sunlight in a greenhouse or shade house or by using electric light sources in a totally enclosed structure, such as a warehouse. In a warehouse type structure, using a combination of coated metal halide and high pressure sodium lamps at 600-footcandle intensity on a 16-hour photoperiod has produced good results.

As the plant classification table shows, plants used in interior landscaping fall into three main categories: trees, floor plants, and potted plants. When selecting plants for interior landscapes, consider these key factors to ensure good maintenance results. The plants should be free from diseases and insects, shipping damage, and spray and water residue.

During evaluation of the available light for interior landscapes, some basic factors should be assessed. They include seasonal changes, exposures, skylights, materials or objects that may filter out valuable sunlight, and distribution of light.

Seasons. Winter light is approximately half that of summer. The sun is lower in the sky, cloudy weather is more frequent, and the hours of daylight are fewer.

Exposures. Northern exposure considerably limits plant selection; however, southern, eastern, and western exposures may be adequate. Duration of light is an essen-

Plant classification

Trees	Single plant in container Minimum size 3 feet, maximum size 25-30 feet Examples: Ficus Benjamina, India Laurel, Japanese Loquat
Floor plants	Grow 2-6 feet tall Used separately or in a group Examples: Norfolk Island Pine, Lady Palm, Green Pleomele
Potted plants	Wide range of plants that grow in different size pots up to 8-10 inches diameter Examples: Asparagus Fern, Grape Ivy, Japanese Laurel

Light-related growth symptoms	
Level	**Results**
Low	Reduced leaf size Increased internode length Changed stem orientation (extend horizontally) Loss of old leaves
High	Plant stunted Leaves curled downward Leaves pale green edged with red Chlorosis or bleaching of leaf tissue
Photoperiod	
Short (<8 hours)	Smaller, thin newly formed leaves Longer or spindly internodes Newly formed shoots stretch to obtain light Older leaves drop off plant No new leaves appear
Long (20-24 hours)	Leaves become light green New leaves fail to green up properly, instead curl downward and eventually die Old leaves become crisp, curling, eventually drop off

tial factor for plant maintenance no matter what the exposure.

Skylights. Skylights are rarely as effective as they seem and must be carefully evaluated before plants are selected. They cover a small percentage of the roof area, lighting only the areas directly below them. They are usually high above the plants, so the light is weakened by scattering or by tall plants shading lower ones.

Light filters. The following materials or objects filter out valuable light: tinted glass, curtains, building overhangs, and trees near windows, especially evergreens, which keep their foliage throughout the year.

Distribution. Light should strike the plant from both a vertical and a horizontal angle for good light distribution. The higher intensity should be received from the vertical position, however, because most of the photoresponses take place in the top part of the leaf. The underside of the leaf receives some light from the horizontal angle to maintain the openings of the stomates, which regulate ambient gas exchanges, and to help retain the bottom leaves of the plant.

Major problems in interior landscapes can arise from inadequate distribution of light. When light enters from a vertical direction only, for example, and filters through a canopy, little light will be available to sustain the bottom leaves, which will eventually drop off. If light strikes the plant from a horizontal direction only, the plant will bend in that direction. Both of these situations will create abnormal looking plants. To overcome these deficiencies, supplemental light may be needed. In some cases, it may be preferable to disregard whatever sunlight there is and to totally illuminate the interior landscape with electric light sources.

Symptoms of Light Problems

Some growth symptoms of plants are related to light. Observation can reveal the causes and effects of the problems so that remedial actions can be taken. An accompanying table describes some common growth symptoms related to light.

The biotic plant. A plant in balance with its interior environment is known as a *biotic plant.* A plant of this type can be maintained for years in an interior landscape. Biotic plants have distinct characteristics. Few new leaves develop on the plant. The most recently formed leaves are deep green and relatively close-set to the plant. The leaf canopy is parallel with the prevailing light source. The oldest leaves remain on the plant for a period of months. The tips of all leaves are green and viable. The plant looks much the same over many months.

Indoor air quality. Recent studies on indoor air pollution indicate that energy-efficient buildings can accumulate concentrated air pollutants, which may have a detrimental effect on human health. Interior landscapes can act as air filters and, through photosynthesis, absorb many indoor air pollutants and greatly improve the indoor air quality.

A research study conducted for NASA by the National Space Technology Laboratories revealed that a mature spider plant in a one-gallon container absorbed 3300 milligrams of carbon monoxide per hour during a 6-hour photoperiod. The test was carried out in a 12-cubic-foot chamber illuminated by wide-spectrum fluorescent grow lamps at 325 footcandles. The study points out the importance of live plants in enclosed areas. They function as a biological air purification system to maintain high quality indoor air.

Successful Interior Landscape

Certain steps should to be taken to establish a successful interior landscape. Some brief descriptions of those steps follow.

Team consultation. The architect, interior landscape designer, illuminating engineer, and photobiologist should discuss the various aspects of the interior landscape installation.

Installation. The team consultants should coordinate the various phases of the interior landscape.

Plant selection. Plants that need similar light levels and cultural conditions should be grouped together.

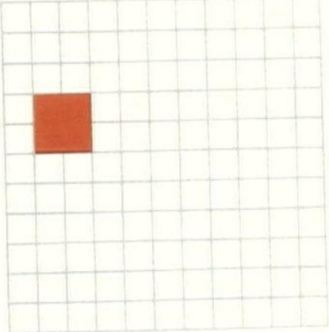
Acclimatization. Plants should be acclimatized to an interior environment to ensure long survival.

Horticultural services. Qualified horticulturists should be selected to care for the plants.

Lighting, in many cases, becomes a limiting factor for good plant maintenance in an interior space. Important parameters of good lighting include knowledge of light sources, intensity levels, photoperiods, and light distribution. Awareness of these factors will result in successful interior landscapes. ■

For product information, see the Manufacturer Credits section on page 70.

The Design Department



Gary Gordon, IES, IALD

The author is principal of Gary Gordon Architectural Lighting Design, New York, a firm that designs lighting systems for commercial and institutional settings. He also teaches advanced courses in architectural lighting design practice and techniques at the Parsons School of Design Lighting Institute.

Each designer has a different interpretation of the visual elements that define a space. Furthermore, when designing light, each space must be approached as if it were unique. Routine solutions may be practical and useful for providing a basic quantity of light; but to create an appropriate emotional environment, the design objectives must reflect the particular functional requirements of the human activities involved.

Learning to design light intuitively is not much different from any other creative act: it requires feeling, not thinking.

A good cook knows which spices work well with certain foods, which foods combine to make interesting dishes, which dishes combine to produce a satisfying meal. The cook learns by eating, by developing a vocabulary about food, and by using a variety of techniques and equipment. Similarly, the designer learns about light by seeing, by developing a basic lighting vocabulary, and by using various techniques and equipment.

The designer learns about light by seeing, by developing a basic lighting vocabulary, and by using various techniques and equipment.

The problem for lighting designers is not merely to *provide* light, but to create a suitable visual environment by *controlling* the light. The terms *luminaire* and *lighting fixture* refer to the ingredients of control. Through the design and placement of these elements, designers can determine the combination of surfaces to be lighted and to be left in relative darkness.

Lamps and lighting fixtures are the working tools of lighting designers. Only through knowledgeable use of these tools can the desired environment be developed. Yet, the selection of lighting equipment requires an understanding of the relationship between light, space, and vision to define the design objectives and ensure an appropriate direction and distribution of light.

Light Distribution

The *distribution* of a luminaire refers to the way that a fixture emits light. *Concentrated distribution* focuses light in the shape of a narrow cone; *diffuse distribution* scatters light over a wide range of angles. Lighting fixtures are designed to produce downward, upward, or multidirectional light output with either concentrated or diffuse distribution. Combining these directions and distributions of light yields distinct subjective impressions of an interior.

Downlighting. A downward concentrated distribution is provided by lighting fixtures with narrow beam spreads lacking an upward component of light. These luminaires tend to de-emphasize ceilings and vertical surfaces. With light directed toward the floor, or toward specific surfaces and objects, the illumination on those surfaces will be high. *Stray* light is limited, however, preventing the remaining surfaces in the room from receiving direct illumination. The overall effect of the lighted space is an impression of low general illumination with high brightness accents.

A *point source*, such as an incandescent or clear high intensity discharge (HID) lamp, has a filament at the center in which light is concentrated. When this filament is located at the focal point of a reflector, the light emitted is redirected in the shape of a narrow cone. In addition to using light more efficiently, fixtures of this design allow designers to organize well-defined and predictable patterns of brightness.

A luminaire that produces a downward distribution will diffuse the beam pattern if its design includes an internal spread reflector or a diffusing cover panel of plastic or glass. These elements, whether individual fixtures or luminous ceilings, emit light at wide angles, thereby increasing the incident light on walls and vertical surfaces and reducing the concentration of brightness within the space. The ceiling area adjacent to the fixture receives no direct illumination, however, and remains relatively dark. This consideration varies in importance depending upon the interreflection of light in the room and the proportion of the total ceiling area covered by the lighting system.

A fluorescent lamp is the ideal choice for developing a broad, diffused distribution. Special phosphors that coat the inside of a fluorescent glass tube convert energy into visible light. Because light emanates from the phosphor, it is emitted at the perimeter of the tube; thus the entire lamp becomes the effective light source. Although diffusion and the lack of concentrated brightness is often a desirable attribute, it may cause an environment to appear overcast and "flat" when compared with incandescent systems.

Uplighting. An upward diffuse distribution directs light toward the ceiling and upper side walls. When light is directed upward and the downward component eliminated, the ceiling becomes a visually dominant feature. It also becomes a diffuse lighting element through reflection.

This technique is often used to emphasize distinctive structural forms or to reveal decorative detail. Yet it also produces a relatively flat, low contrast environment because the extensive interreflection of light reduces contrast and shadow.

The lighted appearance of a surface, object, or space is both a design objective and the end result.

The principal purpose of a lighting system with this type of distribution is to establish an impression of diffusion and general brightness within a space. Such a system has become a common solution to the problem of preventing reflected glare on computer screens. From an engineering viewpoint, though, these systems are inefficient for providing illumination on the floor or horizontal work plane. The light is reflected and partially absorbed by the ceiling and walls before reaching the work surfaces.

Indirect sources can be located in walls, suspended fixtures, or furniture. Coated HID and fluorescent lamps, because of their inherent diffuse emission, are particularly suitable for broad-beam upward distribution systems.

Cold cathode lamps, although lower in efficiency and output than fluorescent lamps, have a longer life. This makes them practical for decorative applications, custom designs, and in inaccessible places where lamp replacement is unusually difficult.

An upward distribution of light can also have a concentrated beam spread. Mounting lamps in close proximity to a surface produces a nonuniform brightness pattern, with the shape of the beam readily apparent. This nonuniformity relieves the extreme contrast created by concentrated lighting systems while adding visual interest through brightness variation.

The same lamps can be used to produce uniform brightness by placing them farther from the surface to be illuminated. Each beam covers a wider area and multiple beam patterns overlap.

Incandescent reflector (R) or projector (PAR) lamps are self-contained beam control devices. In each case, the filament at the focal point of a reflectorized parabolic bulb is intended to produce either a narrow, sharply defined beam (spot) or a broad, soft beam (flood). These lamps provide compact and convenient ways to produce upward distribution. Moreover, their internal reflectors reduce maintenance problems caused by dirt accumulation and reflector deterioration.

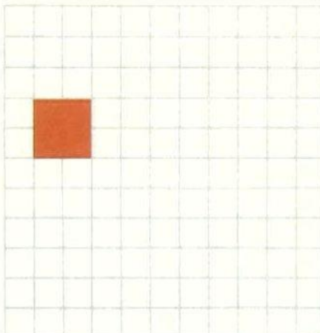
Multidirectional lighting. Multidirectional diffuse distribution is produced by luminaires that deliver both upward and downward components of light. These include open-top and plastic-enclosed fixtures that emit light in several directions simultaneously — toward the ceiling and walls, as well as toward the floor, providing comparatively efficient use of light on work surfaces. The interreflection of light in the space, however, particularly the reflected light from the ceiling, diffuses the direct downward distribution, thereby reducing shadow and contrast and creating bright, generally uniform lighting.

Multidirectional distribution can also be created with concentrated beam spreads. A nonuniform brightness condition results when low intensity or concentrated distributions are characteristic of both the upward and downward components. The upward component relieves extreme contrasts in the space; however, the nonuniform light reflected from wall and ceiling surfaces is insufficient to "wash out" all shadow and contrast. Lack of diffusion results in an impression of moderate contrast and brightness concentration.

The lighted appearance of a surface, object, or space is a design objective. It is, in fact, the end result. But subjective impressions of the environment are interpreted through the dominant brightness relationships. Determining brightness pattern and pattern organization — the relationship of surfaces to be lighted and to be left in relative darkness — requires the appropriate direction and distribution of light.

By gaining knowledge of lighting equipment and its applications, designers can establish a suitable emotional setting. Whether their background for the selection of equipment comes from the experience of an architect or from a consultant in the field, the ultimate visual interpretation of space is strongly influenced by the quality and character of the lighting system. ■

The Daylighting Department

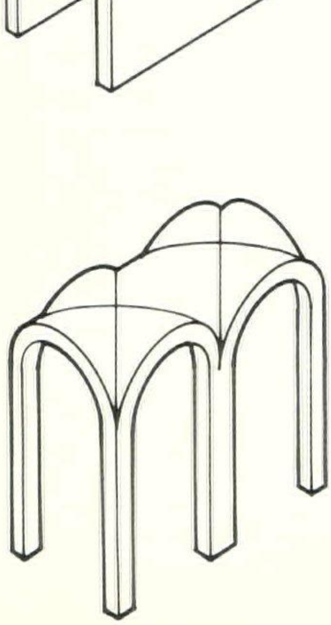


Norbert M. Lechner

Norbert Lechner is an associate professor in Auburn University's School of Architecture, Auburn, Alabama. This initiates a series of daylighting columns adapted from his book on architectural systems, which is nearing completion.

The history of daylighting and the history of architecture were one until the second half of the 20th century, when fluorescent lighting and cheap electricity became available. From the Roman groin vault to the Crystal Palace of the 19th century, the major structural changes in buildings reflected this goal: increasing the amount of light that entered buildings. Because artificial lighting had been both poor and expensive until then, buildings had been designed to make full use of daylight.

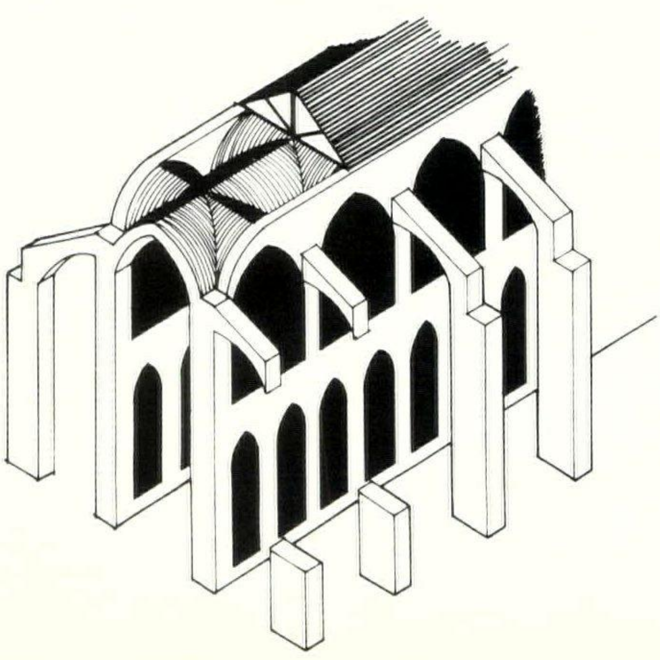
Gothic architecture is primarily a result of the quest for maximum window area. Only small windows were possible when a barrel vault rested on a bearing wall. The Roman groin vault supplanted the barrel vault partly because it allowed large windows in the vaulted spaces. Gothic groin vaulting with flying buttresses provided a skeleton construction that allowed the use of very large windows.



Large and numerous windows were a dominant characteristic of Renaissance architecture. Windows dominated the facade, especially in regions with cloudy climates, such as England. The increase in window size was so striking that one English manor was immortalized in rhyme: "Hardwick Hall, more window than wall." Although the facades of such Renaissance palaces were designed to give the impression of great massive structures, their E- and H-shaped floor plans offered solutions to their ventilation and daylight requirements. As a matter of fact, such shapes are typical of floor plans for most large buildings until the 20th century.

During the 19th century, increased availability of glass combined with new ways of using iron for structures to generate buildings that were all windows. The Crystal Palace by Paxton is the most famous example. Otto Wagner's post office in Vienna used sophisticated control of daylight for difficult visual tasks; a clear glass skylight shelters a diffusing glass ceiling.

In older neighborhoods in New York City it is still possible to find sidewalks paved with glass blocks that allow daylight to enter basements. Cities such as New York enacted zoning codes to ensure minimum levels of daylighting. In England, laws that tried to ensure access to daylight date back as far as the year 1189.



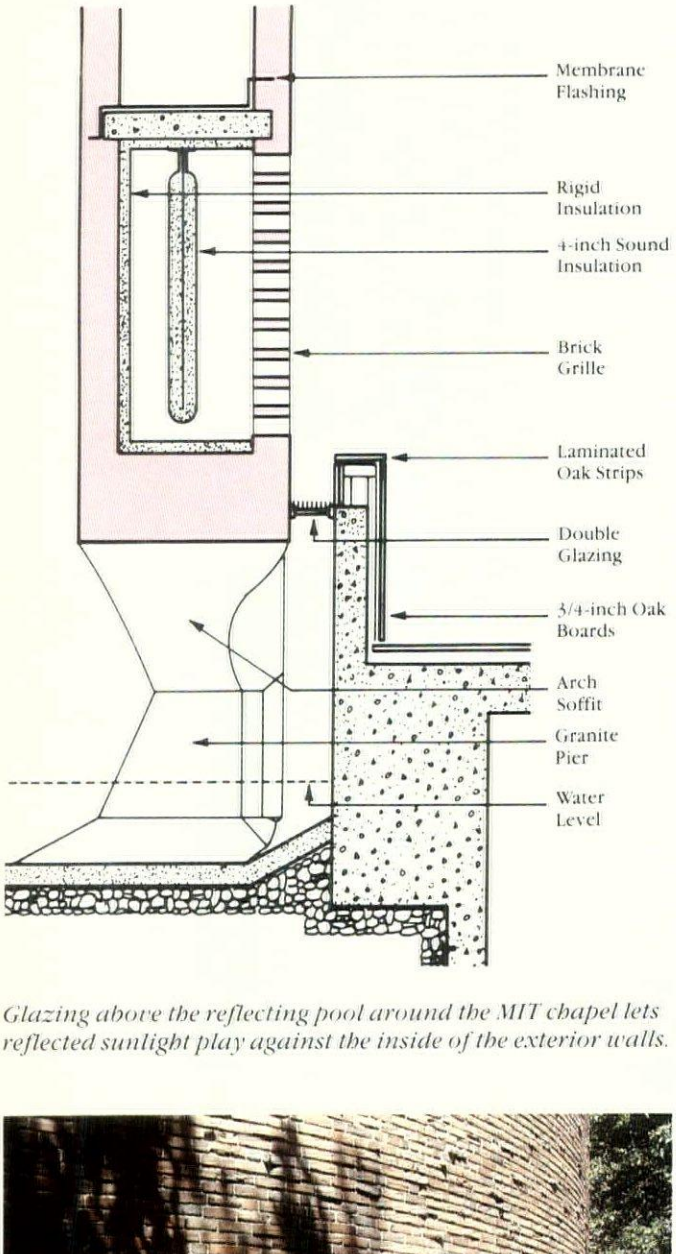
The masters of 20th century architecture continued to use daylight for both functional and dramatic purposes. In the Guggenheim Museum, Frank Lloyd Wright used daylight to illuminate the artwork both with indirect light from windows and with light from an atrium covered by a glass dome. In the Johnson Wax Building, he created a space with no apparent upper boundaries by letting daylight enter continuously along the upper walls and the edge of the roof as well as through skylights around the mushroom columns.

During the 19th century, increased availability of glass combined with new ways of using iron for structures to generate buildings that were all windows.

Le Corbusier created very dramatic effects with the splayed windows and light towers of the Chapel at Ronchamp. Eero Saarinen used a most fascinating form of daylight in the MIT chapel. Sunlight reflected from a pool around and under the building creates a dynamic play of light against the inside of the exterior walls. Saarinen also used a skylight directly over the altar. Baffles below the skylight allow only vertical light to enter; this vertical light is then reflected into the room by a sculpture consisting of tiny reflectors like leaves on a tree.

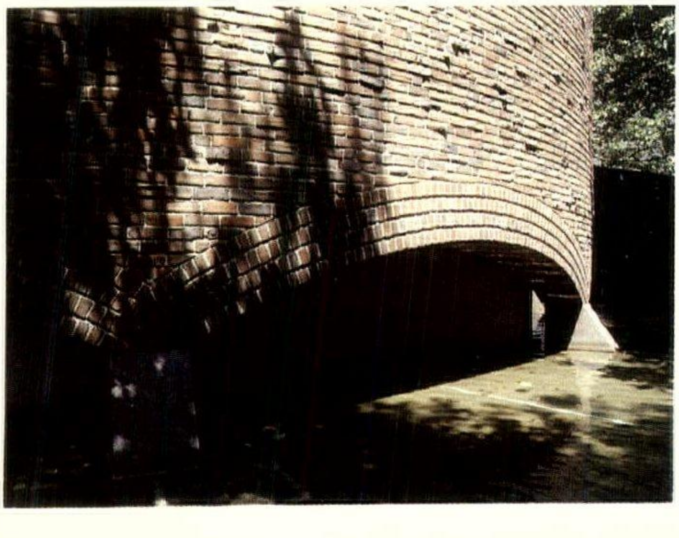
Why Daylighting?

Daylighting became a lost art in the second half of the 20th century because of the availability of efficient electric light sources, cheap abundant electricity, and the perceived superiority of electric lighting. Perhaps the most important advantage of electric lighting was — and still is — the ease and flexibility it permitted in floor plan design by allowing designers to ignore window locations.



Glazing above the reflecting pool around the MIT chapel lets reflected sunlight play against the inside of the exterior walls.

Baffles below a skylight over the altar let only vertical light enter, to be reflected into the room by a sculpture.



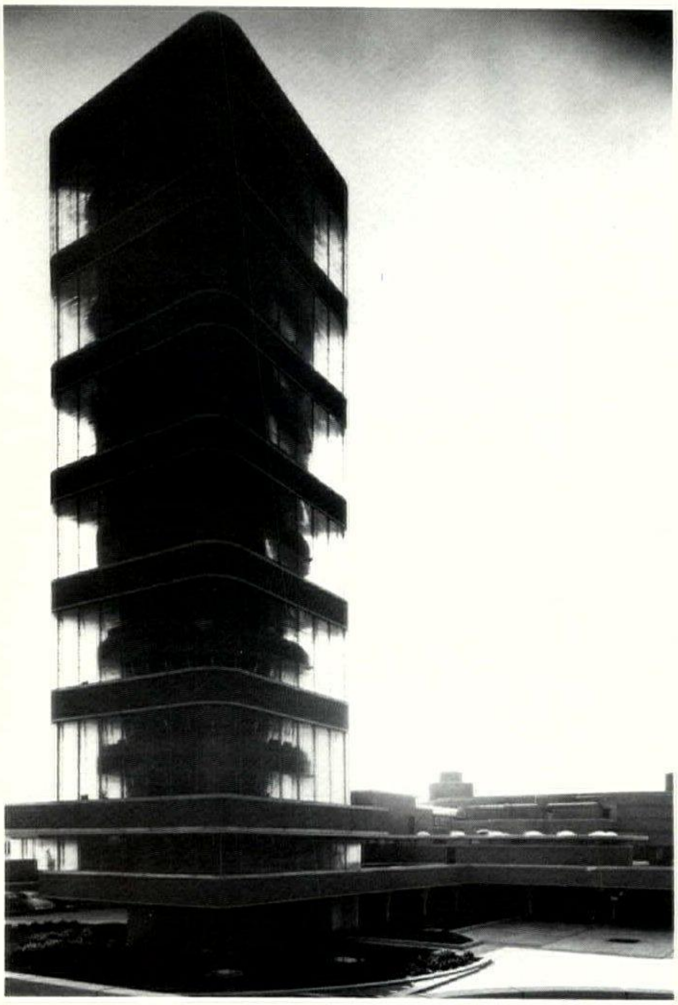
The reflecting pool outside the MIT chapel.

Supplying adequate daylight to work areas can be a serious challenge because of the great variability in available daylight. Electric lighting is much simpler; it offers consistent, easily quantified lighting. But, other considerations come into play.

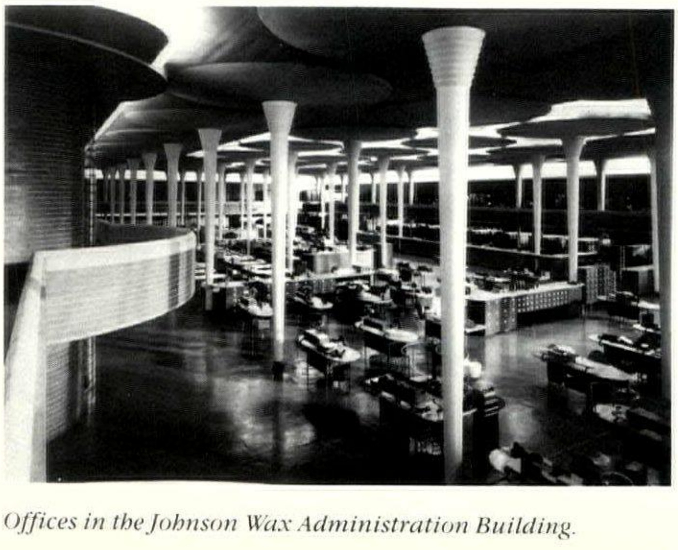
The energy crisis of the mid-1970s led to reexamination of daylighting's potential. At first, energy implications were primarily emphasized; now daylighting is also valued for its aesthetic possibilities and its ability to satisfy biological needs.

For most climates, and many building types, daylighting can save energy. For example, by using daylighting, a typical Southern California office building can reduce its energy consumption 20 percent. Buildings such as offices, schools, and industrial facilities often devote half their energy usage to lighting. Of the 8760 hours in a year, about 3000 are day-shift hours. Consequently, by using daylighting, a large proportion of the energy load for these buildings can be eliminated.

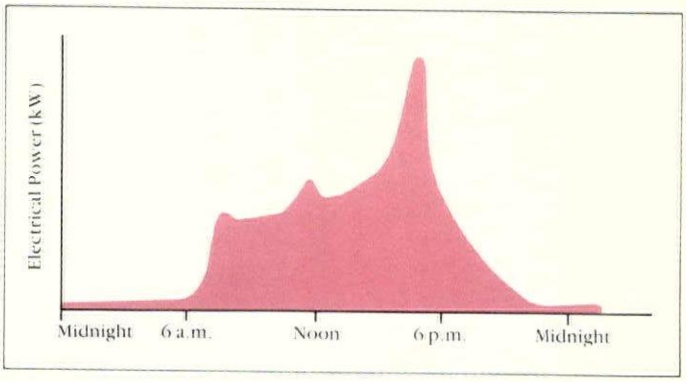
The energy crisis of the mid-1970s led to reexamination of daylighting's potential.



Light enters through the roof and upper walls of the Johnson Wax Administration Building.



Offices in the Johnson Wax Administration Building.



Typical office building energy consumption on a sunny day.

An important factor in the use of daylight in large office buildings is illustrated in the accompanying demand graph. On the graph — which shows the rate at which a typical office building uses energy during a sunny summer day — the horizontal axis represents time, and the vertical axis represents the rate at which electricity is used. The greatest demand for electricity usually occurs on sunny summer afternoons — when the air conditioning is working at full capacity.

At the same time the sun is creating this heavy cooling load, it supplies abundant daylight. Consequently, there is no need for some of the electric lights — which together account for about 50 percent of the total energy consumption. Therefore, the proper use of daylighting can reduce the maximum demand for electricity by as much as 50 percent.

Electric power plants are, and must be, built and sized not for the total energy they provide, but for maximum peak demands. Heavy consumers of electricity are therefore billed not only for the total energy they use but also for the maximum demand they make. For such users — large office buildings, schools, and factories, for example — daylighting can reduce the cost of electricity. This is because of both reduced energy use and reduced demand charges. These savings can offset any extra cost for daylighting. Society also will benefit if maximum demand can be reduced, because fewer electric power plants will be needed in the future.

Designers and building owners now see daylight's dynamic nature as a virtue rather than a liability. Daylight satisfies human biological needs for relating to the natural rhythms of the day. It also creates drama that is much more stimulating than a completely consistent electric lighting scheme.

Human needs — for visual relief, to communicate with the outdoors, and to enjoy views — convinced architects to continue using windows, even when daylight was completely ignored. The irony is that all-glass curtain walls were most popular during the 1960s — when daylighting was not used. Consequently, daylighting design does not require adding windows to otherwise windowless buildings. In most cases it doesn't even require increasing the window area. Daylighting design does, however, require the careful design of the fenestration for the proper distribution and quality of daylighting. It also requires automatic sensors to turn electric lights off when they are not required. ■

The Parts Department

A latecomer among light sources, fluorescent surpassed incandescent as the most widely used lighting for nonresidential applications in the early 1950s. The development of modular 2-by-4 surface-mounted and recessed fixtures in the middle and late 1950s set the stage for the fluorescent lighting "explosion" that accompanied the building boom that began right after World War II and continued beyond the 1960s.

April 1987 marks the 49th anniversary of the introduction of the fluorescent lamp by General Electric and Westinghouse at the 1938 New York World's Fair. Advances in lamp and ballast technology over the past few years now make possible potentially greater lamp efficacy (lumens per watt) and vastly improved color rendering.

The high cost of energy has also demanded a better relationship between output and color capability. This will be discussed more fully in a future column, focused upon the new generation of fluorescent products.

Advances in lamp and ballast technology make possible potentially greater lamp efficacy and vastly improved color rendering.

As a general light source, fluorescent is much more economical than incandescent, producing as much as five times the lumens per watt while generating only a fraction of the heat of incandescent lamps. Fluorescent lamps operate at lower cost per watt, with comparable lamp performance and considerably longer lamp life. There are three principal families of fluorescent lamps: preheat, instant start, and rapid start.

Sidney M. Pankin

Sid Pankin, the principal of Pankin & Associates, Inc., is a lighting applications engineer who specializes in lighting design, energy conservation, and the design and fabrication of lighting retrofit components.

A Separate Starter

Preheat is the original lamp introduced in 1938. It requires a separate starter, usually automatic, which supplies the current to preheat the lamp cathodes. The starter then automatically opens, stopping the current flow, and allows the ballast to provide full voltage to the lamp. Usually there is a delay of a few seconds, during which the lamp may flash on and off before finally starting. Fluorescent desk lamps often have a preheat system, in which a starting button is depressed and released to start the lamp.

Preheat lamps vary in length from 6 inches to 60 inches; wattages range from 4 to 90 watts. All of the lamps have bipin bases.

Miniature T5 lamps ($\frac{5}{8}$-inch diameter) are available in 4, 6, 8, and 13 watts; they are used where highly efficient small lamps are needed, such as at make-up mirrors.

T8 lamps (1- inch diameter) are most frequently used in display case lighting and desk lamps. They are available in lengths from 12 to 36 inches and wattages of 13, 14, 15, 20, and 30. All wattages but the 30-watt T8s are also available in the T12 lamp size ($1\frac{1}{2}$ inch). The 14-, 15-, and 20-watt lamps may be used with trigger-start ballasts that provide quick starting without the starters. The 90-watt T17 is an infrequently used lamp with a diameter of $2\frac{1}{8}$ inches. Some industrial fixtures now in operation may still use this lamp.

Later Starting Systems

Instant start and slimline lamps were introduced in 1944 to correct the slow starting of preheat lamps. The instant start with cold cathodes requires higher voltages to strike the arc. The single-pin lamps are used with depressable lamp holders; they are available in lengths from 24 to 96 inches and in wattages from 20 to 75 watts.

The most common application for T12 lamps in 72- and 96-inch lengths is in industrial applications, for strip fixtures, and in retail cornice and valance lighting systems. Shorter T12 lamps are seldom used where rapid start and trigger start lamps can be used. T8 and T6 ($\frac{3}{4}$ inch) versions of the lamp are used in display case lighting systems — the T8s in 72 and 96 inch lengths, the T6s in 24-, 36-, and 42-inch lengths.

Rapid start lamps were first marketed in 1952 as an alternative superior to 40-watt lamps. The high-voltage slimline lamps require large and relatively heavy ballasts; rapid start lamps use a smaller and more efficient ballast. Heating windings provide cathode heating in the ballast, without the need for a starter and at a starting voltage lower than that required for similar slimline lamps. What's more, they start almost as fast as the higher voltage slimlines. All rapid start lamps have bipin bases.

Rapid start lamps use smaller and more efficient ballasts than the high-voltage slimline lamps.

Development of the rapid start F40 lamp triggered the development of the 2-by-4 modular fixture during the mid-1950s. The recessed version became the mainstay of fluorescent lighting design. Because of their common use, 4-foot lamps are designated simply as F40; 3-foot lamps still carry the full designation — F30T12. The two lengths available are 48 inches and 36 inches.

Rapid start high output (HO) lamps produce 40 percent to 45 percent more light output at 800 milliamperes than slimline lamps of equivalent length for indoor use. The standard indoor high output lamp is available in lengths from 24 inches to 96 inches and in a wattage range from 25 watts to 110 watts. Most commonly used is the 8-foot high output lamp for industrial and strip fixtures. It uses a recessed double contact base to eliminate electric shock hazard.

Design applications for VHO lamps must consider heat dissipation to prevent reduced light output and lamp life.

Rapid start very high output (VHO) lamps operate at 1500 milliamperes and 25 watts per foot of lamp length, compared to HO lamps at 14 watts per foot and slimlines at 10 watts per foot. VHO lamps are available in lengths from 24 inches to 96 inches, and wattages from 70 to 215. They are primarily used in the 96-inch length in industrial and strip fixtures.

Design applications for VHO lamps must take into consideration the need for heat dissipation to prevent severe reductions in light output and lamp life. VHO lamp systems are used considerably less often than HO systems for applications in which heat development is a problem.

HO and VHO lamps are differently configured for outdoor applications. A high output instant start is used for illuminated signage; its shrouded single-pin base provides reliable electrical contact. For high efficiency in cold temperatures, the rapid start high output is also operated at 1000 milliamperes. VHO outdoor lamps are used in tilted fixtures for optimum performance; they may be seen in use for general lighting at auto dealerships and service stations and in roadway applications.

U Lamps

The rapid start U lamp, a product of the late 1960s, is basically an F40 lamp bent into a U shape so that two or three lamps can be used in a 24-inch square fixture. The lamps operate with standard rapid start ballasts, which allow wiring the lamp holders on one side of the fixtures. The legs of the lamps may be spaced nominally 3 inches apart when three lamps are used per fixture and 6 inches when two lamps are used in a fixture. Lumen output and rated life are less than those for straight F40 lamps. The designations are F40/U3 and F40/U6.

For architects and designers, the U lamp permits efficient use of nondirectional fixtures in modular ceiling systems. The light output and lamp life of a two-U lamp fixture is much greater than that of four F20T12 trigger start lamps — and less expensive.

Of course, all of the lamps mentioned work in combination with ballasts; ballasts will be the subject of a future column, as will the new families of miniature fluorescent lamps. In a future column, The Parts Department will cover energy-saver lamps and exciting developments in color.

Two or three rapid start Ulamps can be used in a 24-inch square fixture.

A good reference source to have at hand as various lamp types are discussed is a full lamp catalog from at least one of the full-line lamp manufacturers. You can get them from the manufacturer or an electrical distributor. ■

Continued from page 27

modifying the color may be necessary just to obtain a match. The distinction between a polished finish and a satin or brushed finish can be of great importance to a manufacturer when selecting the material and developing tooling.

Even painted finishes should be specified. Designers typically select colors from the color charts of architectural paint suppliers, but these colors are not necessarily

A straightforward design is one way to minimize difficulties.

made for lighting fixtures. Fixture manufacturers use baking enamels, polyurethanes, polyesters, and fluoropolymers. The cost of mixing special colors varies greatly with the type of paint, and the cost of obtaining a perfect match should be considered when making the specification.

One recurring ambiguous finish specification manufacturers see is "brass." Brass is a metal available in a number of alloys, each with its own color and formability characteristics. Brass metal can also be plated over a variety of other metals, chosen for their own characteristics. It can be polished, satin finished, or left in a mill finish. It can wear a protective finish or can be allowed to age and tarnish naturally. Brass also is used as a color description for anodized finishes and paints. Clearly, using "brass" as a finish specification is inadequate.

Once the designer and manufacturer have coordinated on specifications, the information they generated must work its way through trade channels for the bidding process. A designer should bear in mind that — in most cases — other parties have an opportunity to review the drawings after they are submitted; it is not unknown for an architect, electrical engineer, or owner to amend a design at the last moment. These parties all must recognize, therefore, that it is unrealistic to assume the manufacturer has the latest requirements.

The bid documents should be available to the specified manufacturers in time to allow them to properly prepare prices. Custom fixture designs nearly always require at least some outside component sources, and it can easily take more time to price a fixture than it takes to design it in the first place. When deprived of adequate specification information or preparation time, a manufacturer will probably increase the price sufficiently to cover the most costly possibility.

The lighting performance characteristics of most custom lighting fixtures usually are not critical. Many designs are decorative or are for a purpose in which any light in the right direction will be adequate. In those cases in which photometric qualities are important, the only way to accurately predict performance is to make a fixture and test it. For this reason, it is most beneficial to try to use known optical components. If no suitable ones are available, new development is possible — the cost will be part of the fixture price.

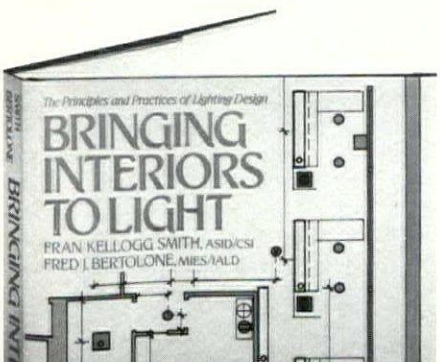
Custom lighting fixtures are an exciting part of today's architecture, allowing designers to add individuality and innovation to the practical purpose. With an understanding of what manufacturers need to ensure successful execution of designs, lighting professionals can make use of the many possibilities with confidence. ■

Book Reviews

Bringing Interiors to Light, by Fran Kellogg Smith and Fred J. Bertolone. New York: Whitney Library of Design. 1986. 224 pages. $39.95.

This welcome addition to a library of lighting design contains a tremendous amount of information in a relatively slim volume. For Smith and Bertolone, the design of lighting is not limited to prescribing recommended levels of illumination, glare-free fixtures, and energy-efficient light sources. They consider light on a par with form, color, and texture in architecture. As such, it is one of the determinants of the composition, scale, proportion, and ultimately the delight of interior spaces.

The authors emphasize that the lighting of interiors depends not only on the location and type of light source, but also on the design of materials and finishes in the interior. Their perspective is based on years of successful practice as interior designers, and they have managed to present the principles of lighting most important to designing for real world situations.



Smith and Bertolone consider light on a par with form, color, and texture in architecture.

The book is divided into three parts, followed by appendixes and a bibliography. The first part is devoted to techniques for design, the second part to case studies of actual lighting designs, and the third part to special topics in lighting.

Chapter one begins with guidelines for assessing the client's needs and the building site. A sample questionnaire is accompanied by instructions for conducting a client interview and analyzing a user's seeing requirements. The attitude is toward balancing climate, site, and user requirements.

The authors point out that interior designers play an important role in the use of passive solar energy and daylighting through the ways they arrange interior colors and finishes, plan space, and orient furniture. The first chapter is a potpourri, with quick reviews of the physiology of vision, solar geometry, sunshading, and color theory sandwiched between site analysis and psychological factors in lighting. Most of the information is useful, however, and important to design.

Chapter two introduces the authors' technique of lighting composition. The emphasis is on using "a minimum of electricity to deliver the maximum in meaningful brightness." Their approach to design is obviously based on many years' cumulative observations and successful practice. The set of prescriptive rules they have developed will be helpful to novice designers.

The remaining chapters in Part One cover the selection of light sources and fixtures, drawing conventions, bidding instructions, specifications, and development of the fixture list. This is utilitarian information that helps designers understand the complicated information in codes and regulations and today's standards of office practice.

The nine case studies of specific interiors in Part Two contain the most useful information in the book. Here is a glimpse of how lighting designers work and think. Theory materializes into form and space, and the reader is guided step by step through the process. From an analysis of the design program to compositional strategy and lighting tactics, readers are shown a wide spectrum of actual lighting designs for a variety of different lighting situations — from the entryway of a private residence to the lobby of a major hotel, from the dining room of a town house to that of a busy restaurant. One detailed daylighting study of an open office design features the now-famous Lockheed office building in Sunnyvale, California.

The presentation of the case studies is appealing. The text is clearly organized, and the numerous illustrations will be appreciated by visually oriented professionals. Design principles are profusely diagrammed, and construction details are shown in dimensioned drawings. Photography is used effectively to show finished spaces, and most of the color photographs are of top quality.

Color plates for the book are gathered into a separate section between Parts One and Two and illustrate the chapters. The theory of color, spectra of light sources, and color photographs of interiors appear here. There are good color photographs of the work of California artist James Turrell, along with other examples of lighting as an art form.

Light as art is the subject of the last chapter, and in it the authors cover the latest in hardware, kinetic effects, and illusions being created by artists and designers. The section on spatial illusions will be especially interesting to architects who are interested in manipulating spaces without using physical enclosures. The authors speculate that, in the future, designers will be able to do more with less by shaping and creating spaces with these emerging lighting techniques.

The authors address some difficult issues in lighting, such as the integration of electric lighting and daylighting, the lighting of video display terminal workstations, lighting for the elderly and the disabled, and lighting plants. The coverage in these areas leaves the reader with an appetite for more information. The principles and salient design issues are covered, with enough information to begin designing.

To summarize, *Bringing Interiors to Light* is a good reference for those who would like to know how to begin a conceptual lighting design; it provides guidelines for producing a completed project. The book is a thought-provoking reminder of the importance of light in creating spatial effects — from the smallest residence to the grandest public space.

—David Lord

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

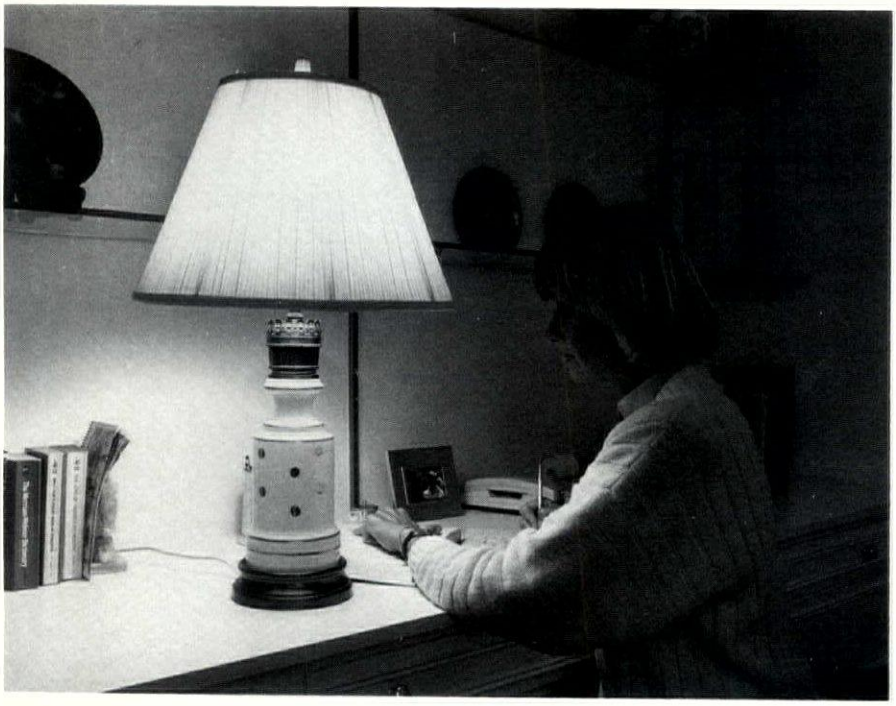
Sun, Wind, and Light: Architectural Design Strategies, by G.Z. Brown. New York: John Wiley & Sons, 1985. 176 pages, $17.95 (paper), $32.95 (cloth).

Gone are the days when the only thing an architect needed to know about building energy usage was an engineer's phone number. The decisions that affect the majority of energy usage in buildings are made during the schematic design phase. This is not a new phenomenon; what is new is the seriousness of the economic consequences brought on by ignoring energy issues during the most formative stage of design. As a result, architects are necessarily concerning themselves with climate, building orientation, passive heating and cooling strategies, and daylighting.

In *Sun, Wind, and Light*, G.Z. Brown concentrates on the relationship between architectural form and energy usage — specifically passive solar heating, cooling, and daylighting. This is an appropriate focus because these passive strategies are more closely tied to building form

Continued on page 61

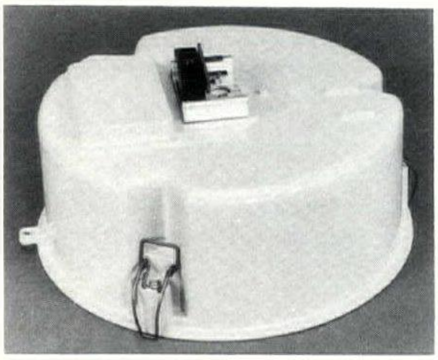
Product Showcase



■ Reading lamp

The Soft-White Reader Light from General Electric Lighting Business Group is designed to provide a high level of diffused light for reading and other work that requires visual concentration. According to the manufacturer, the lamp is distinguished from most lamps used for reading by a more powerful filament that produces more light, a larger surface that softens the light, and an interior coating and matte-textured exterior surface that diffuse the light. The 80-, 170-, or 250-watt lamps fit floor, table, and wall luminaires that have inner harps of 7 inches or more. Suggested applications include hotel rooms, offices, and dormitories. General Electric Lighting Business Group, Cleveland, OH.

Circle 50



■ Multipurpose ballast

A new die-cast aluminum ballast assembly from General Electric Lighting Systems accommodates several existing optical assemblies. The high pressure sodium, metal halide, and mercury vapor luminaires include the Conserva 150, open and enclosed Minimite, Versaglow 150 and 250, and Lowmount with flat pan.

The ballast housing has a baked acrylic gray electrocoat paint finish that resists corrosion, the manufacturer reports. A primary electrical sliding disconnect allows installation with a variety of mounting hardware options. Three stainless steel latches secure the optical assembly to the ballast housing, allowing workers to replace lamps without tools.

The manufacturer offers the ballast assembly for 50- through 250-watt luminaires. Optical components are completely interchangeable within their permissible wattage range. General Electric Lighting Systems Department, Hendersonville, NC.

Circle 51

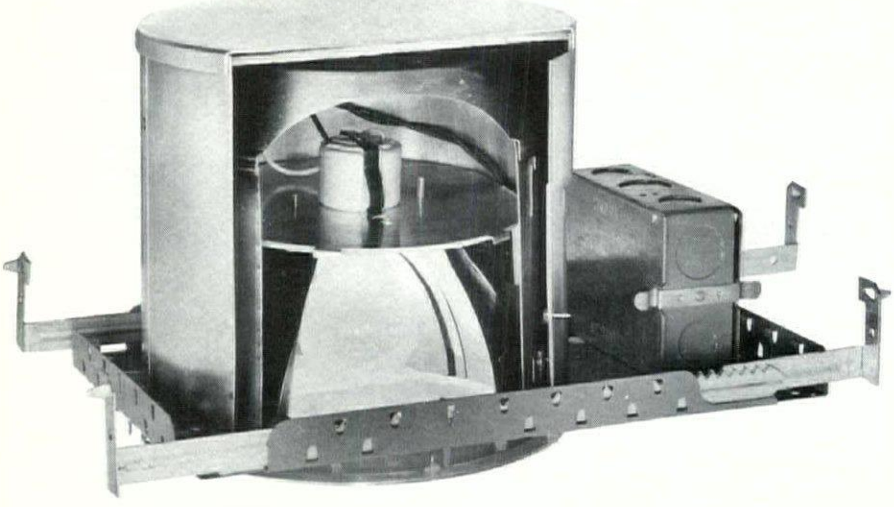
■ Luminance meter

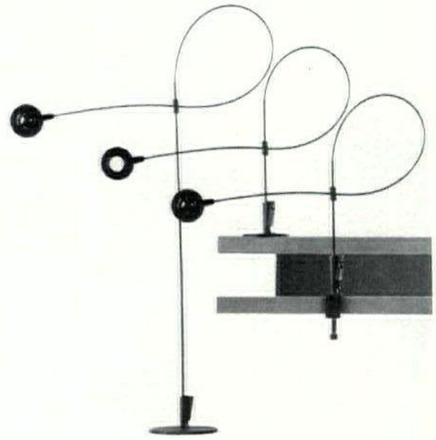
Bruel and Kjaer's new hand-held model 1101 luminance meter measures luminance levels from 0.01 candelas per square meter to 2000 kilocandelas per square meter. The meter has built-in auto-ranging and auto-zero functions to facilitate readings in widely varying ambients. Users can select measurement field angles of 1/3 degree or one degree using targets visible through the 11-degree viewfinder.

Users can choose average, maximum average, or peak functions to measure the luminance of fluorescent or other flickering light sources. In addition to measuring luminance directly, the meter also can measure illuminance and intensity with an aperture adapter.

The spectral sensitivity of the meter matches that of the standard photopic curve within 3 percent, and its sensitivity to stray light is less than 1 percent, the manufacturer reports. Charts of spectral response at each wavelength, spectral match to the V(λ) curve, directionality of the optics, and stray light sensitivity are supplied with each meter. Bruel & Kjaer Instruments, Inc., Marlborough, MA.

Circle 53





■ Recessed fixtures

New recessed fixtures from Halo Lighting are thermally protected for insulated ceilings. The luminaires can be covered by insulation to prevent thermal exchange through the ceiling. Model H77, shown here, provides ambient and accent lighting and offers a choice of 16 trims, including reflectors, baffles, open and lens trims, and adjustable eyeballs. Model H99, designed for smaller apertures, has a choice of five trims with 4¾-inch diameters.

The fixtures, which can use a variety of lamps up to 150 watts, are equipped with integral thermal protection. Their Underwriters Laboratories IP rating indicates that the thermal protector will detect an improper or overwattage lamp, deactivate the unit, and cycle it on and off until the situation is corrected. Halo Lighting, Elk Grove Village, IL.

Circle 54

■ Task lamp

Innovative Products for Interiors (IPI) has added a new task lamp to its Sirrah lighting collection. Rene Kemna designed the low-voltage halogen luminaire, the Sigla T. A 360-degree rotating reflector directs the light in any direction. The task lamp's adjustable height and extendable arm offer flexibility. A companion floor lamp is also available. Innovative Products for Interiors, Inc., Long Island City, NY.

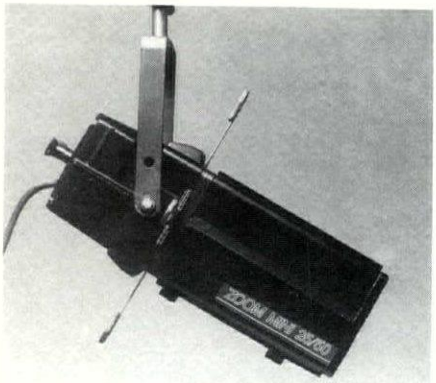
Circle 55

■ Thermal skylights

Sierralite thermal-barrier skylights from Sierra Plastics are designed to reduce heat transfer through the aluminum frame. The cutaway view shows the polyurethane thermal barrier that is extruded between the main frame and the condensation rail. Triple ½-inch-wide seals of polyisobutylene tape provide a watertight bond between the lenses and increase the insulating capacity of the skylight, according to the manufacturer. The tape is designed to stay pliable to ensure a tight seal as the cell-cast acrylic glazing expands and contracts.

The manufacturer offers mill and anodized dark bronze finishes on the fully welded, extruded-aluminum frames. Most units can be supplied with a manual opening mechanism and a double frame. Custom shapes include domes, triangles, pyramids, barrel vaults, and multisided polygons. Sierra Plastics Inc., White City, OR.

Circle 56

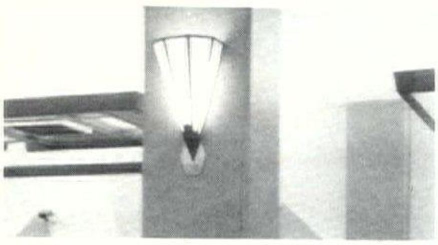


■ Ellipsoidal spotlights

Colortran's variable-focus ellipsoidal spotlights feature a new 600-watt lamp that is reported to provide 50 percent more light output than conventional 500-watt screw-based systems. A lamp-house design that allows constant orientation of the filament support bridge makes the light source more compact and more efficient, according to the manufacturer.

The Zoom Mini 25/50, shown here, has a spot focus of 25 degrees at 20 feet and a flood focus of 50 degrees at 10 feet. Two other models — one for longer distances and one for shorter distances — are available. The special-effects projection and beam-shaping capabilities of the Zoom Mini make it suitable for isolating such objects as paintings, photographs, and signs in a a custom-shaped area of illumination. Colortran, Inc., Burbank, CA.

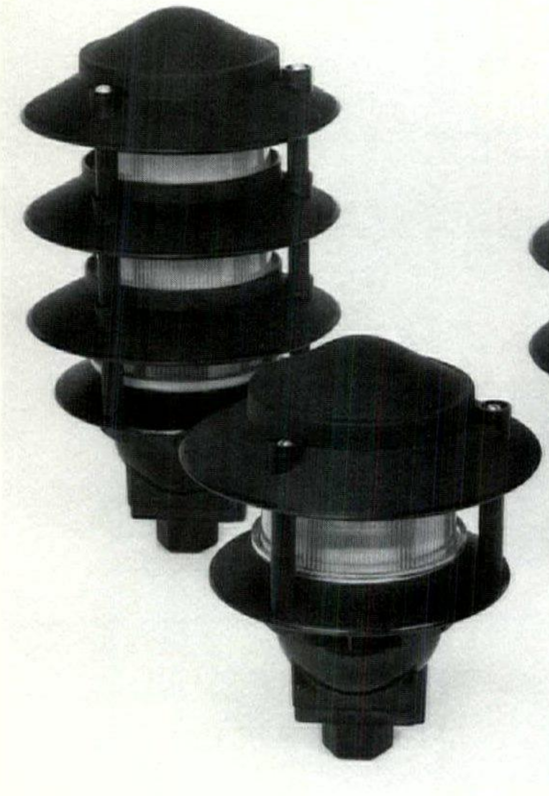
Circle 57



■ Custom fixtures

A set of six custom fixtures demonstrates the capabilities of Appleton Lamplighter, a custom lighting fabricator. Installed in the Merchandise National Bank, Chicago, the fixtures are an updated version of the building's original art deco fixtures, installed in the 1920s, which still light its first-floor hallway. Each of the new fixtures accommodates two fluorescent lamps and is 31 inches long. The frame is constructed of solid brass and the lens is opal glass. Appleton Lamplighter, Appleton, WI.

Circle 58



■ Energy-saving landscape fixtures

Electro Elf's outdoor fixtures feature injection-molded, high-impact plastic construction that resists chipping, peeling, and environmental corrosion. The lens-to-body seal is completely waterproof, preventing damage to inner electrical contacts. The fixture's compact fluorescent light source is reported to last 5 to 12 times longer and consume 75 percent less energy than incandescent sources.

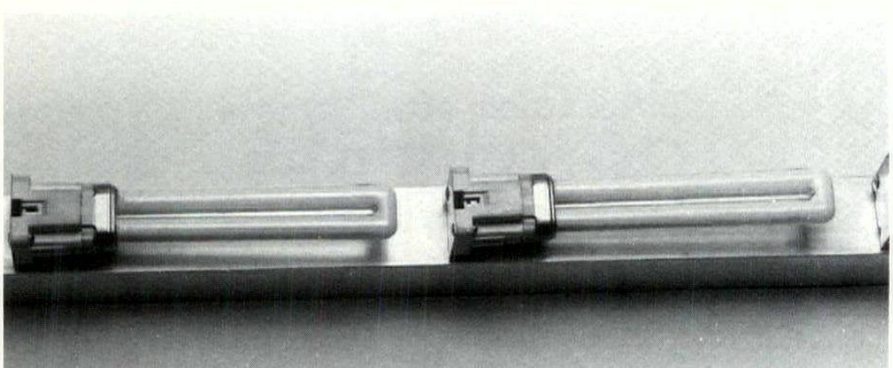
Six models with 5-, 7-, 9-, or 13-watt lamps are available in four standard colors; custom colors can be molded on special orders. The pagoda-style fixtures shown here are especially suitable for garden settings. Electro Elf, Temple City, CA.

Circle 59

■ Illuminance meter

Minolta's illuminance meter features a sensitive silicon photocell for rapid and continuous measurement of illumination. The hand-held instrument is equipped with a microprocessor and an LCD, weighs $7\frac{3}{4}$ ounces, and is less than 7 inches long. In addition to providing immediate readings, the meter calculates illuminance over a period of time and measures deviation between sources. The instrument also measures the deviation of a single illumination source at different meter positions. Minolta Corporation, Industrial Meters Division, Ramsey, NJ.

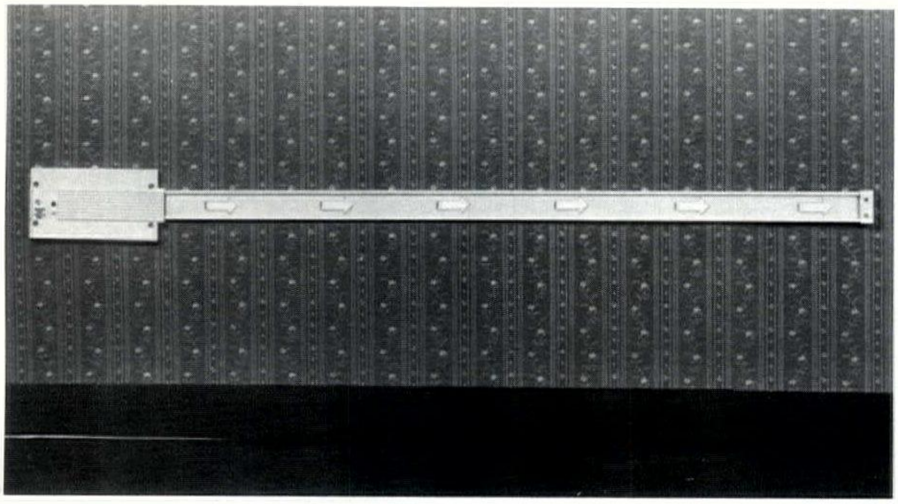
Circle 60

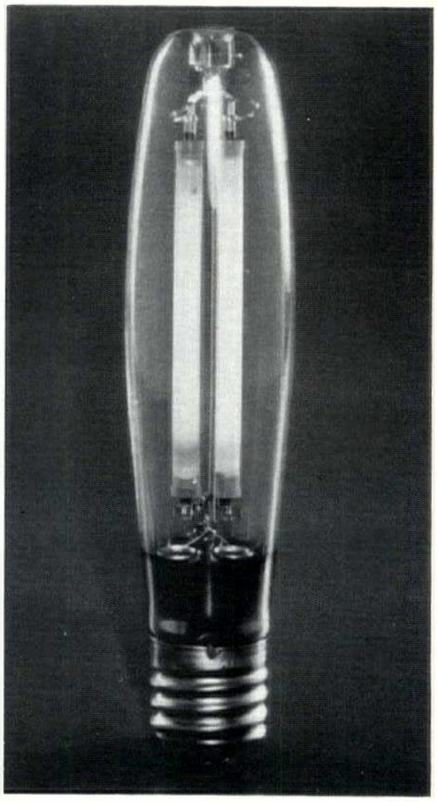


■ Light strips

PL-Plus light strips from Norbert Belfer Lighting house compact fluorescent lamps on an extruded aluminum raceway with self-contained ballasts. The strip, including lamps, measures $1\frac{1}{2}$ inches wide and $2\frac{5}{8}$ inches high; lengths are custom cut to any length required. Swiveling sockets ease relamping. The strip, available in models that accept 7- and 9-watt lamps, is recommended for lighting coves, shelves, and valances. Norbert Belfer Lighting, Ocean, NJ.

Circle 61



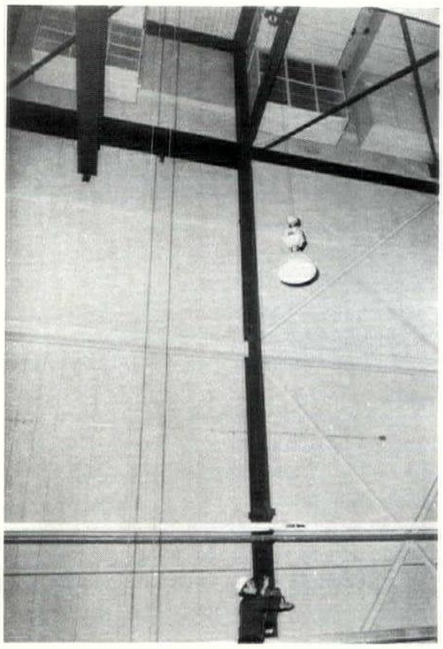


■ Emergency exit light

Vectorstrobe, a battery-powered emergency light from Chloride Systems, is designed to show the way to exits even if smoke obscures lights near the ceiling. The manufacturer recommends installing the 48-inch strip 18 inches above the floor. When a power failure or remote smoke detector activates the unit, six electroluminescent arrows light up in a strobe effect for about $3^1/_2$ hours, according to the firm.

A battery charger, solid-state circuitry, and a 12-volt rechargeable battery pack can be recessed in the wall as an integral part of the device or mounted as far as 5 feet away. The lamps have an expected life of 10 years. Chloride Systems, North Haven, CT.

Circle 62



■ Lighting hangers

Joslyn has introduced a new line of Thompson lighting hangers for servicing and relamping high-bay fixtures. The hangers automatically disconnect power as they begin to lower a fixture for servicing at ground level; they reconnect power after they elevate a fixture, restoring its original position and focus. They enable one person to safely clean, service, or relamp fixtures mounted at heights up to 450 feet and eliminate the need for scaffolding, ladders, catwalks, or other special equipment.

The new models feature special pulleys for a free-running cable and a portable winch and bracket system for handling the cable. The devices are suitable for such applications as aeronautical obstruction lights and beacons, manufacturing plants, sports arenas, and other facilities with high ceilings. Joslyn Corporation, Hi-Voltage Equipment Division, Cleveland, OH.

Circle 63

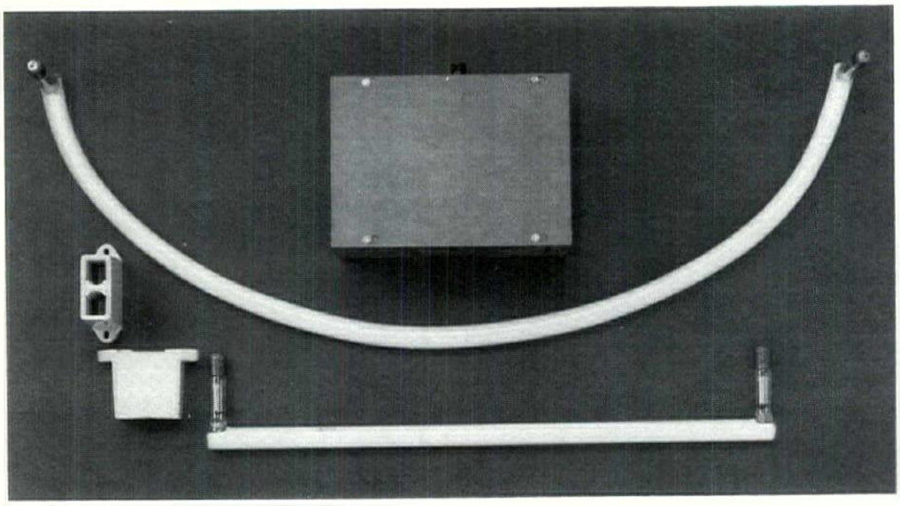
■ Fast-relighting lamp

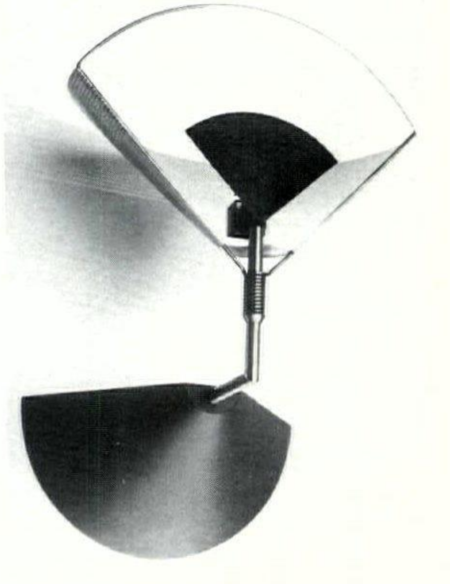
New Ceramalux high pressure sodium lamps from North American Philips feature two arc tubes mounted in parallel. The double-tube design provides fast relighting after a momentary power interruption, shortening the restrike and recovery cycle associated with high intensity discharge lamps.

Only one of the arc tubes is lighted at any given time of operation. When power is restored after a momentary interruption, the second arc tube lights instantaneously. It immediately provides 3 percent to 5 percent of full lumen output; within about two minutes, it provides full output.

The manufacturer recommends the 250- and 400-watt lamps for areas where power interruptions can cause low light levels that present a safety hazard. Applications include manufacturing plants, warehouses, foundries, power plants, steel mills, airports, correctional facilities, and maintenance shops. North American Philips Lighting Corporation, Somerset, NJ.

Circle 64





■ Cold cathode lighting

A line of cold cathode architectural lighting products has been introduced by Newman Cathode Lighting. The firm offers modular components and entire systems of white and colored lighting. Design assistance is available.

The firm's complete lighting systems include lamps, sockets, transformers, and high-voltage secondary cable. The heavy glass lamps are 25 millimeters in diameter, comparable in size to T 8 fluorescent lamps. Right-angle electrodes (shown on the lamps here) or straight electrodes can be specified. Porcelain sockets allow a single lamp or several lamps in series to be connected to a transformer. Safety circuit interlocks are designed according to NEC Article 410, Part R.

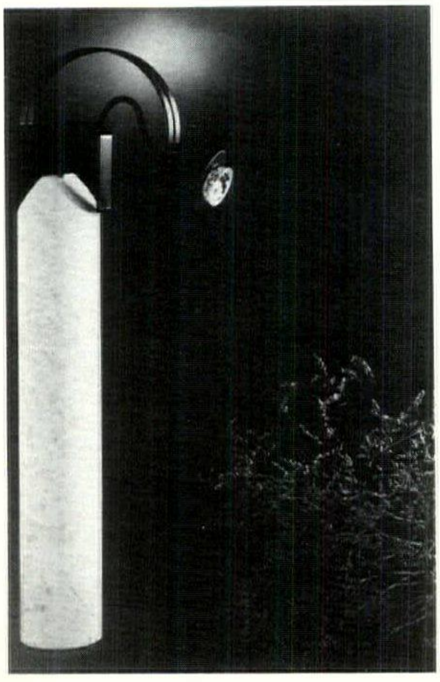
The manufacturer's modular components include a variety of lamp sizes, colors, and shapes. Aperture and reflector lamps are also available in the modular series. For custom systems, the firm can provide specialized lamp designs and custom-blended colors. Designers can add solid-state wall-box dimmers for full-range dimming. Newman Cathode Lighting, Santa Monica, CA.

Circle 65

■ Lighting collection

Nessen Lamps has introduced a collection of luminaires designed by F.A. Porsche. The Sintheto collection uses halogen, incandescent, and fluorescent light sources in ceiling, hanging, wall, torchère, floor, and table luminaires. The Parete H sconce shown here features a baked enamel shield that refracts light. U.S. distributor: Nessen Lamps Inc., Bronx, NY.

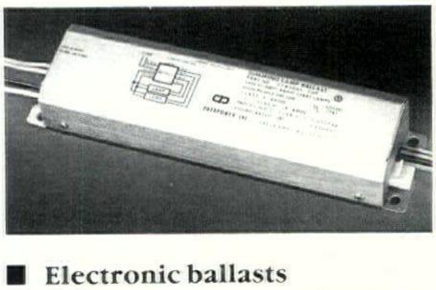
Circle 67



■ Designer lamp

Solzi Luce of Italy has designed a lighting collection that includes the Sigmund Tavolo floor or table lamp, distributed in the United States by Lightning Bug. The white or black marble body of the luminaire supports a metal frame that serves as a track, allowing a halogen lamp in a flower-shaped socket to be positioned anywhere in a 270-degree arc. The 20-inch-high lamp is recommended for highlighting plants and art. Distributor: Lightning Bug, Ltd., Hazel Crest, IL.

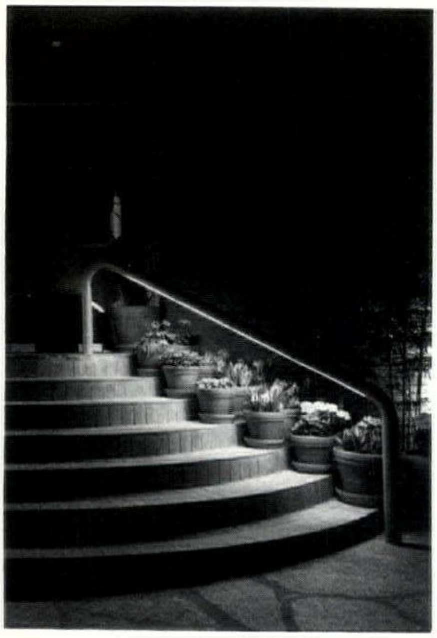
Circle 66



■ Electronic ballasts

Datapower has introduced a line of completely electronic ballasts for service with dual 40-watt fluorescent lamp fixtures. The ballasts provide full-range dimming control that can be manually or automatically activated. Suitable for retrofit applications, the ballasts carry a three-year limited warranty. Datapower, Inc., Santa Ana, CA.

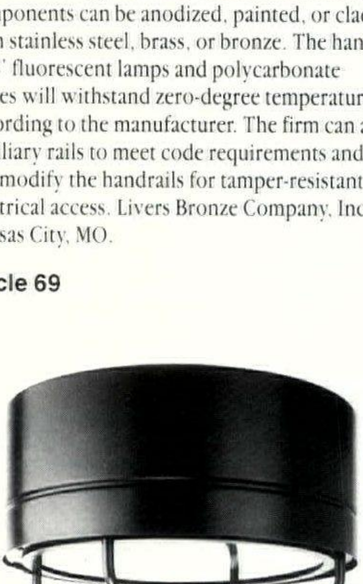
Circle 68



■ Illuminated handrails

Livers Bronze produces a series of illuminated handrails with various profiles for both interior and exterior applications. Extruded aluminum components can be anodized, painted, or clad with stainless steel, brass, or bronze. The handrails' fluorescent lamps and polycarbonate lenses will withstand zero-degree temperatures, according to the manufacturer. The firm can add auxiliary rails to meet code requirements and can modify the handrails for tamper-resistant electrical access. Livers Bronze Company, Inc., Kansas City, MO.

Circle 69



■ HID outdoor lighting

A one-piece spun aluminum housing encloses the high intensity discharge light system of QL's Design 124 luminaire. Outside air circulates throughout the optical chamber and ballast compartment. A gasketing system filters the air, keeping out moisture, dirt, and insects, according to the firm. The system is designed to permit cleaner, cooler operation and extend the service life of electrical components.

Both the lens frame and the reflector are hinged for access to the optical chamber and ballast compartment. The ballast, capacitor, and wiring are mounted on a separate tray to ease installation, service, and upgrading.

The luminaire is available in three housing sizes, and designers can choose a variety of electrobrightened, anodized, and sealed reflectors. Four light distribution patterns are available: square, symmetrical, asymmetrical, and forward-throw floodlighting. A built-in mounting spider and tenon filter will secure the luminaire atop a pole with a 2-inch pipe tenon. QL, Inc., Northbrook, IL.

Circle 70

■ HID wall washer

Guth Lighting has introduced the Q-Lux series of wall washers. The luminaires are specifically designed for use with 70-watt to 150-watt tungsten halogen and metal halide lamps. Each unit swivels up to 25 degrees from vertical on its mounting attachment, which may be recessed, surface, or pendant style. The computer-designed optical chamber has a reflector with 31 primary control surfaces that provide uniform light distribution from floor to ceiling, the manufacturer reports. Guth Lighting, St. Louis, MO. ■

Circle 71

Continued from page 52

than are mechanical and electrical alternatives. The book is organized in three parts: Analysis Techniques, Design Strategies, and Strategies for Supplementing Passive Systems.

The first part, on analysis techniques, plays a supporting but crucial role for the second part. The analysis techniques help designers define the context of a problem by understanding the sun, wind, and light resources at a particular site in a given climate.

The heart of the book is the second part, on design strategies. This is the section that designers will find the most useful while formulating a basic design concept for a project. The design strategies are organized first in terms of scale: building groups, buildings, and building parts. Within the scale organization, strategies are organized by architectural elements, such as streets, blocks, and rooms. Brown's approach considers architectural elements the common denominator of issues considered at the schematic design stage. Designers manipulate those elements to develop a design concept.

The third part of the book, on supplements to passive systems, is the shortest. It addresses the important issue of integrating passive design strategy with more conventional mechanical and electrical systems in buildings.

The author assumes that readers have some background in energy issues and techniques. As a result, *Sun, Wind, and Light* does not pretend to be a complete, self-sufficient reference or textbook. Instead, it presents information at a rule-of-thumb level, giving only general ideas about architectural elements, their sizes, and their relationships to other elements.

Because the book is so successful in addressing issues of concern during the schematic design phase, ultimately it may well be the most useful book for professional architects and architectural students that has been written on the subject. It is not surprising that *Sun, Wind, and Light* has already been widely adopted as a text at architectural schools throughout the country. Significantly, this adoption has taken place not for lecture courses, but for design studios.

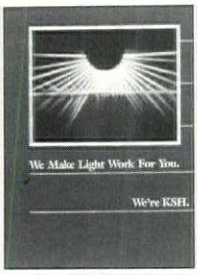
The success of the book is in no small part due to the superb illustrations by Virginia Cartwright. Her background as an architect and educator shows through quite clearly, not only in the visual quality of the drawings but also in the selective emphasis that she uses in illustrating the book's design principles.

—Fuller Moore

Fuller Moore is a professor of architecture at Miami University, Oxford, Ohio.

Product Literature

■ Prismatic lenses



A brochure from K-S-H demonstrates nine applications of the firm's prismatic lenses. The brochure provides a list of regional sales offices. K-S-H, Inc., K-Lite Division, St. Louis, MO.

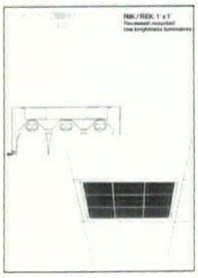
Circle 130

■ Metal halide lamp

Osram's HQI-TS 250-watt lamps have double-ended quartz envelopes. A technical data sheet details the compact metal halide lamps and graphically presents lumen maintenance, lamp mortality, and spectral data. Osram, Newburgh, NY.

Circle 131

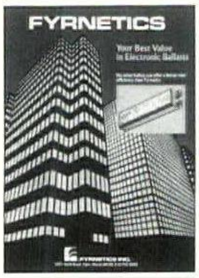
■ Recessed luminaires



New literature from Zumtobel describes the RIK and REK low-brightness recessed luminaires. Designed for easy mounting in a one-foot-square ceiling grid, the luminaires use compact fluorescent lamps. Zumtobel Lighting Inc., Fairfield, NJ.

Circle 132

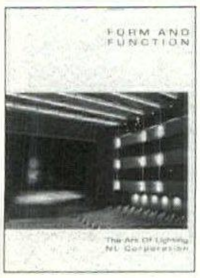
■ Electronic ballasts



Replacing conventional ballasts with high-frequency electronic ballasts can save up to 30 percent in energy costs, according to a brochure from Fyrnetics. The brochure includes a worksheet that helps calculate potential savings. Fyrnetics Inc., Elgin, IL.

Circle 133

■ Interior lighting



A pictorial brochure from NL Corporation illustrates applications of the firm's lighting fixtures and systems. Chandeliers, custom luminaires, track and channel lighting, and church lighting are featured. NL Corporation, Cleveland, OH.

Circle 134

■ Lighting collection

The Lighting Imprints catalog from Columbia Lighting presents a collection of lighting products selected for their aesthetic qualities, both as visual objects and as producers of light. Ordering guides and color-finish samples are included. Columbia Lighting, Spokane, WA.

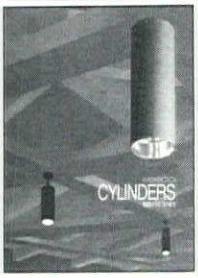
Circle 135

■ Wood fixtures

Idaho Wood's line of cedar and oak lighting fixtures includes indoor and outdoor luminaires. A catalog depicts the products and provides ordering information. Idaho Wood Industries, Inc., Sandpoint, ID.

Circle 136

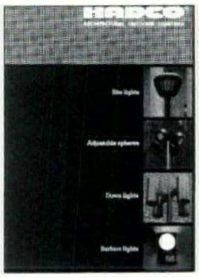
■ Cylinders



Esco's 6000/6100 Series aluminum cylinders accommodate mercury vapor, high pressure sodium, and metal halide lamps. A brochure illustrates the luminaires and furnishes specifications and sections. Esco International, Inc., Chicago, IL.

Circle 137

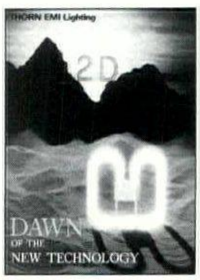
■ Outdoor lighting



Hadco's architectural outdoor lighting catalog details the firm's site lights, adjustable spheres, downlights, and surface lights for exterior locations. Charts and tables show footcandle values. Hadco, Littlestown, PA.

Circle 138

■ Fluorescent lamp



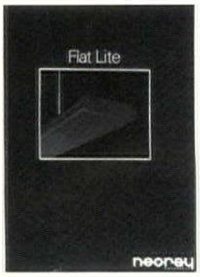
The 2D fluorescent lamp from Thorn EMI Lighting is available with two temperature ratings, 2700 and 3500 degrees Kelvin. The firm introduced the 28-watt lamp in Europe in 1981 and now distributes it in the United States. Thorn EMI Lighting, Mississauga, Ontario, Canada.

Circle 139

■ Traditional lighting

The TrimbleHouse Traditional Lighting Selector displays more than 125 choices of traditional designs for various outdoor lighting projects. TrimbleHouse, Norcross, GA.

Circle 100



■ Lighting designer's catalog

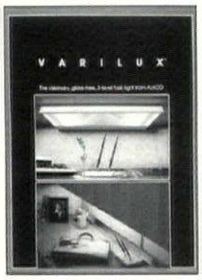
The latest Neo-Ray Lighting catalog features detailed descriptions and illustrations of products offered by the firm, including the Flat Lite pendant wall washer. A postcard is provided with the catalog for new literature follow-up. Neo-Ray Lighting, Brooklyn, NY.

Circle 101

■ Track lighting

Juno's Trac-Master catalog features eight design families suitable for most track lighting applications, a collection of special-application track lights, and track sections, connectors, and accessories. Juno Lighting, Inc., Des Plaines, IL.

Circle 102



■ Task light

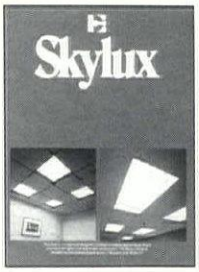
The Varilux three-level task light is the subject of a data sheet from Alkco. The user adjusts a sliding cross-distribution lens to provide optimum illumination of a work surface. Alkco, Franklin Park, IL.

Circle 103

■ Glare-free lighting

Zero-Glare Videolux lighting from Litecontrol is specifically designed to prevent any reflected glare on a VDT screen. The system combines a compound parabolic baffle with a T 8 lamp, according to a brochure. Litecontrol Corporation, Hanson, MA.

Circle 104



■ Low-brightness lighting

A brochure issued by Illumination Concepts & Engineering details the features of the Skylux line. The fixtures are designed to produce nonglare, low-brightness lighting. Illumination Concepts & Engineering, Providence, RI.

Circle 105

■ Landscape lighting

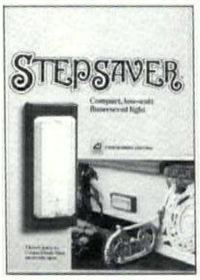
The Hydrel catalog of architectural and landscape lighting features border lights, accent lights, flush-up lights, accessories, well lights, step/wall lights, area lights, and a line of fixtures that can be mounted in a variety of ways. Hydrel, Sylmar, CA.

Circle 106

■ Plastic enclosures

Elkamet plastic lamp enclosures are shown in a brochure from Crown Elkamet. The brochure shows sphere, cube, lantern, cylinder, and mushroom shapes and details available colors and materials for the enclosures. Crown Elkamet Inc., Maryland Heights, MO.

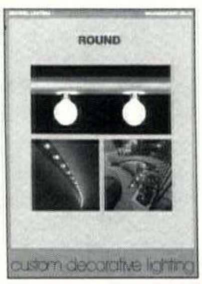
Circle 107



■ Steplight

The Crouse-Hinds Stepsaver luminaire accommodates an energy-efficient compact fluorescent lamp and can be mounted either horizontally or vertically without requiring separate units for each configuration, according to a brochure from the manufacturer. Crouse-Hinds Lighting, Vicksburg, MS.

Circle 108

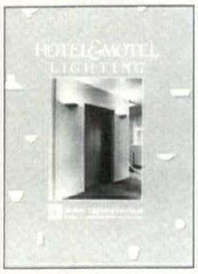


■ Decorative incandescents

A data sheet available from Sentinel Lighting demonstrates how the firm's round aluminum extrusions can house decorative incandescent lamps. The snap-in cover of each extrusion contains all wiring and lamp holders. Sentinel Lighting, Los Angeles, CA.

Circle 109

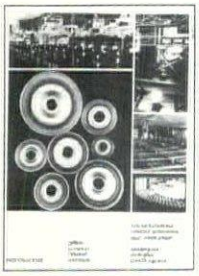
Hotel, motel lighting



Shaper Lighting Products has issued a brochure that displays a collection of luminaires recommended for indoor hotel and motel lighting. The brochure illustrates representative applications. Shaper Lighting Products, Richmond, CA.

Circle 110

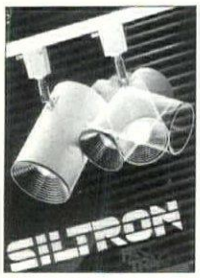
Industrial lighting



Holophane's industrial lighting catalog details indoor and outdoor luminaires, including high pressure sodium, metal halide, mercury, fluorescent, and incandescent products. The publication also contains guides for calculating lighting needs and energy savings. Holophane, Newark, OH.

Circle 111

Track fixtures



Siltron Illumination's catalog illustrates the Fast Track series of track fixtures, power feeds, accessories, and section joiners. The fixture line includes luminaires with glass shades and others with brass, oak, steel, and plastic housings. Siltron Illumination, Inc., Cucamonga, CA.

Circle 112

Low-voltage lighting

A 42-page catalog introduces Capri Lighting's new line of low-voltage products, including recessed fixtures, retrofit adapters, lamp holders, projectors, power packs, and track systems. The catalog also illustrates applications and provides technical data. Capri Lighting, Los Angeles, CA.

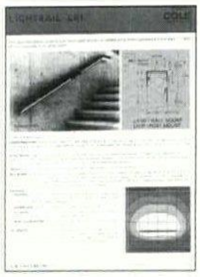
Circle 113

Auto dealership lighting

The optical reflector system of the Autobrite Series outdoor display fixture produces high, even light levels, according to a brochure from Bieber Lighting. The luminaires are specifically designed to light outdoor automobile sales facilities. Bieber Lighting Corporation, Inglewood, CA.

Circle 114

Illuminated handrails



A brochure profiles C.W. Cole's fluorescent illuminated handrails and explains how to order the rails for specific installations. Designers can select post- or wall-mounted models with any of three light distribution patterns. C.W. Cole & Co., Inc., South El Monte, CA.

Circle 115

Architectural glazing

Lexan polycarbonate sheets can be used in vertical, overhead, thermal, and high-security glazing applications. A brochure from General Electric Company Plastics Group includes technical data and installation guidelines. General Electric Company Plastics Group, Pittsfield, MA.

Circle 116

Fluorescent louvers

An 8-page brochure from American Louver features the Paracube line of louvers for fluorescent fixtures. The louvers' highly polished and parabolically curved cells direct light downward and control glare on computer screens, according to the manufacturer. American Louver Company, Skokie, IL.

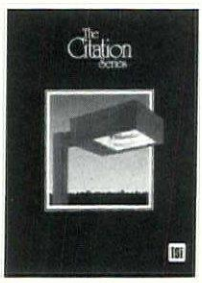
Circle 117

Tube systems

A catalog details the components of Amerlux's fluorescent tube systems, which can provide indirect and direct lighting. Standard assemblies on all tubes allow rotation of the sections, and mounting options include cables, stems, and end and wall mountings. Amerlux, West Caldwell, NJ.

Circle 118

Area lighting



A brochure and data sheet from Lighting Systems Inc. profile the Citation series outdoor luminaires, which are now available in three sizes. The segmented optical system can be supplemented by an optional forward-throw reflector for perimeter lighting applications. Lighting Systems Inc., Cincinnati, OH.

Circle 119

READER SERVICE CARD

FEBRUARY 1987
THIS CARD EXPIRES MAY 1987

Do you wish to receive (continue to receive) Architectural Lighting Yes ☐ No ☐
Do you now receive? Yes ☐ No ☐

Name ______________________
Title ______________________
Company ______________________
Business Address ______________________
City ______________ State/Zip ______________

This card must be completed and SIGNED in order to be processed.

PHONE NO. ______________ Date ______________
Signature ______________________

A. What is your company/business type? (Check one only)
☐ 1. Architecture
☐ 2. Landscape architecture
☐ 3. Engineering
☐ 4. Design
☐ 5. Contracting/building
☐ 6. Independent consulting
☐ 7. University/school
☐ 8. Government
☐ 9. Library
☐ 10. Other ______________ (please specify)

B. What is your profession? (Check one only)
☐ 1. Architect
☐ 2. Landscape architect
☐ 3. Engineer
☐ 4. Lighting designer
☐ 5. Architect/engineer
☐ 6. Electrical engineer
☐ 7. Interior designer
☐ 8. Contractor/builder
☐ 9. Other ______________ (please specify)

C. What are your **major** project types? (Check all that apply)
☐ 1. Commercial
☐ 2. Industrial
☐ 3. Institutional
☐ 4. Other______________ (please specify)

D. What is your **primary** market? (Check one only)
☐ 1. New construction
☐ 2. Retrofitting of existing structures
☐ 3. Equal emphasis

E. Do you have the authority to specify products used in daylighting and electrical lighting?
☐ 1. Yes
☐ 2. No

F. Do you have the authority to purchase products used in daylighting and electrical lighting?
☐ 1. Yes
☐ 2. No

G. Do you have any lighting projects that may be suitable for publication in Architectural Lighting?
☐ 1. Yes
☐ 2. No

Please send free information on items circled below:

1	2	3	4	5	6	7	8	9	10	11
12	13	14	15	16	17	18	19	20	21	22
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Intensity of need:
☐ Immediate ☐ Reference ☐ Future Purchase

What did you like or dislike about this issue?

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265	266	267	268	269	270	271	272	273	274	275

Intensity of need:
☐ Immediate ☐ Reference ☐ Future Purchase
What did you like or dislike about this issue?

______
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______

HAVE YOU SIGNED AND DATED THIS CARD?

■ Outdoor luminaires

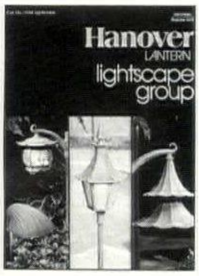
A catalog from Bega/FS presents the firm's most commonly specified products for outdoor lighting. The 64-page catalog includes distribution diagrams, polar diagrams, and isolux curves. Bega/FS, Santa Barbara, CA.

Circle 140

■ Linear luminaires

Linear Lighting has published a brochure that folds out into a fixture specification index. The index details the photometrics, ballasts, mountings, lenses, and louvers of the firm's Linear Lites. Linear Lighting, Long Island City, NY.

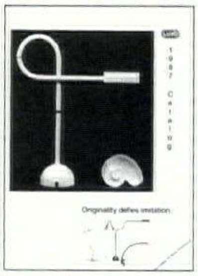
Circle 145



■ Landscape lighting

Hanover Lantern has released a brochure that presents the Lightscape group of landscape luminaires. Most of the cast aluminum fixtures can be modified to use low voltage. Hanover Lantern, Hanover, PA.

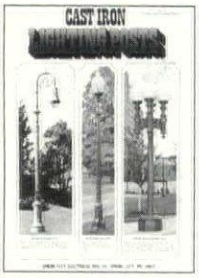
Circle 141



■ Desk lamps

Luxo's 24-page 1987 catalog describes and illustrates the firm's desk lamps. Fifteen new products are featured, including a 50th anniversary edition of the LTR spring-balanced desk lamp. Luxo, Port Chester, NY.

Circle 146



■ Iron posts

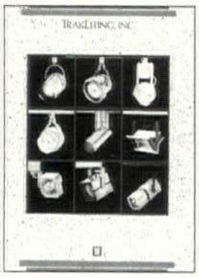
A brochure from Spring City Electrical Manufacturing displays 21 applications of the firm's cast-iron lighting posts. Sales representatives, installation locations, and historical data on the post designs are also listed. Spring City Electrical Manufacturing Co., Spring City, PA.

Circle 142

■ Metal-clad cable

AFC has developed a typical application layout for Home Run cable. The layout shows how the metal-clad cable can connect lighting, power, control, and signal circuits without using large pipe and wire home runs. AFC, New Bedford, MA.

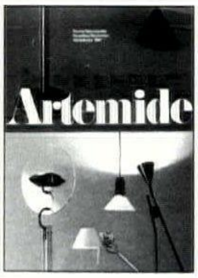
Circle 147



■ Track lighting

A 78-page catalog from TrakLiting details the firm's low-voltage and line-voltage track fixtures and systems. An index, installation diagrams, design guidelines, footcandle graphs and charts, and a matrix of lamps and fixtures assist catalog users. TrakLiting, Inc., City of Industry, CA.

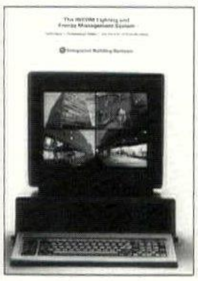
Circle 143



■ Novelties

A foldout brochure portrays Artemide's 1987 selection of novelty luminaires. The group includes two halogen floor lamps, a low-voltage suspension fixture, and three task lamps. Artemide Inc., Farmingdale, NY.

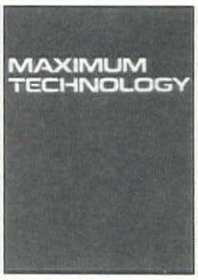
Circle 148



■ Control system

A brochure from Westinghouse Electric outlines the features of the Incom lighting and energy management system. The hardware and software of the microprocessor-based system can manage electrical power usage in buildings of 50,000 square feet or more.

Circle 144



■ Energy-saving reflectors

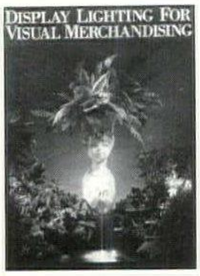
Maximum Technology offers field auditing, design, manufacturing, and installation of lighting reflectors. The specular silver optical reflectors save energy by reflecting more light into the work area, allowing reductions in lamping. Maximum Technology, Brisbane, CA.

Circle 149

■ Emergency lighting

An 84-page catalog describes the full line of emergency lighting products available from Lightalarms Electronics. The catalog includes information about applications, capacities, and dimensions. Lightalarms Electronics Corporation, Baldwin, NY.

Circle 120



■ Display lighting

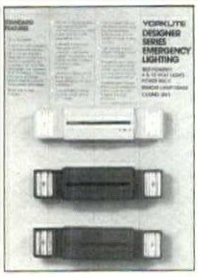
A brochure from Lighting Services Inc. illustrates commercial display lighting using the firm's fixtures, mountings, and accessories. Color photographs show the fixtures in use in malls, atria, stores, boutiques, and display windows. Lighting Services Inc., New York, NY.

Circle 121

■ Indirect HID lighting

The Luxxtra series of indirect high-intensity discharge lighting products includes eight fixture shapes, two reflector sizes, and a variety of light sources, according to a brochure from Lam Inc. Photographs illustrate new construction and remodeling installations. Lam Inc., Wakefield, MA.

Circle 122



■ Emergency lighting

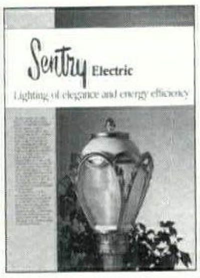
A brochure from Yorklite outlines the components of the firm's Designer Series emergency lights. The standard halogen lamp heads are available as remote units. Yorklite Electronics, Inc., Austin, TX.

Circle 123

■ Louvered fluorescents

The Blade from H.E. Williams combines a metal louver and diffusing overlays with the firm's EP troffer. Warm white and cool white fluorescent lamps create different hues with the six available louver colors. H.E. Williams, Inc., Carthage, MO.

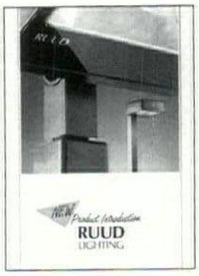
Circle 124



■ Park and street lighting

Sentry Electric's new catalog shows lighting fixtures and posts for parks, streets, plazas, malls, walkways, and esplanades. Sentry Electric Corporation, Freeport, NY.

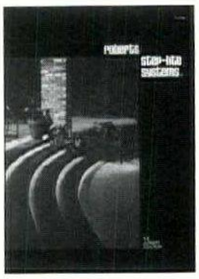
Circle 125



■ Cutoff floodlight

A brochure from Ruud Lighting introduces a floodlight with adjustable backlight cutoff. The brochure also describes a new parking and roadway fixture. Ruud Lighting, Inc., Sturtevant, WI.

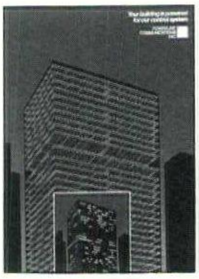
Circle 126



■ Stairway lighting

Roberts Step-Lite Systems, a manufacturer of low-voltage lighting systems, outlines its product lines in a brochure. The firm's systems illuminate stairsteps, handrails, and moldings. Roberts Step-Lite Systems, Oklahoma City, OK.

Circle 127



■ Power-line controls

A brochure from PowerLine Communications explains how the firm's hardware and software use existing power lines to control lighting, HVAC, security, and process equipment. PowerLine Communications, Inc., Williston, VT.

Circle 128

■ Switch

Lutron introduces the Nova electronic switch in a brochure. A light touch activates the on-off switch, which can replace existing single- or multiple-location switches without extra wiring. Lutron Electronics Co., Inc., Coopersburg, PA. ■

Circle 129

Calendar

February 11–13, 1987
Software seminar, Lighting Technologies, Boulder, Colorado. Participants will learn how to use lighting analysis software. The optional third day is devoted to graphics. Contact: Director of Client Services, Lighting Technologies, 3060 Walnut Street, Suite 209, Boulder, CO 80301, (303) 449-5791.

February 18, 1987
Museum lighting seminar, Metropolitan Museum of Art, New York City. The seminar, sponsored by Designers Lighting Forum, features a lecture by Bill Riegel, lighting designer for the Metropolitan Museum. Contact: Louis Baldinger & Sons, Inc., 19-02 Steinway Street, Astoria, NY 11105, (718) 204-5700 or (212) 678-0414.

February 18, 1987
Retail and residential lighting tour, Design Center, Boston. Contact: John C. Gates, IES New England Section, (617) 655-1180.

February 20, 1987
Deadline for submission of portfolios, IALD internship program. Contact: Marion Greene, IALD, 18 East 16th Street, Suite 208, New York, NY 10003, (212) 206-1281.

February 23–25, 1987
Fundamentals II, short course, General Electric Lighting Institute, Cleveland. The course teaches advanced indoor and basic outdoor lighting techniques to experienced professionals. Repeats December 14–16. Contact: Janet Allen, Registrar, GE Lighting Institute, Nela Park, Cleveland, OH 44112, (216) 266-2614.

February 24–27, 1987
Reflector design seminar, Lighting Sciences Inc., Scottsdale, Arizona. Hands-on instruction will include computer techniques. Contact: Lighting Sciences Inc., 7830 East Evans Road, Scottsdale, AZ 85260, (602) 991-9260.

February 24– April 14, 1987
Neon design class, Museum of Neon Art, Los Angeles. The class meets for three hours each Tuesday night. Contact: Mary Carter, Registrar, Museum of Neon Art, 704 Traction Avenue, Los Angeles, CA 90013, (213) 617-1580.

March 2–4, 1987
Seminar on modern store lighting, General Electric Lighting Institute, Cleveland. Repeats October 21–23. Contact: Janet Allen, Registrar, GE Lighting Institute, Nela Park, Cleveland, OH 44112, (216) 266-2614.

March 9–13, 1987
Fundamentals I, short course, General Electric Lighting Institute, Cleveland. The course covers basic aspects of indoor commercial and industrial lighting. Repeats June 15–19, September 14–18, October 26–30, and November 30–December 4. Early registration is recommended. Contact: Janet Allen, Registrar, GE Lighting Institute, Nela Park, Cleveland, OH 44112, (216) 266-2614.

March 30–31, 1987
Indoor lighting design seminar, Lighting Sciences Inc., Scottsdale, Arizona. Contact: Lighting Sciences Inc., 7830 East Evans Road, Scottsdale, AZ 85260, (602) 991-9260.

March 30–April 1, 1987
Seminar on lighting for museums, art galleries, and displays, General Electric Lighting Institute, Cleveland, Ohio. Contact: Janet Allen, Registrar, GE Lighting Institute, Nela Park, Cleveland, OH 44112, (216) 266-2614.

April 1–3, 1987
Outdoor lighting design seminar, Lighting Sciences Inc., Scottsdale, Arizona. Contact: Lighting Sciences Inc., 7830 East Evans Road, Scottsdale, AZ 85260, (602) 991-9260.

April 30–May 2, 1987
Light Works, conference, Lincoln Hotel, Dallas. Speakers will include Motoko Ishii, Craig Roeder, Rita St. Clare, Don Baldinger, Allan Bean, and others. Contact: Ruth Maddox, 1506 Commerce, Dallas, TX 75201.

May 11–13, 1987
Lighting World International, Jacob Javits Convention Center, New York City. The event is jointly sponsored by IALD and IES. Contact: Marion Greene, IALD, 18 East 16th Street, Suite 208, New York, NY 10003, (212) 206-1281. ■

Manufacturer Credits

Neon goes high-tech — from boardroom to corporate image (Ashton-Tate boardroom, Torrance, California). Neon lighting: **Archigraphics.** Recessed incandescent luminaires: **Kurt Versen.** Continuous fluorescent lighting: **Prudential.** Royal white 3K lamps: **Sylvania.**

Tube-mounted metal halides set devotional mood in synagogue (Young Israel Synagogue, West Hartford, Connecticut). Metal halide lamps: **Osram Corporation.** Tubular brass lighting systems: **Staff Lighting, Inc.**

Champagne Taste shows in upscale men's clothing store (C.T. Man, San Francisco). Custom cabinetry: **Mike Peck.** Staggered strip fluorescents: **Wellmade Metal Products.** Color tube sleeves: **Alp Lighting & Ceiling Products, Inc.** Low-voltage, integral transformer track fixtures: **Lightways, Inc.** 16-watt DD2000 lamp: **Damon Design Co.**

Light leads the way for horse racing's new image (Garden State Parkway, Cherry Hill, New Jersey). Recessed fluorescents, fluorescent cove lighting: **Mark Lighting.** Fluorescent troffers: **Lithonia.** Recessed incandescent downlights: **Marco.** Plastic light tube, chasing system: **Lite Lab.** Light strings, low-voltage light strips, custom brass fixtures: **Norbert Belfer.** Brass wall brackets: **Visa.** Dimming equipment: **Lutron.** Racetrack lighting: **Thorne EMI.** Racetrack poles: **Valmont.** Crystal Paddock metal halide floodlights: **Sterner.** Crystal Paddock metal halide canned uplights: **Spaulding.** Exterior metal halide floodlights: **Spaulding.** SCI pin beam spots: **Thorne EMI.** Exit lights: **Marco.**

Let there be light: A design for meditation (Our Lady of Grace Church, Edina, Minnesota). Recessed downlights: **Rambusch.** Lamps: **General Electric** and **Sylvania.** Control system: **Architel Systems, Inc.**

Four light levels illuminate corporate boardroom (Ameritech boardroom, Chicago). Low-voltage incandescent floodlights: **Wendelighting.** All other luminaires: **Lightolier.** Custom torchere (marble column and light fixture enclosure): **Midwest Marble & Granite Corporation.** Suspended lacquered-wood structure: **Olsen Woodwork Company Inc.** Sandblasted glass disks: **LaSalle Glass.** Lighting control system: **Lutron.** Footcandle meter: **General Electric.**

Down the tubes: Solar light goes indoors (Victoria Park Place, Toronto). **TIR Systems Ltd.**

Neon: A hands-on craft with its own vocabulary. Neon layout and installation, Oasis Fine Foods Marketplace: **Jones Sign Systems.** Neon lamps, Oasis Fine Foods Marketplace: **Don Matthews.** Neon and glass bells, Jo Federigo's Cafe and Bar: **Peter David.** All other neon: **Neon Art and Tube Bending School.**

Indoor landscaping for healthy, beautiful workplaces. Indoor tropical garden lamps: **Sylvania Metalarc.** Wide-spectrum lamps used in NASA research: **Sylvania Gro-Lux.** For the complete reference list available for this article, contact: Christos C. Mpelkas, Manager, Photobiological Applications, Sylvania Lighting Center, 100 Endicott Street, Danvers, MA 01923. ■

Advertiser Index