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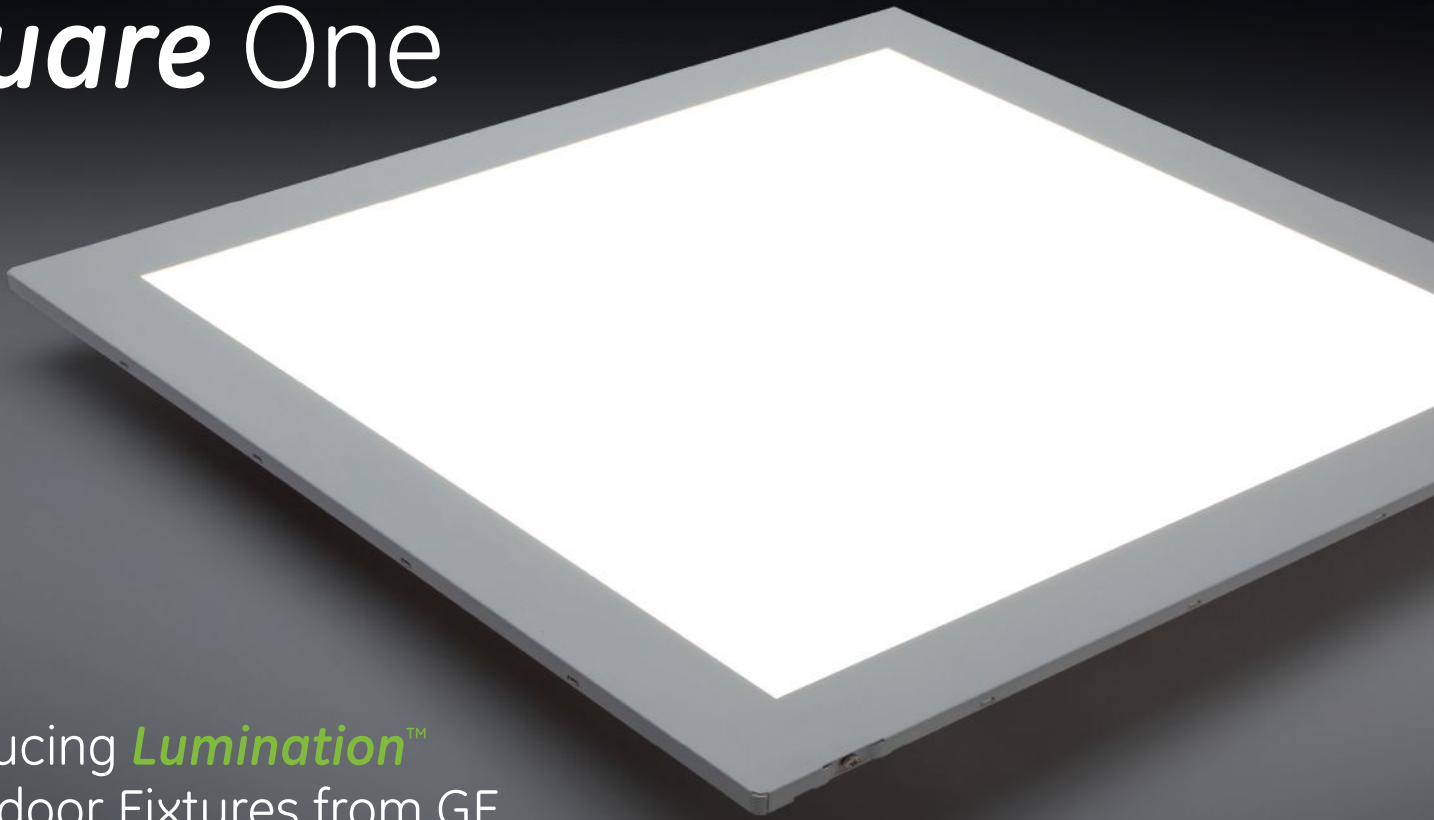
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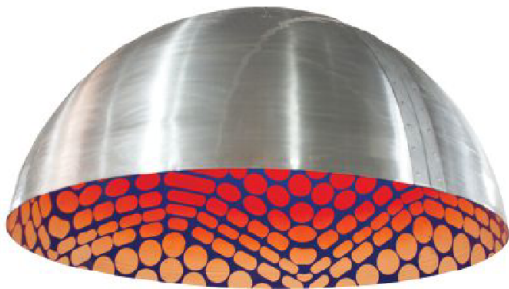
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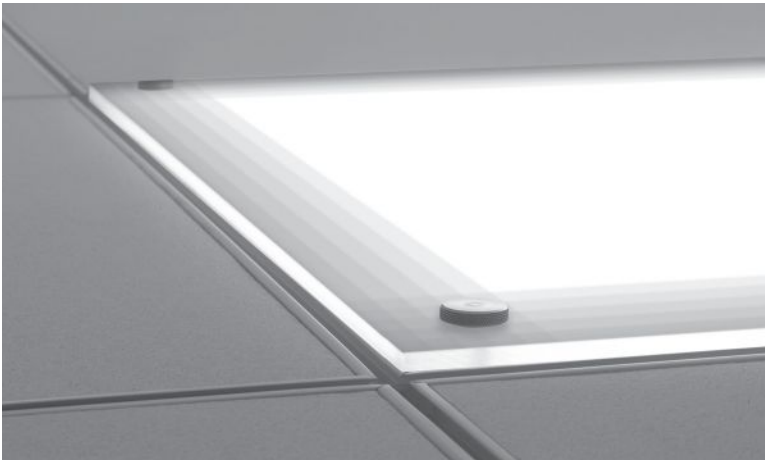
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• CONTENTS

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Daydreaming in Light Additional slide shows of *Light: Installations* by Bruce Munro.

Technology Craig DiLouie looks at the Light Right Survey and how this new tool is helping designers define best practices for good lighting design based on occupant feedback.

And as always, check out our website for expanded article content, news, and calendar listings. Also, subscribe to our email newsletter, e-notes, and find a link to ARCHITECTURAL LIGHTING's digital edition.

• FEATURES

Light and Lightness An enigmatic presence at Rice University, James Turrell's latest "skyspace" bedazzles with radiating displays of color at dawn and dusk, p. 34

Daydreaming in Light Bruce Munro's magical light installations transform Longwood Gardens into an illuminated landscape that celebrates nature, p. 38

• FRONT

Comment Through the "Lighting" Looking Glass, p. 10

Briefs New York City energy codes and Local Law 88 and the 2012 IALD Compensation & Workforce Study, p. 12

Professional Practice Attorney Peter J. Lamont outlines best practices for human-resource management strategies, p. 16

• DEPARTMENTS

DESIGN

In Focus Light Collective creates an immersive and interactive experience for Xicato's exhibit at this year's Light+Building in Frankfurt, p. 23

TECHNOLOGY

Products Delightfully Decorative: An array of eye-catching luminaires that add interest to walls, floors, and ceilings, p. 29

BACK

One-on-One Interview with Mariana Figueiro, Light and Health Program Director and Associate Professor at the Lighting Research Center, Rensselaer Polytechnic Institute, Troy, N.Y., p. 48

Corriette Schoenaerts (cover image); Ian Allen (left); Headcase Design (bottom right)



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“The lighting design profession is in its prime. The real test is how the IALD, as well as the lighting design community as whole, can and will use the data from the IALD Compensation & Workforce Studies to figure out a clear path forward.”

THROUGH THE “LIGHTING” LOOKING GLASS



How do you get an accurate read on your profession? It's not always easy, especially in lighting where there are so many different avenues by which one can enter the profession and so many different professional paths that can be pursued. But one tool that does provide a window of insight is the IALD Compensation & Workforce Study (see Briefs, page 14).

Released this past June, the 2012 report is the fourth edition of the survey, which was first released in 2006. The survey was conducted from mid-January through mid-April of this year and sent via email to a qualified sample of U.S.-based IALD members—a total of 420 individuals, yielding 182 responses. (The qualified member categories are Professional, Associate, Design, and Fellow. IALD member categories Educator, Student, Commercial Affiliate, Practicing Affiliate, Press, and Honorary were not included.)

The study is as important for what it tells us as it is for what it does not. Although the 2012 survey has a smaller sample of respondents than in previous years (216 in 2010, 200 in 2008, and 214 in 2006), that could very well be explained by the recent weak state of the economy and the subsequent changes in personnel.

Additionally, the survey is sent only to U.S.-based members. According to the IALD, this is because the U.S. provides the only sample size large enough from which statistically meaningful data could be extrapolated. Nevertheless, the sample pool does remain a good indicator of the profession as a whole. (In the future, the IALD hopes to be able to conduct similar surveys of its members in other regions of the world.)

So what does the survey data tell us? To start, the lighting profession is split almost evenly by gender (51.1 percent male, 48.9 percent female), the average age of a lighting designer is 45.5 years, the average total years of professional experience is 21, and the average number of years that an individual has been with his or her company is 10. It also reveals that the highest degree that is most commonly held is a bachelor's (56 percent) followed by a master's

(34.1 percent). Only 0.5 percent of respondents hold a Ph.D.

The survey also shows that 49.5 percent of lighting designers hold the LC (lighting certified) designation as part of the NCQLP exam, and that 4.4 percent of people are presently studying for the exam. The next most widely held professional certification among lighting designers is LEED AP at 34.6 percent, and another 7.1 percent of people are working toward obtaining that credential. This is not surprising given the way sustainability has entered design discourse the last several years.

The survey also revealed that most firms are independent entities (84.6 percent) and that the rest are a division or a subsidiary of another company or organization (15.4 percent). From this emerges one of the most interesting insights: the year that these independent entities were founded. The sample revealed that 11.7 percent of firms were founded prior to 1970; 11 percent from 1970 to 1980; 18.8 percent from 1981 to 1990; 21.4 percent from 1991 to 2000; 13.6 percent from 2001 to 2005; 13.6 percent from 2006 to present; and 9.7 percent had no response. This suggests great staying power for lighting firms, given that 62.9 percent of practices have been in existence for anywhere from 11 to more than 40 years. But should we be concerned about the lack of new growth, given that only 27.2 percent of firms were founded over the past 11 years?

The survey goes on to report on changes in salary and other compensation (such as benefits), as well as project type involvement, 12-month performance projections, and trends in request for proposals.

Overall, 57.2 percent of respondents indicated a positive outlook for the coming year. The lighting design profession is in its prime. The real test is how the IALD, as well as the lighting design community as a whole, can and will constructively use the data from the IALD Compensation & Workforce Studies to forge a clear path forward.

Elizabeth Donoff
Editor

LIGHT DEFINES THE EXPERIENCE

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Photography: Jack Parker

"We were able to fine-tune the setting to emit a color that matches the VW blue."

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TURNING DOWN THE LIGHTS

In New York City, lighting designers are responding to a suite of new city and state energy regulations that are changing the lighting requirements for virtually every building, new and old.

text by Ben Adler,
additional reporting by Elizabeth Donoff

New York City has been a leader in sustainability policy under Mayor Michael Bloomberg since he took office in 2002. Part and parcel to that leadership is Bloomberg's trademark PlaNYC 2030, which has received a great deal of national media attention for its move to reduce traffic congestion by creating more pedestrian-friendly areas in the city and the expansion of alternative forms of transportation, such as bicycle lanes. But a far less widely noticed legal change, as part of the city's Greener Greater Buildings Plan, has dramatically altered energy-efficiency standards for virtually every building in New York City.

Historically, New York state's lighting efficiency requirements only applied if a building was new, or if more than 50 percent of it was being altered. Since most of New York City is already built out, the rules seldom apply there, where most new lighting is installed as part of renovations. Even when applicable, the requirements were seldom enforced.

In 2009 the city council passed a series of ordinances—local laws—to promote energy conservation. The first of these, NYC Energy Conservation Code, Local Law 85, required all new buildings as well as any renovations or alteration projects to meet the state energy code. Simultaneously, the New York City Department of Buildings started to enforce the rules and reject permits for plans that failed to comply. At the same time, but separate from

the energy code, the city also passed Local Law 88: Lighting Upgrades and Sub-metering. It states that large nonresidential buildings must retrofit luminaires to comply with the code by 2025—and also provide separate meters for each tenant, or have them submetered, if the space exceeds 10,000 square feet.

In 2010, the city passed Local Law 48, requiring that manual-on, automatic-off occupancy sensors be provided in a few space types, such as offices and classrooms.

All of this has major implications for lighting designers, who now find themselves spending more time doing lighting calculations than design in order to document a project's code compliance. "It means there's more work out there, but the work is a little less fun," says Jack Bailey, a partner at One Lux Studio, a New York City-based lighting design firm. "It's gone from [being] an extremely lax regulatory environment, where there was no applicable energy requirement, to one where plans were being rejected. People have had to learn it [the new codes] in a hurry."

These new retrofit requirements mean lighting upgrades are needed, and to meet the new strictures, a lighting designer is more necessary than ever to decipher the complexity—and nuances—of the code.

Lighting designers on the whole have been working with stricter energy limitations for some time. For example, a designer renovating a bathroom can no longer simply use a 100W

incandescent source. Instead, the present code allows anywhere from 21W to 69W installed, depending on the chosen compliance path. The new requirements have forced lighting designers to shift away from sources they once used, such as incandescent and halogen, to other sources, such as compact fluorescents, LEDs, and ceramic metallic halide lamps, even though the color temperature is cooler. "The color is not as rich," Bailey says. "You particularly notice the difference with high-efficiency sources. What's lacking—even though the technology has gotten very good—is the warmth [found] in low-light applications like restaurants, hotels, and residences."

However, the code does create incentive for manufacturers to make technical improvements to luminaire and lamp choices, which expands lighting options. "It's a virtuous cycle," Bailey says. "Products are becoming more efficient and that improves the efficiency of lighting systems overall."

Energy codes will only continue to grow more strict. "It makes it more difficult to do good lighting well," Bailey says. "Look at retailers on Madison or Fifth Avenue and you'll see [ceramic metallic halide lamps] where they used to have halogen," Bailey says. "That's being driven by the code." •

Ben Adler is a contributing writer for The Nation who also writes about architecture and urban planning for Next American City and other publications.

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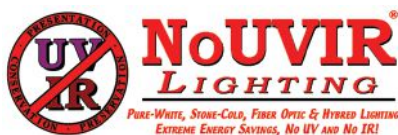
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IALD COMPENSATION STUDY

The fourth edition of this biannual survey suggests a slow but steady recovery.

text by Elizabeth Donoff

The International Association of Lighting Designers (IALD) recently issued its 2012 Compensation & Workforce Study. This is the fourth edition of the survey, which was first released in 2006, and it provides association members with up-to-date information about what trends affect them as design professionals.

The survey was conducted from mid-January through mid-April of this year and sent via email to a qualified sample of U.S.-based IALD members—a total of 420 individuals. (Qualified member categories included Professional, Associate, Design, and Fellow.) The survey yielded 182 responses.

According to the IALD, the survey is sent only to U.S.-based members because it is the only population sample size large enough from which to extrapolate statistically meaningful data. In the future, the organization wants to conduct similar surveys for its constituents in other areas such as Europe, South America, Asia, and Australia.

The results of the survey are divided into eight sections: Respondent Demographics; Company Profile; Revenue Sources and Market Sectors; Economic Trends; RFP and Proposal Trends; Current Positions/Employment Situation; Compensation; and Benefits. Each iteration of the IALD's survey has retained a core set of questions for comparison's sake, and this year new questions were added to examine specific issues such as the economy's impact on the number of requests for proposals that lighting design firms are receiving and sending.

One of the most interesting developments over the past six years is the change in base-salary levels. Firm principals and junior-level staff have seen a decrease in pay, while senior- and mid-level designers have seen an increase.

The data collected in the four IALD Compensation & Workforce Studies is a valuable resource and offers one of the most accurate and current portraits of the lighting design community. The report is available for purchase through the IALD (iald.org).

SALARY COMPENSATION

2012	% CHANGE 2010 TO 2012
\$80,000	-3.6%
\$82,500	9.3%
\$59,000	9.1%
\$48,500	-1.0%

Principal/Partner/Owner
Senior Associate/Senior Designer/Senior Project Manager
Associate/Designer/Project Manager
Lighting Designer

REPORTED REVENUE

25.8%	Less than \$200,000
12.6%	\$200,000-\$500,000
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PROFESSIONAL PRACTICE

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Understanding human-resource management.

text by Peter J. Lamont

illustration by Headcase Design

Peter J. Lamont is a business and commercial litigation attorney nationally recognized in a wide variety of highly specialized areas within the kitchen, bath, lighting, construction, and design industries. He routinely represents various national and international companies within the design sector, and has achieved the highest rating in both legal ability and ethical standards as awarded by AVVO (avvo.com).

The importance of effective human-resource management for a lighting design business cannot be overlooked. Often, the areas of accounting, finance, production, and marketing take precedence over human resources, but it is extremely difficult for a design firm to function optimally or to grow and develop without having a formal set of procedures and policies in place to guide the management and the employees. The topic of human-resource management is far reaching and expands into payroll management, health insurance benefits, and related financial areas. In this article, we'll focus on the employer-employee relationship.

Over the past 10 years, we have seen an increase in litigation stemming from a failure to maintain employee policies and procedures. The primary claims made by employees arise from state and federal anti-discrimination laws. Under federal law, it is unlawful for employers to discriminate in relation to hiring, discharging, compensating, or providing the terms, conditions, and privileges of

employment to an individual based upon his or her race, color, religion, sex, or national origin. (Under Title VII of the 1964 Civil Rights Act, sex includes pregnancy, childbirth, and related medical conditions.)

Often, a state's statutes will contain additional employee safeguards on top of the federal laws. For example, New Jersey's Law Against Discrimination is far broader than its federal counterpart, so New Jersey employees often opt to bring claims against their employers under the state law, instead of federal. And attorneys are eager to take such cases because of various fee-shifting provisions contained in the employment statutes, which basically provide for the attorney's fees to the employee's lawyer should he or she successfully prove that a violation of the law did occur.

The vast majority of litigation such as this can be prevented by proper and effective human-resource-management procedures and policies. For the most part, smaller design firms can implement these policies themselves;

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larger design firms may wish to outsource them. Proper management is not necessarily expensive, but it can be time-consuming and confusing. Design firm owners need to know when to ask for help from lawyers and human-resource professionals.

Finding Good Employees

Today's job market is flooded with potential candidates, but it can be difficult to find the candidate that is the right fit for your firm. Before you begin the search, you must be clear about exactly which position, or positions, that your company needs to fill. This will aid in writing a clear job description. One of the biggest mistakes employers make is trying to find an employee who can fill a large number of roles. This results in receiving far too many résumés from individuals who do not have adequate experience.

There are several good ways to locate candidates: through ads in trade publications or on the Internet, through word-of-mouth and referrals, and by posting employment opportunities on your website. When employers become frustrated with their search, they often turn to employment agencies, but with such a diverse candidate pool available today, it does not make sense for a design firm to enlist the help of an employment agency, especially since the agency's fees can be excessive.

Screening Potential Candidates

The economic crisis, combined with the overwhelming size of the applicant pool, has created a vastly different system of employee-screening procedures than those that existed five to 10 years ago. Employers are struggling to find the right candidate on the first try; they do not want to hire a candidate who appears good on paper and makes a good impression during the interview, only to find that the individual cannot do the job or does not adequately represent the firm. Having to repeat the screening process and hire someone new is costly and time-consuming.

Also, employers need to be mindful of liability issues. Under certain circumstances, they can be vicariously liable for the actions of their employees, so most employers want to learn as much about a potential employee as possible. As a result, new and often invasive screening procedures (given the amount of information that can be obtained on the Internet) are being used.

Once you have received résumés and applications for your open position, you need to weed out those who lack the requisite experience or skills. Then, begin screening the remaining applicants. Call to confirm his or her interest in the position and set up an in-person

interview. Prior to committing your time to an interview, however, conduct a general Internet search for information. Often, you can learn a significant amount of information about a person through an online search. This research may result in information about the candidate that would exclude them from consideration, and thereby eliminate time wasted on an in-person interview.

Search for the candidate's name combined with his or her state of residency, or prior job positions. This should bring up social media links and photographs. Oftentimes, people do not limit access to certain social media sites and a potential employer can legally access certain information about a potential candidate.

Once you have met face to face with the candidate and have determined that the individual might be a match for your firm, it is highly recommended that you conduct a general background check. A typical background check, performed by a competent investigator, can cost between \$50 and \$100 and is certainly worth the cost if it saves you from lengthy and expensive litigation later.

One interesting and developing area concerning candidate-screening procedures involves employer requests for social media logins. Under Title II of the Electronic Communications Privacy Act of 1986, also known as the Stored Communications Act, employers are prohibited from accessing their employees' personal online information in an unauthorized manner. But when an employee or applicant willingly provides login information, the protections of these two laws may not be triggered since the employer is not accessing the information in an unauthorized manner.

Still, if an employer lawfully accesses an applicant's social media pages and uses the information to discriminate against the applicant in any manner, the employer would be liable under Title VII of the 1964 Civil Rights Act, which prohibits discrimination based on the protected categories of "race, color, religion, sex, and national origin."

If an employer lawfully obtains the social media login from an applicant and does not violate Title VII, the employer would still be privy to personal information and private postings. Since jobs are scarce, many applicants are giving employers this access; others are deleting their social media accounts altogether.

State legislators across the country are aware of the shortcomings in the current federal laws and are debating the issue. Two states, Illinois and Maryland, have already passed bills making it illegal for an employer to ask an applicant or employee for his or her social media logins. Washington, D.C., Delaware, and New Jersey are considering similar bans. However, neither

The economic crisis, combined with the overwhelming size of the applicant pool, has created a vastly different system of employee-screening procedures than those that existed five to 10 years ago.

You should also provide each new employee with a basic orientation that should include an overview of your company's employee handbook and various policies including sexual harassment, Internet and cell phone usage, intraoffice dating, vacation, and sick leave.

the Illinois nor the Maryland laws prohibit an employer from viewing information that is not restricted by privacy settings. And employers are free to set workplace policies on the use of the Internet, social networking sites, and email.

Hiring and Office Policies

Once you have made the decision to hire a candidate, it is important to take the time to meet with the new employee and provide them with adequate training. You should also provide each new employee with a basic orientation that should include an overview of your company's employee handbook and various policies including sexual harassment, Internet and cell phone usage, intraoffice dating, vacation, and sick leave. If your company does not have an employee handbook, you should create one. It

is simply a written collection of policies and procedures concerning the way your employees are expected to act while they are at work.

Failing to have an adequate employee handbook can lead to significant liability. For example, a typical handbook contains a section advising employees that sexual harassment of any nature will not be tolerated. It then provides employees with instructions concerning who to contact should they feel that they are a victim of sexual harassment. Employees have won cases when the employer failed to have such a policy in writing or failed to enforce it.

Generic employee handbooks can be purchased on the Internet or can be prepared by attorneys or human-resource consultants. You need to have a handbook and understand the policies contained in it so that you can explain

it to your employees. If you are confronted with time constraints, consider enlisting an outside consultant who can explain the policies and procedures to your staff.

Employee Training Seminars

You should provide your employees with annual training on a variety of general employment topics. For example, every company with five or more employees should consider an annual workplace violence and sexual harassment training seminar. A seminar such as this can be helpful for your employees and can help to protect you from liability.

Another seminar that is worthwhile is one that discusses confidentiality in connection with your firm's client list, prospects, designs, and other proprietary and sensitive materials. Many employees who violate the confidentiality terms of their employment were not aware that their actions constituted a breach. Training your employees about what to do regarding issues of confidentiality reduces the likelihood that you will experience a breach.

Employee Performance

In addition to annual training, you need to conduct performance evaluations. Most employers conduct annual reviews, but it may also be beneficial to your company to conduct a six-month informal review. Regularly reviewing the performance of an employee will allow you to point to areas for improvement as well as acknowledge your employees' contributions to your company.

Regular performance reviews can also protect employers from the effect of wrongful-termination lawsuits, provided that the reviews are accurate and honest. For example, if an employee was fired due to excessive tardiness and that employee attempts to sue alleging discrimination, the performance review can be used as evidence to support the employer's nondiscriminatory basis for the termination.

Termination

Regardless of how effective your human-resource management is, unfortunately, situations arise that necessitate releasing an employee. In general, firing an employee for financial reasons is a hard decision, but it does not often result in litigation. But when you fire an employee for improper behavior or ineffective performance, it is recommended that you speak to an attorney or human-resources consultant beforehand to ensure that you handle the termination properly, and to avoid litigation. There are a number of laws concerning what employers can and cannot do when terminating an employee. For example, employers often offer severance pay



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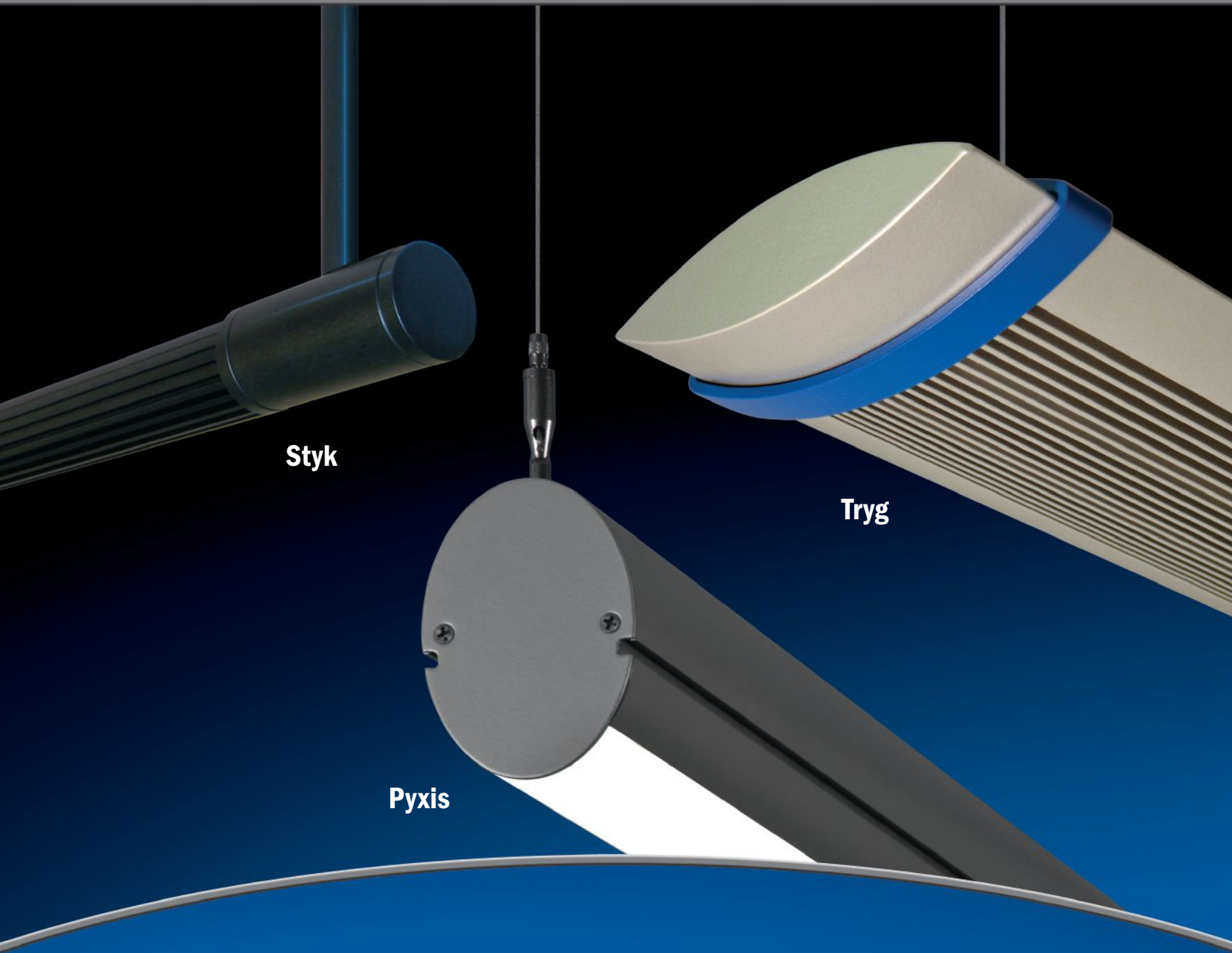
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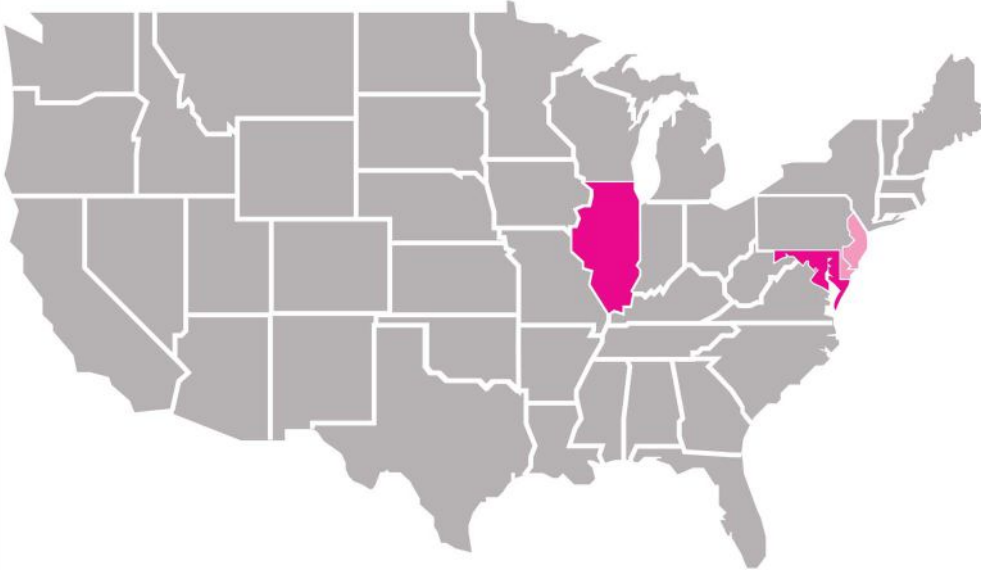
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Social Media Legislation



Illinois and Maryland have passed laws making it illegal for an employer to ask an applicant or employee for his or her social media logins.



Delaware, New Jersey, and Washington, D.C., are reviewing legislation and are considering voting on similar bills.

in exchange for the employee signing a release and waiver of liability. Depending upon the state and the wording of the agreement, such an action may be unlawful.

When an employee makes the decision to leave, you should conduct an exit interview. This will afford you an opportunity to recover any company property, including office keys, cell phones, and laptop computers. It also gives you an opportunity to ask the employee about his or her reason for leaving and presents you with an opportunity to gather some constructive criticism about how you are running the business.

So while it may not be on the top of your list of things to take care of, human-resource management should never be taken lightly. While improper management can result in significant liability, effective management can increase your firm's reputation, productivity, and revenue. These employment issues are complicated and often overwhelm even the most seasoned business owner, so employers should never hesitate to seek assistance from trained professionals in order to prevent problems and to keep their business running smoothly. •



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IN FOCUS

STANDING OUT

Light Collective creates an immersive and interactive experience for Xicato's exhibit at this year's Light+Building in Frankfurt.

text by Deane Madsen
photos by Sanna Fisher-Payne

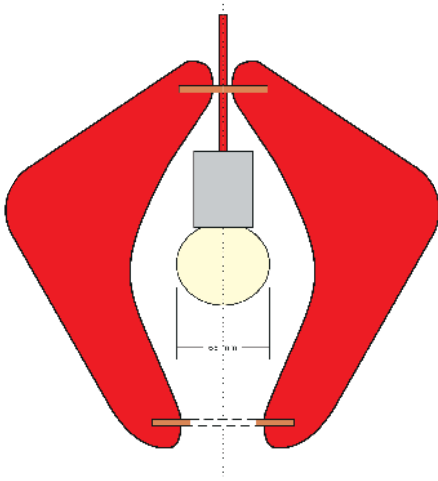
Imagine for a moment the opportunity to take a mundane trade show stand and turn it into an experience where attendees can experiment with new products. That's exactly what Martin Lupton and his U.K.-based studio Light Collective were tasked with when approached by LED module company Xicato to design its exhibition tent at this year's Light+Building.

Lupton has been critical of trade show displays in the past, and was particularly so after Light+Building 2010. "It seems that the main aim was to have as many products as possible, all as bright as possible, all aimed in your face," he says. Xicato took note of Lupton's

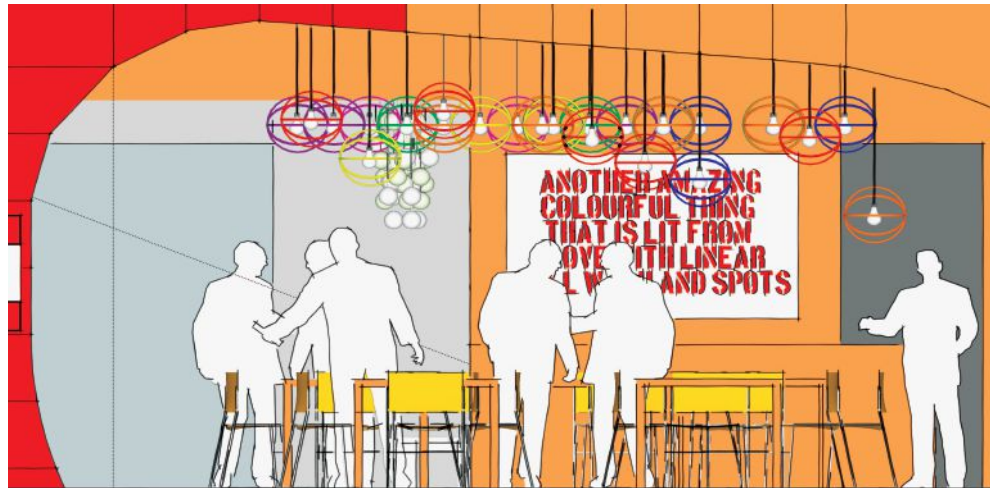
concerns. "Xicato came to us, and they said, 'You guys are always criticizing trade shows; why don't you do better?'" Lupton recalls.

One of Lupton's critiques was that the lighting displays were often a sea of stark, white spaces that focused on the use of colored light. To address this, Light Collective decided to create a colorful space that would allow Xicato to showcase the color consistency of its LED modules. "Because the stand was a bit more colorful, it didn't rely on colored light," Lupton says. Rather, the Xicato LED module provided a white light source with high color-rendering ability, which was visible throughout

Detail of Custom Pendant



Section Through the Xicato Stand



the various display presentation areas.

In 2010, Xicato had decided to exhibit at Light+Building a bit at the last-minute. As such, its stand was actually a tent located in the plaza area outside two of the main halls—Hall 3 and Hall 4. The location proved excellent in terms of visitor traffic, and so for 2012, they decided to stay with the same spot. Light Collective saw this as an opportunity not to be squandered, and aimed to make this year's space one that would capitalize on the placement between two such prominent halls, and become a meeting place for designers.

The 2012 iteration of the tent featured three areas: a large, colorful gathering space festooned with custom pendants, and two smaller spaces with a wide array of luminaires using Xicato products. A perimeter display wall—internally lit folded boxes inspired by origami—showcased the consistent color-rendering of the Xicato LED modules. The other workshop-like space gave lighting designers an opportunity to experiment with the modules and various OEM luminaires.

Given the temporary nature of lighting trade shows, the other key design feature of the stand was its ability to be recycled. "So much waste is generated over the course of these week-long events," Lupton says. "Every year, we see piles of MDF in the bins, so we wanted to do something more environmentally responsible." All of the ceilings, walls, and surfaces—including furniture designed by Luke Smith-Wightman—were designed and fabricated out of cardboard for ease of post-show recycling. Lupton notes that "Germany has recycling facilities everywhere," so there was little chance of waste ending up in a landfill.

Light Collective also collaborated with Mike Stoane Lighting to create the custom pendants that illuminated the stand, all of which featured

Xicato's LED modules. Lupton wanted these fixtures to be consistent with the rest of the atmosphere, so these, too, were designed out of cardboard. "Why not make them out of the same material and make a three-dimensional form?" he says. Given the positive response by fairgoers during Light+Building, Xicato now has plans to sell the pendant.

Another one of the issues that Lupton wanted to address via the stand's design was that of the on-site staff's involvement. In his view, companies often enlist the help of additional personnel to answer general questions, but they are not necessarily directly familiar with the products. So Light Collective proposed an interactive space in which designers could disassemble and reassemble luminaires from a variety of manufacturers who use Xicato's products. This ability to play around with, and understand the capabilities of, the modules allowed lighting designers to experience the products in a more hands-on way.

"One of the things we wanted to do was create a space for people to hang out in," Lupton says. Judging by the immense popularity of the tent, and the constant crowding of the workshop area, it seems they succeeded beyond their brightest hopes. •

Details

Project: Xicato exhibition tent at Light+Building 2012, Frankfurt • Lighting Designer: Light Collective, Birmingham, U.K. • Stand Construction: Hart Wilcox, Essex, U.K. • Cardboard: WH Skinner, Kent, U.K. • Cardboard Pendants: Light Collective and Mike Stoane Lighting, Midlothian, U.K. • Furniture and Picnic Lamps Designer: Luke Smith-Wightman, Birmingham, U.K. • Paper sculpture: Richard Sweeney, Wakefield, U.K. • Project Size: 150 square meters (approx. 1,614 square feet)

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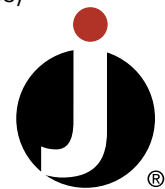
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text by Wanda Lau

Synapse, Luceplan • Intrigued by the communication activity that occurs between neurons, Argentine designer Francisco Gomez Paz designed Synapse, a sculptural LED luminaire that can assume a range of dimensions and configurations (ceiling, wall, or suspension) by repeating the use of a three-armed module. The 34-centimeter-diameter (13.4-inch-diameter) module is composed of a polycarbonate shell that houses three white or three color-changing LEDs that can be controlled wirelessly. The ceiling or wall version uses a minimum of three interlocking modules, while the suspension luminaire uses a core of nine modules. The three- and nine-component sets may be combined to create a number of patterns. • luceplan.com • Circle 135



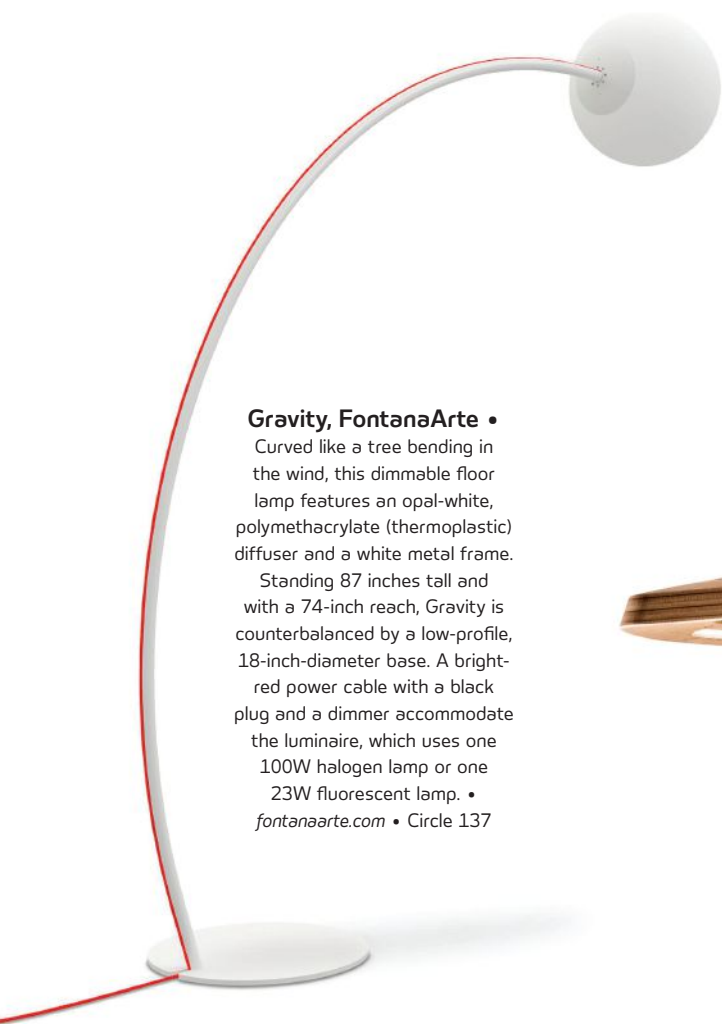
Mino 18, Aqua Creations • Designed by Aqua Creations co-founder Ayala Serfaty and designer Benad Dar, these luminaires expand the company's collection of silk lighting. Suitable for use as room dividers and floor accent pieces, these light screens feature Aqua Creations' distinctive silk material draped purposefully over a polycarbonate, vacuum-formed shell. Available in 16 different color silks (silver and gold shown), Mino 18 is 18 inches wide by 63 inches tall by 8.5 inches deep. The dimmable lights use either two or four T5 lamps. The silk shades may also combine two colors. • aquagallery.com • Circle 136



Gravity, FontanaArte •

Curved like a tree bending in the wind, this dimmable floor lamp features an opal-white, polymethacrylate (thermoplastic) diffuser and a white metal frame.

Standing 87 inches tall and with a 74-inch reach, Gravity is counterbalanced by a low-profile, 18-inch-diameter base. A bright-red power cable with a black plug and a dimmer accommodate the luminaire, which uses one 100W halogen lamp or one 23W fluorescent lamp. • fontanaarte.com • Circle 137



Aki Light by Ite, a Leucos USA Brand •

German furniture and product designer Studio Dreimann handcrafts this open-structured light fixture using CNC-milled wood that is routed to accommodate six built-in LED strips, which, according to the manufacturer, consume less than 50W. Measuring 47¹/₄ inches long by 19⁵/₈ inches deep by 4 inches tall, the luminaire is suitable for illuminating expansive areas, such as conference tables. The wood frame can be finished in white or gray enamel. • leucosusa.com • Circle 138

Pleat Box, Marset •

Designed in collaboration with master ceramicist Xavier Mañosa and Berlin design studio Mashallah, the Pleat Box pendant luminaire superimposes the subtle shape of a digitally designed crease in a piece of fabric onto a handmade ceramic diffuser. The exterior of the diffuser comes in white or terra-cotta—unglazed to show the true color of the potter's clay—or it can be finished with a dark gray glaze made by mixing recycled glazes. The interior finish may be white enamel or 10-karat gold. Pleat Box comes in four sizes—18.5-, 14.2-, 9.4-, and 5.1-inch diameters—and uses a halogen or a fluorescent lamp. • marset.com • Circle 139



Etch Light Web, Tom Dixon • The British design and manufacturing company formed this open-structured, spherical shade by repeating an irregular pentagon shape 60 times. With its centralized source—either an oversized LED lamp or a 28W clear halogen lamp—this pendant luminaire fills the room with abstract geometric shadows when illuminated. The 25.6-inch diameter copper-anodized aluminum shade weighs 2.2 pounds and hangs from a copper-coated steel ceiling canopy using a 98-inch-long black fabric cable. • tomdixon.net • Circle 140



Da Ma Sospensione, Viabizzuno • This pendant luminaire designed by architect David Chipperfield and Viabizzuno founder Mario Nanni features stacked bands of brass-edged, biconcave lenses that measure 2.5 inches in diameter. It comes in three circular and two elliptical sizes. The circular fixture is approximately 17, 30, or 60 inches in diameter, with a respective height of 13, 19.3, or 25.6 inches; the elliptical-shaped luminaire is 82.6 inches long by 15 inches wide and 13 inches tall or 69.3 inches by 30 inches and 19.3 inches tall. Depending on the fixture size, the luminaire requires eight to 14 14W halogen lamps or eight to 32 3W 3000K LEDs. All options operate on a 12V power supply. • viabizzuno.com • Circle 141

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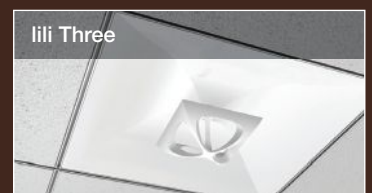
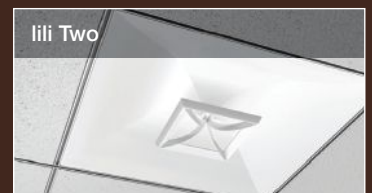
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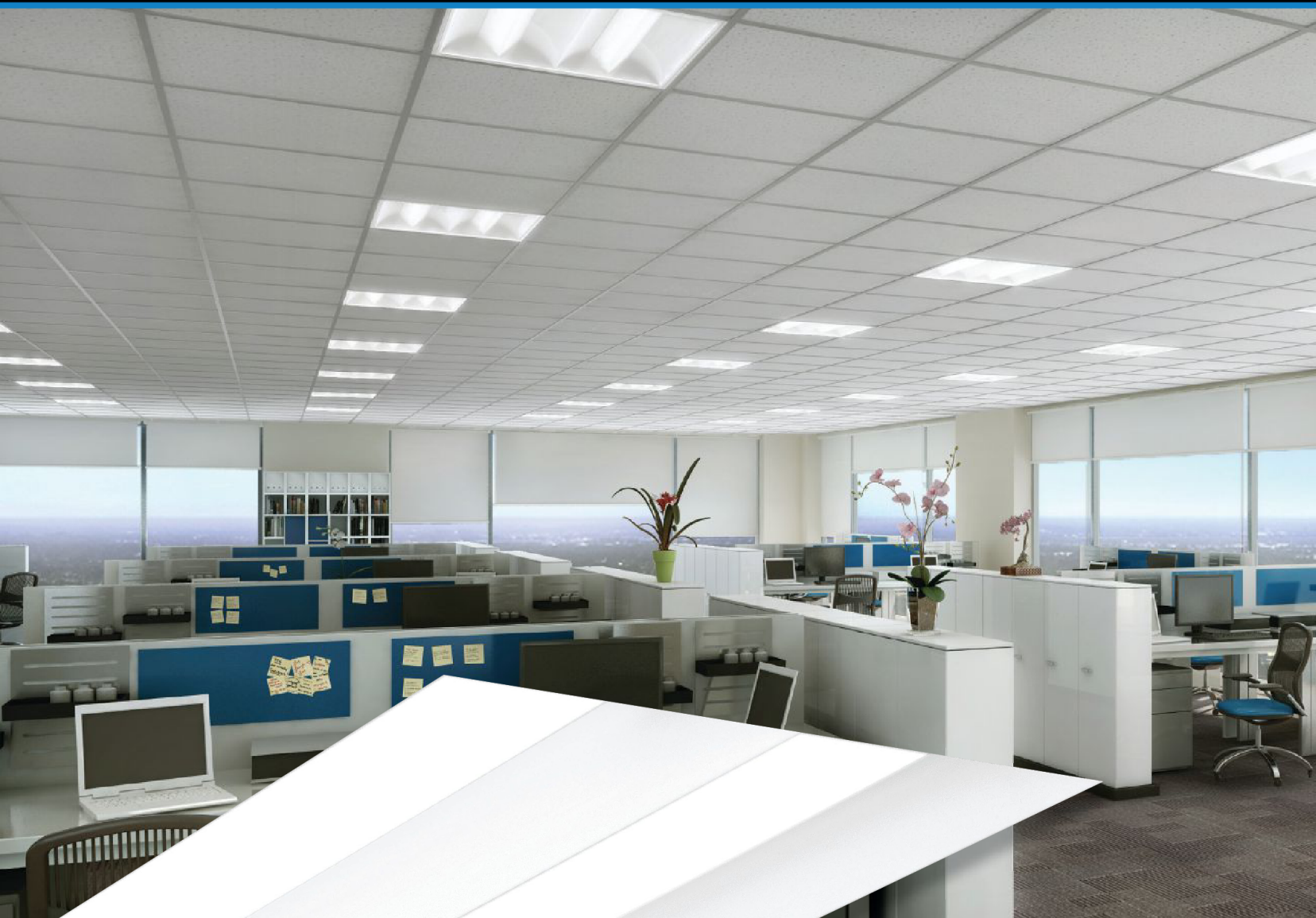
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• CONTENTS

• FEATURE

Portals of Light LEDs turn skylights into nightlights at the Städel Museum, p. 24

• FRONT

Comment, LED Speak, p. 8

Briefs Department of Energy LED Benchmarks, ASSIST Celebrates 10th Anniversary, and more, p. 10

Products Solid-State Success, p. 14

• DEPARTMENTS

Report The Zhaga Consortium: Tackling LED issues as the lighting industry strives for greater coordination of solid-state lighting components, p. 17

Technology Designing LED roadway fixtures requires more than simply replacing the light source, p. 21

• BACK

One-on-One Interview with Ann Reo, founder of io Lighting, p. 32

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LIGHT DEFINES THE EXPERIENCE

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Photography: Jack Parker

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“The lighting community has struggled with the conversion to LEDs because it has been confusing two different languages: the language of the chip (the diode) and the language of the LED luminaire.”

LED SPEAK

Each new lighting technology brings with it a new set of questions and a new set of issues to address. These issues pertain to lighting metrics, as well as installation and application, all of which change the conversation and add another layer of terminology. While this has always been so, the introduction of solid-state lighting (SSL) and its widespread use has cajoled the lighting community into altering the industry’s lighting jargon on a whole new scale, and I sometimes wonder if that hasn’t steered the conversation about lighting off course, away from illumination.

With SSL technology, much more is at stake. The entire dynamic of the lighting system has changed, and lighting now seems to be less about individual components—the lamp, the ballast, the reflector, and the housing—that can easily be replaced when they reach a very clear end of life. Instead, SSL technology sets up a system where the components—the diode, the circuit board, the heat sink, and the driver—are integral to one another. When an LED reaches its end of usable life—or fails—you can’t just switch out one diode.

I think that the lighting community has struggled with the conversion to LEDs because it has been confusing two different languages: the language of the chip (the diode) and the language of the LED luminaire. What a lighting designer needs to know about an LED fixture when making a specification choice is very different from what an OEM needs to know when designing a luminaire, or from what a chip manufacturer is concerned with when producing a diode. But all of this hasn’t stopped the general conversation about LEDs from getting into a level of detail that similar conversations about previous light sources did not have to contend with. Does a lighting designer really need to spend his or her valuable time knowing how a luminaire’s LEDs are binned? And to how many steps on a McAdam ellipse? Probably not, and yet we seem to be getting pushed into talking about this type of information regardless.

To get a handle on the discussion, many entities in the lighting community—including the IALD, the IES, the DOE, and individual

manufacturers—have started to create “LED checklists” to help guide their various constituencies determine what questions they should be using to evaluate their LED choices.

As SSL technology continues to evolve, I do not doubt that these checklists will expand. At present, though, the core items a designer should be aware of include light output, color and color shift over time, thermal management, life and warranty, and testing.

The lighting industry has done a very good job, in a relatively short amount of time, of creating a new set of metrics that provide the framework for understanding how LEDs operate: LM-79, which deals with absolute photometry; LM-80, which addresses length of life; and TM-21, which looks at lumen degradation of the lumen package. These are a great help, but there is always the risk of designers, manufacturers, and sales reps referencing these guidelines, along with others, without really understanding what they are measuring.

And that brings us to the last, and perhaps most “invisible” part of the LED conversation—trust. Designers need to know that they can trust manufacturers to stand behind their products, and manufacturers need to know that they can source components from reliable vendors. You can ask for all the technical data you want, but if a company is not going to step forward and deal with problems that might arise, or if that company is not going to be in business six months from now, then it is irrelevant whether an LED is 100 lumens per watt or 160 lumens per watt. Rather than get caught up in the metrics of LED speak, let’s not lose sight of lighting speak: trust and quality illumination.

Elizabeth Donoff
Editor



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LED BENCHMARKS

The Department of Energy's solid-state lighting programs continue to provide helpful resources for the lighting industry.

text by Elizabeth Donoff

• L Prize Lumen Maintenance Report

As part of the ongoing monitoring process for the L Prize, the DOE published "Lumen Maintenance Testing of the Philips 60-Watt Replacement Lamp L Prize Entry," in August. This report documents 18,000 hours of lumen maintenance testing. This minimum test period, outlined in the competition brief, was achieved in April 2011.

Because length of lifetime is a key issue in making the case for one of the benefits of using LEDs, the DOE continues to run the lumen maintenance testing on the Philips entry.

According to the DOE, the testing process includes 200 samples that are being run continuously in a high-temperature (45 C, 113 F) test bed that simulates actual conditions. A movable, integrating sphere takes spectral readings of each lamp at regular intervals. After the first 7,000 hours of run time, lumen maintenance predicted with 95 percent confidence was found to be 97.1 percent at 25,000 hours, higher than the L Prize lumen maintenance requirement of 70 percent (L70). In July, after the 18,000-hour mark was passed, the projected lumen maintenance was 97.8 percent at 25,000 hours. Additionally, there was very little change to overall light output, and chromaticity levels remained well within the L Prize criteria. Further details about the entire L Prize testing process can be found at lightingprize.org

• CALiPER Testing

The DOE has completed four more rounds of product testing through its CALiPER (Commercially Available LED Product Evaluation and Reporting) program.

Round 14, completed in March, examined LED downlight retrofit units. Eleven samples were evaluated in a downlight housing rated for 6-inch insulation contact (IC) and mounted in a 24-by-24-inch insulated

enclosure. The summary report includes photometric performance results and compares the findings to equivalent luminaires using conventional lamps.

Round 15, completed in May, tested 10 LED floodlights that represent the functionality of an equivalent range of conventional floodlight luminaires. The findings suggested that there are still areas in which LED floodlights can be improved.

Completed in July, Round 16 looked at 13 LED products labeled as BR30 or R30 (spot and flood reflector) lamps. Testing showed significant improvements over earlier generations of LED BR30 and R30 lamps. However, the summary report did indicate that there is still a need for more selection within this LED lamp category, both in terms of lumen output and distribution type.

The latest round of testing—Round 17, completed in August—focused on six LED AR111 lamps. The summary report indicated that this niche lamp category is not as far along as some other directional LED lamp types. At present, LED AR111 offerings are not competitive replacements for halogen AR111 lamps, particularly in terms of color quality and luminous intensity distributions. All of the summary reports can be downloaded at 1.usa.gov/wZ2q14.

• Research and Development

Following its fourth annual SSL Manufacturing R&D Workshop, which took place in San Jose, Calif., on June 13 and 14, the DOE has published the 2012 report "Solid-State Lighting Research and Development: Manufacturing Roadmap." This roadmap serves as a guide to the R&D program and assists in answering funding questions. The 2012 version includes a few important updates from the previous years, including most of the priority manufacturing task descriptions with status updates toward completion.

The DOE has also posted a summary report from the workshop along with all of the presentations (see link below). More than 200 individuals attended the most recent workshop where discussions focused on cost reductions, as opposed to price, of bringing LED technology to market. A PDF of the roadmap can be downloaded at 1.usa.gov/P2iJoN. The workshop report can be downloaded at 1.usa.gov/Q4BY2R.

In June, the DOE announced the selections for its third round of SSL manufacturing R&D funding opportunities. According to the DOE announcement, three two-year projects will concentrate "on achieving significant cost reductions while maintaining quality by improving manufacturing equipment, processes, or monitoring techniques." The three recipients are Durham, N.C.-based Cree; Milpitas, Calif.-based KLA-Tencor; and Dexter, Mich.-based k-Space Associates.

Cree's project will focus on the development of an optimized LED fixture design, at low cost, for general illumination purposes both indoors and out. KLA-Tencor's initiative will focus on improving color consistency of LEDs using measurement tools during the manufacturing process to reduce fluctuations in LED quality. Finally, k-Space Associates is working to develop a more efficient manufacturing process for OLED layers. The project furthers the technical capabilities of its existing optical-monitoring technology, which enables high-precision measurements of OLED layers during mass production.

DOE support for the projects totals \$7.1 million, and private-sector funding from the three companies will add another \$5 million. Due to budgetary restrictions during fiscal year 2012, the DOE will not select or fund any projects in the SSL Core Technology or SSL Product Development categories. Full details on all of the DOE's SSL R&D initiatives can be found at 1.usa.gov/QnwEUc. •

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ASSIST CELEBRATES 10TH ANNIVERSARY

The collaborative solid-state lighting alliance has helped guide LED discussions for a decade.

text by Elizabeth Donoff

The Alliance for Solid-State Illumination Systems and Technologies (ASSIST), an industry-sponsored organization, is celebrating its 10th anniversary. The group, formed in 2002, has an international makeup and brings together interested parties from different areas within the lighting community to discuss issues related to solid-state lighting (SSL) and LEDs. ASSIST members include manufacturers such as Acuity Brands Lighting, Bridgelux, Cree, GE Lighting Solutions, Osram Sylvania, Philips Lighting, Sharp, Toshiba, and WattStopper; government entities such as the Federal Aviation Commission and the U.S. Environmental Protection Agency; academic institutions such as the Lighting Research Center (LRC); and public benefit groups such as the New York State Energy Research and Development Authority (NYSERDA).

Members of ASSIST meet on a regular basis to discuss issues and areas in need of further research. The group utilizes the expertise of the LRC's researchers and that institution's facilities. Since the inception of ASSIST, strides have been made in establishing definitions and test methods for LEDs and LED luminaires, creating a portfolio of demonstration projects, and providing educational resources such as seminars and white papers. Critical to these initiatives is the "ASSIST Recommends" series of guidelines (the most recent paper published discusses LED light source flicker) and the LRC's bi-annual, three-day LED Lighting Institute, the first independent, research-based university workshop on the subject of LEDs, which has hosted more than 500 participants to date. For a full overview of ASSIST members and activities, and of the LRC SSL program, go to bit.ly/TsbnPs. •

"Going forward, ASSIST intends to maintain its collaborative approach to overcoming market transformation barriers. This will include knowledge creation and dissemination, demonstrating applications where LED lighting shows better performance and value, creating innovative concepts for using LEDs, and educating those with an interest in this next-generation technology."

— Nadarajah Narendran, LRC director of research and director of the SSL program

ENVIRONMENTAL IMPACT REPORT

The U.S. Department of Energy's Pacific Northwest National Laboratory, in conjunction with several industry partners, has released a new report, "Life-Cycle Assessment of Energy and Environmental Impacts of LED Lighting Products." The report is the conclusion of a study of the energy usage of an LED from its creation to its retirement. Part One of the report compares the energy consumption of incandescent, compact fluorescent, and LED lamps. (A 60W lamp was used as the test source.) Part Two examines LED manufacturing and performance.

This is the first report to holistically examine the energy and natural resources required in the production, shipping, operation, and disposal of LED lamps. Fifteen criteria were used in evaluating an LED's environmental footprint including the potential to increase global warming, to reduce usable land for wildlife sanctuaries, to generate waste, and to pollute water, soil, and air.

Key results from Part One of the report indicate that the average life-cycle consumption of energy by LED lamps and by compact fluorescents are similar—approximately 3,900 megajoules (MJ) per functional unit (20 million lumen-hours). Incandescent lamps, by comparison, consume nearly four times more energy—15,100 MJ per functional unit (20 million lumen-hours)—than either of those. Accordingly, if LED lamps meet their 2015 performance targets, "their life-cycle energy use is expected to decrease by approximately one half."

In terms of an LED lamp, the greatest uncertainty about its life-cycle energy use comes from the manufacturing phase. In the study, life-cycle energy use ranged from as little as 0.1 percent to as much as 27 percent, depending on the LED package. The summaries and full reports are available at 1.usa.gov/yr0cQb. •



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SOLID-STATE SUCCESS

New LED products for a range of architectural lighting applications.

text by Wanda Lau



io Tile Gen II, Cooper Lighting •

Designed to be both functional and decorative, the io Tile Gen II can be surface mounted, pendant mounted, or recessed into walls and ceilings. The LED luminaire uses Cooper Lighting's patented optical waveguide technology, which the manufacturer says produces directional lighting without hot spots or glare. Using 2700K, 3000K, 3500K, 4000K, or 5000K LEDs, the Tile Gen II can be 6 or 12 inches square or rectangular, in dimensions between 6 inches by 12 inches and 12 inches by 24 inches. Hundreds of color gels and graphics can be applied to the luminaire's lens. • cooperlighting.com • Circle 125

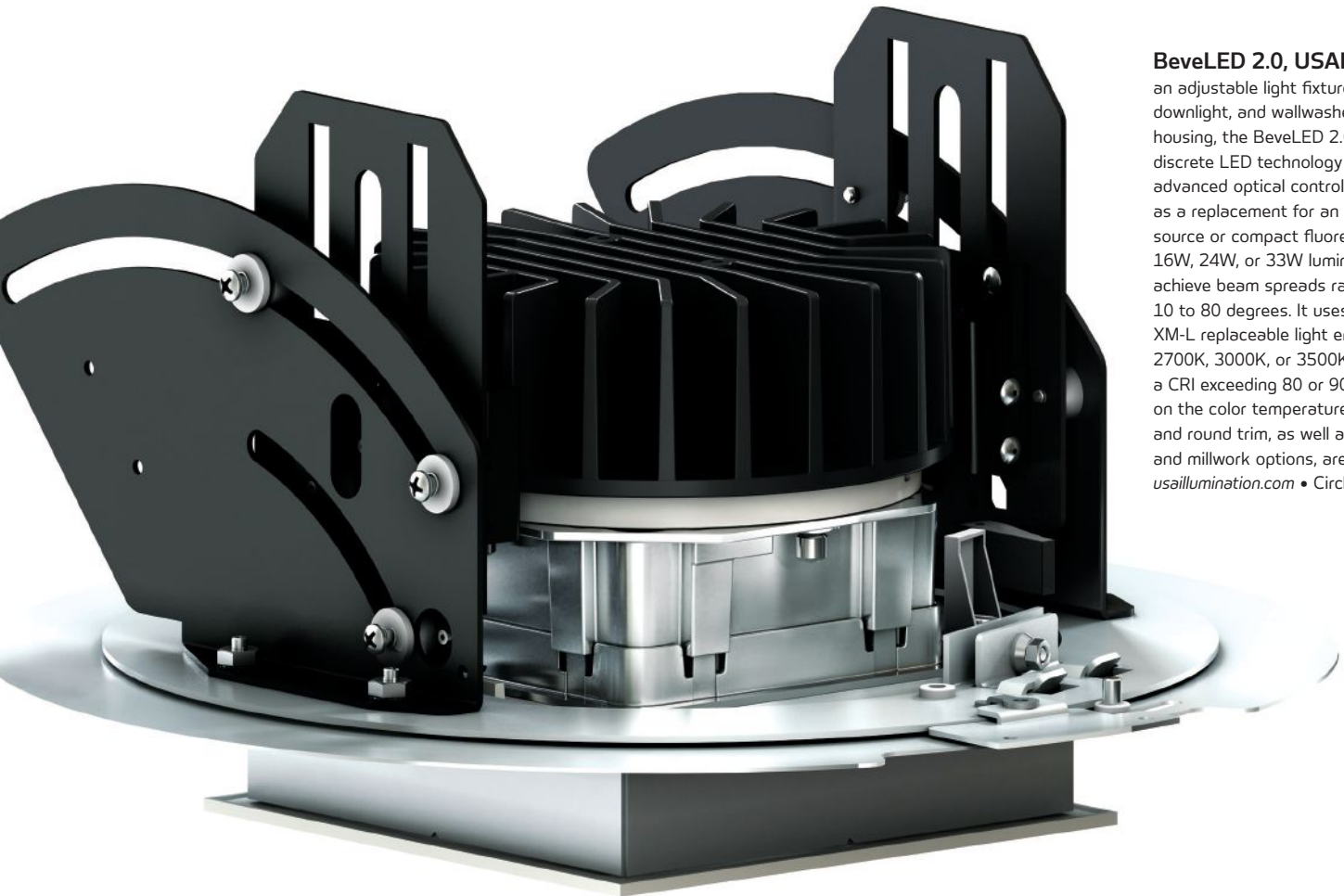


Ergo, Prudential Lighting •

The Ergo LED wall sconce is designed to respond to California's healthcare-design safety codes, which mandate that a light fixture cannot protrude more than 1½ inches from the wall in exit access corridors, so as to avoid interference with medical equipment. Ergo measures 11¼ inches in diameter and is available in either a square or round housing (shown). It projects exactly 1½ inches from the wall and comes in two color temperatures: 3000K or 4000K. The frosted, tempered glass face can withstand medical cleaning solvents. • prulite.com • Circle 126

LED Wall/Slot 6000, Litecontrol • Designed for wall-grazing, this small-scale, recessed perimeter luminaire features multi-die LED packages with secondary optics and multiple total internal reflector lenses. Available in 2-, 3-, 4-, 6-, and 8-foot lengths, the LED Wall/Slot 6000 is composed of an extruded aluminum LED module that snaps into a steel housing. The luminaire can be mounted in a grid or on a ceiling. An optional luminance-control deflector conceals the LED source, which comes in four color temperatures—2700K, 3000K, 3500K, and 4000K—each with a CRI exceeding 80. • litecontrol.com • Circle 127





BeveLED 2.0, USAI • Combining an adjustable light fixture, recessed downlight, and wallwasher in a single housing, the BeveLED 2.0 uses discrete LED technology to provide advanced optical controls. Designed as a replacement for an MR16 point source or compact fluorescent, the 16W, 24W, or 33W luminaire can achieve beam spreads ranging from 10 to 80 degrees. It uses a Cree XM-L replaceable light engine and 2700K, 3000K, or 3500K LEDs with a CRI exceeding 80 or 90, depending on the color temperature. Square and round trim, as well as trimless and millwork options, are offered. • usaillumination.com • Circle 128



Indy Performance Series LED Downlights, Juno Lighting Group •

This series of dimmable LED downlights comes with two reflector options: a hyperbolic reflector (shown) that hides the LED from view and reduces glare, and a parabolic reflector with an aesthetic that is more typical of conventional downlights. The 4-, 6-, or 8-inch-diameter luminaires can produce color temperatures of 2700K, 3200K, 3500K, and 4100K, with a minimum CRI of 80. Seven trim colors, including clear (shown), are offered. An optional lumen depreciation indicator system in each fixture alerts facility staff when the delivered lumen output falls below 70 percent of initial lumens, so that the light source can be replaced. • junolightinggroup.com • Circle 129



QLW Series Wall Sconces, Philips Wide-Lite •

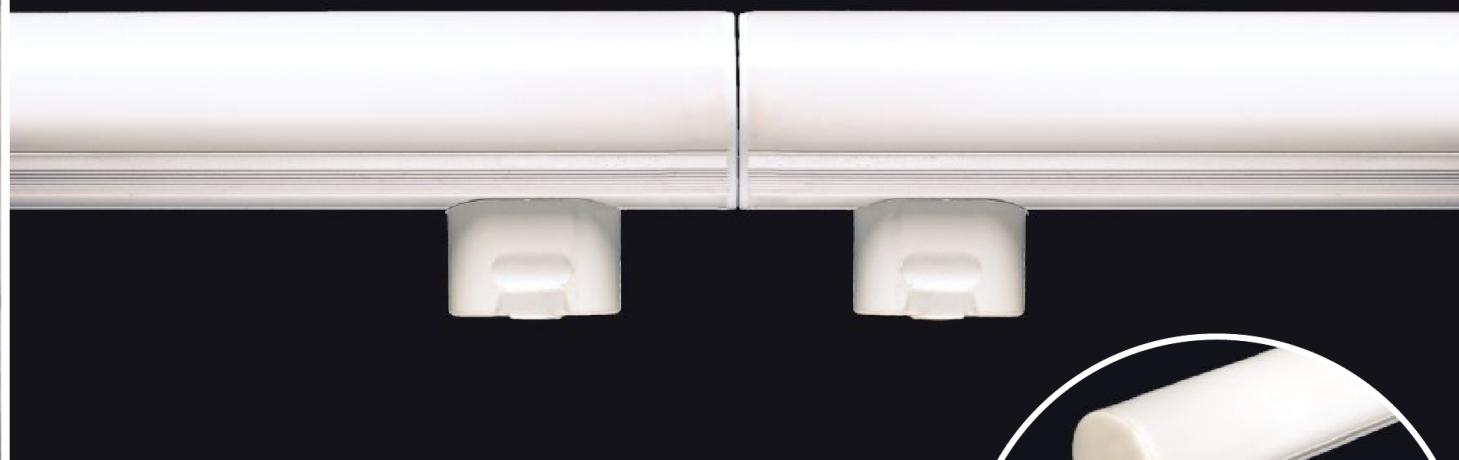
Philips Wide-Lite has added two wall-mounted fixtures to its Quality LED Wall and Surface Mount series of luminaires. The 13W QLW-7G1 LED wall sconce delivers 47 lm/W and can be mounted 6 to 10 feet high, above doors and entrances. The 36W QLW-16G1 LED wall sconce, which uses the Philips LEDgine platform, delivers 80 lm/W. Designed to replace 150W HID fixtures, it can be mounted 10 to 15 feet high. The fixture offers advanced control options, including a photo-control sensor for automatic on-off. • widelite.com • Circle 130

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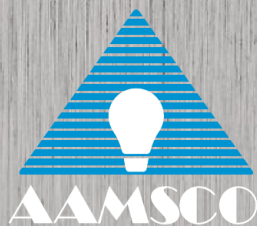
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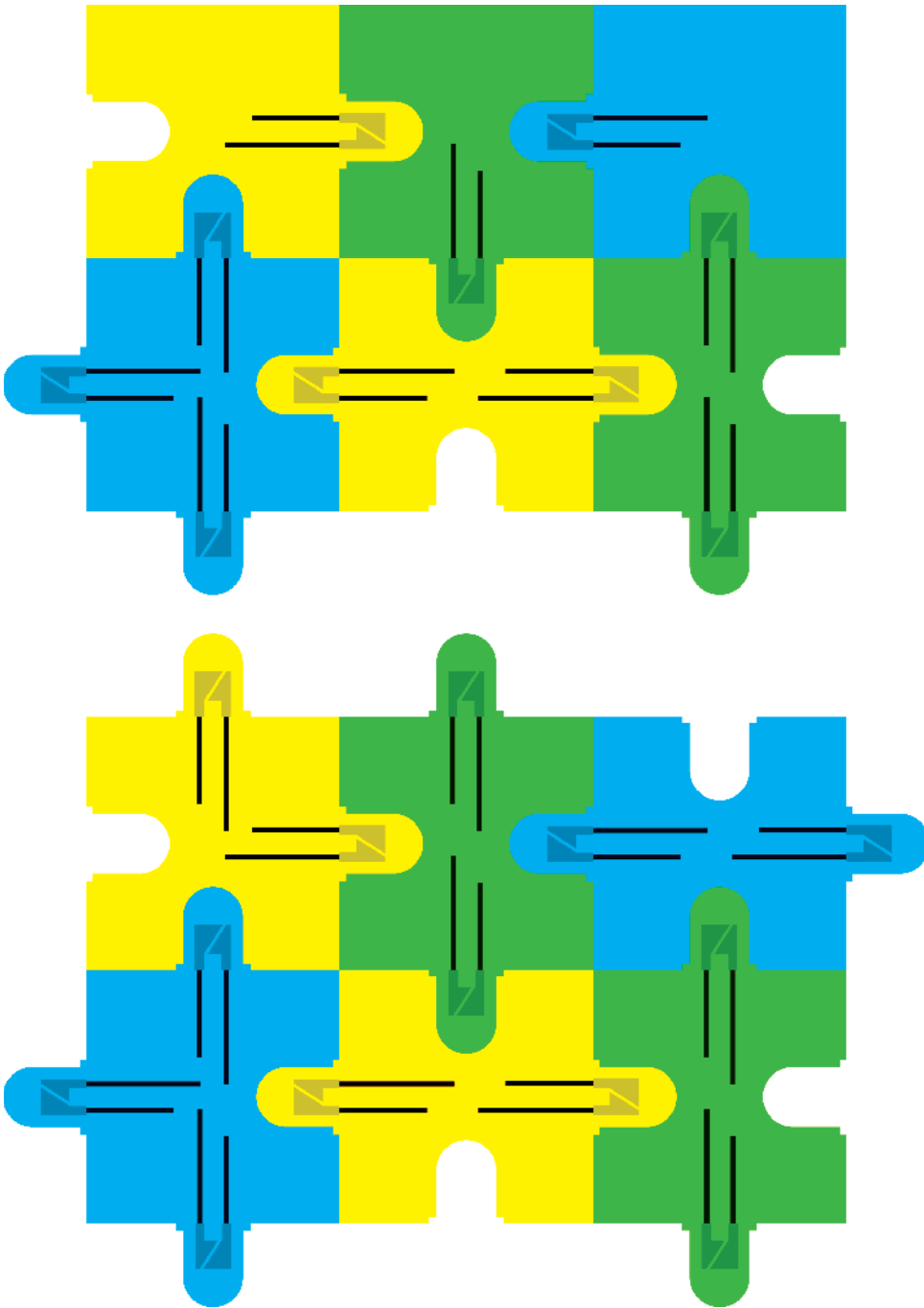
- Directly replaces incandescent versions without modification, facilitates end-to-end mounting
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Solid-state lighting (SSL) has transformed the lighting industry and has had a great impact on the development of luminaires that use LEDs as their source. But while SSL technology has given the industry a starting point for new luminaire design, it has also presented a new set of issues that manufacturers and lighting designers have to contend with—issues such as appropriate metrics for LEDs, color rendering, and the replacement of individual elements within the overall LED luminaire package.

At the root of the matter is the very concept of the lighting system itself. Previously, one would select a luminaire and the coordinating lamp and ballast to go with it. And, for the most part, a designer could do that and use products from different manufacturers for the overall luminaire without too much complication. But with LEDs and their electronic complexity, the ability to use components from different manufacturers has been met with more difficulty. LED fixtures and their components, including the LED engine, heat sink, and driver, have thus far been designed as integral systems. This has made it impossible to use anything but one manufacturer's complete LED product line. Realizing the limitations that this puts on the continued evolution of LED luminaires, lighting manufacturers have been working to figure out a way to overcome this hurdle, and to share information without compromising proprietary research and technological developments that will distinguish them from their competitors.

Z IS FOR ZHAGA

The two-year-old manufacturer consortium is tackling LED issues as the lighting industry strives for greater coordination of solid-state lighting components.

text by Thomas Wensma

illustration by Patrick George

An Industry Network

One way the lighting industry is working to overcome these technology hurdles is with the formation of working groups, or consortia, where manufacturers with similar vested interests can work together and develop industry protocols. Zhaga is one of the first of these groups to have been established. Founded in February 2010, the

The consortium's hope is that the standardization and coordination of LED components that it is working toward will lead to an increase in a designer's confidence when it comes to specifying LED fixtures for a project.

group is an industry-wide consortium of global lighting companies.

Zhaga (the word means waterfall in Sichuan, but has no intended meaning otherwise for the group) was started with the aim of "creating specifications that will enable the interchangeability of LED light sources from different manufacturers." Members include luminaire manufacturers, LED module makers, and material and lighting component suppliers. The nine founding consortium members are: Acuity Brands Lighting, Cooper Lighting, Osram, Panasonic, Philips Lighting, Schröder Lighting, Toshiba, Trilux, and Zumbotel. Since the launch, more than 200 companies from Asia, Europe, and North America have joined.

Establishing Protocols

So how is Zhaga able to advocate for this desired interchangeability of LED light sources? It does this by defining interfaces for a variety of application-specific light engines. (An LED light engine is defined as the combination of an LED module and the associated control gear.) Zhaga specifications cover physical dimensions, photometric data, and the electrical and thermal behavior of the LED light engine. The interchangeability of the LED light engine is specified independently from the type of technology used inside the light engine. This way the interface stays the same, but the light engine can be replaced with a new one as evolutions in technology occur.

Industry Progress?

So what kind of progress has Zhaga made in its first two years? Having so many of the leading lighting industry players involved is good, but it doesn't mean that reaching consensus on the specification formats has been easy. At present, Zhaga is working on the standardization of interfaces for downlights, general lighting, and spotlights. These are good starting points, as they already coincide with the areas in which LED luminaires have made strides product-wise. This will also allow Zhaga-based specifications to have a high market impact.

Zhaga members meet several times a year to discuss technology developments to further develop the standardization of these interfaces. Particular focus is given to the mechanical and thermal fit of the heat sink, the size and height of the light-emitting surface, and the

photometric properties in regards to different application areas.

When asked about the current state of Zhaga and the challenges it faces going forward, Fred Bass, director of Neonlite, and a Zhaga member, notes, "Zhaga has achieved a great deal in two-and-a-half years, first by bringing together more than 250 industry players globally, [and] with more than 50 meeting regularly every couple of months." But the key challenge is for Zhaga "to gain wider acceptance by both luminaire makers and specifiers," he says. "It comes down to improving Zhaga's market communications to demonstrate the clear benefits of the sustainable approach Zhaga platforms offer."

And while Zhaga's intent is good, one does wonder if it adds further confusion to this rapidly advancing area of lighting technology, at least until more people become familiar with the consortium and its activities. Nevertheless, as the consortium explains in its literature and on its website (zhagastandard.org), its purpose is to "benefit consumers and professional buyers of light engines and luminaires in the expectation that interchangeability will prevent market fragmentation into incompatible products."

The consortium's hope is that the standardization and coordination of LED components that it is working toward will lead to an increase in a designer's confidence when it comes to specifying LED fixtures for a project. This should lead to further commercial availability, easy replacement, and continued performance upgrades, all of which should aid in speeding up innovation and improving competition in the application of LED lighting. The end goal for manufacturers is the delivery of stable design platforms.

Industry Perception

But will Zhaga be able to make an impact and transform the LED discussion? Looking at the list of lighting companies that have signed on as Zhaga members, one does get the sense that momentum is in the consortium's favor when it comes to further and more widespread adoption. Interestingly, most of the companies appear to want to offer products that meet the Zhaga specification protocols, but to also leave room for products that continue along the lines of single-manufacturer specifications. The idea for this is that it is better to let the specifier decide which route he or she wants

to take based on the client's wishes and the project's needs.

This might seem to be at odds with establishing the consortium in the first place, but given how quickly LED technology is changing, giving specifiers and manufacturers a Zhaga and a non-Zhaga option does allow for greater flexibility. It will be interesting to see if the push for interchangeability between LED products makes technology upgrades more likely to be adopted in what are still very traditional approaches to project scheduling and purchasing of equipment. The question remains how important these intermittent performance upgrades are to specifiers, as opposed to the overall lighting system solution. And it raises important questions about what the criteria should be for technology upgrades and product replacement in the long term.

Design Freedom

Even though the consortium's intent stems from the need to provide a better form of communication between companies working in the LED sphere, if interpreted the wrong way, standards do risk interfering with the design process and inhibiting creative freedom. Great product design focuses on incremental details. Designing to a particular platform—Zhaga or any other standard—potentially eliminates that.

It is then up to lighting designers to know when they should or shouldn't avail themselves of a particular framework for product solutions. Manufacturers are also not immune to this phenomenon. One would hope that they continue to push themselves to innovate and create lighting options that provide quality lighting solutions while meeting today's energy requirements—and even anticipate more stringent energy criteria.

Next Steps

Zhaga, as an initiative, is addressing the challenges of LED market adoption and product development, all while trying to solve a serious problem. The lack of a common product and specification language has been somewhat problematic and especially frustrating for specifiers who are always trying to achieve the greatest flexibility in the design of their lighting solutions. But just how much the issue of interchangeability and the possibility to upgrade comes into play in the overall specification process is hard to say.

Perhaps rather than focusing on market adoption of LED products, companies should focus on how they can make better products and incorporate more sustainable manufacturing processes into luminaire design. This is particularly relevant when it comes to LED luminaires. SSL gives our industry so much flexibility—and the potential for good that an initiative like Zhaga can have is huge. It would be a great step if Zhaga embraced a "cradle-to-cradle" platform as it thinks about LED specifications and interchangeability of light engines.

Thinking about the entire manufacturing process and supply chain is in keeping with the move by lighting companies to offer total-lighting solutions. The Zhaga consortium has the opportunity to make an even greater statement in advocating for LED market adoption by thinking more broadly. The group just needs to take this logical next step. •

Thomas Wensma is a design and lighting consultant, as well as founder of Ambassador Design in the Netherlands.

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SWITCH APPEAL

Designing LED roadway fixtures requires more than simply replacing the light source.

text by Wanda Lau

illustration by Tang Yau Hoong

Change can be hard. Witness the reluctance with which some building owners, and even consumers, are approaching the switch to certain lighting technologies, such as T8s and LEDs—even though these sources meet new energy mandates better than previous options.

For roadway lighting, change is already well under way in the form of solid-state lighting. The new paradigm gives designers and manufacturers immense opportunity to experiment with a light source that looks and behaves differently than conventional high-intensity discharge (HID) and high-pressure sodium (HPS) lamps. But rather than rush into uncharted luminaire design territory, many manufacturers have continued to stick with form factors that they are familiar with rather than exploring something new.

This lack of design change doesn't surprise John Bono, chairman of the IES Street and Area Lighting Committee. "Everyone's used to seeing cobra heads," he says. "Everybody wants the same look except with LEDs [as the

light source], but that doesn't necessarily allow LEDs to perform properly."

Retired lighting engineer Del Armstrong, now president of Soft Lighting Systems in Bellevue, Wash., remembers seeing his first LED roadway fixture about six years ago. "It basically was LEDs mounted on a [metal] pan," he says. "It didn't do that good of a streetlighting job."

Though LED technology has advanced significantly since that demonstration, Armstrong still worries about the lack of considered optical design for LED streetlights. Whereas luminaires outfitted with conventional lamps need refractors to deliver candlepower to the roadway, LEDs, a point source, provide a more directional light than their filament-lamp counterparts. But to reduce glare and provide the contrast necessary for driver and pedestrian visibility, Armstrong would like to see fixtures in which the LEDs are aimed at about 60 degrees rather than the 72 degrees of HID or HPS luminaires.

Like many of his lighting colleagues, Armstrong would also prefer a lower spacing-to-mounting-height ratio than what many utility companies and municipalities anticipate in their quests to save costs by employing LEDs. Though LEDs generally have a better efficacy at cooler, brighter color temperatures, he finds 3000K to 3500K to be most successful in viewer comfort and reducing sky glow.

These optical requirements aside, Armstrong looks forward to seeing more design innovation in roadway LED luminaires. "We have a huge opportunity to do some really nice things with LEDs," he says.

Several manufacturers, including the four discussed on the following pages, are starting to reimagine not only how the form of an LED roadway luminaire can speak to its function, but how its design can maximize the diode's potential as a source, while still producing quality illumination.

Manufacturers and designers have hit a few potholes on the road to LED conversion, but change is happening. And it looks promising. •



Name: Altitude

Manufacturer: Kim Lighting

Website: kimlighting.com

Overview: Altitude has an optical design created specifically for LEDs. Kim Lighting's patent-pending PicoPrism optics feature four LEDs and an acrylic prism in a replaceable, modular assembly. The LEDs, individually directed to provide horizontal spotlighting and redirect spill light, overlap to create uniform illumination. The horizontal spotlight is aimed at slightly less than 70 degrees.

Configurations: Altitude is available in six different housing sizes, from 23¹/₄ inches by 17 inches in plan to 42³/₄ inches by 25 inches in plan; Altitude 180, 240, and 300 LED fixtures are most appropriate for roadway lighting.

Lighting Distribution: Available in nine IES distribution types, including one-way-left and one-way-right distributions

Height and Spacing: Altitude has a recommended mounting height of 10 to 40 feet and a spacing-to-mounting-height ratio (SHR) of 4 to 5.

Housing: Low-profile, composed of die-cast aluminum with a low copper alloy.

Thermal Management: Ribs, vents, and barrier walls separate electrical components from optics in the housing; ribbed exterior serves as the heat sink. A thermal sensor automatically lowers the current when ambient temperature becomes too warm.

Color Temperature Options: 4000K, 5000K, and amber

Additional Features:

- Rotatable photoelectric receptacle.
- Wireless control optional.
- Retrofit with existing poles possible.
- Neighbor-friendly optic option (similar to IDA compliant) further reduces backlight.



Name: Avanza

Manufacturer: Selux

Website: selux.de

Overview: The exterior street and area luminaire Avanza uses Selux's Cross Beam Technology (CBT) to create uniform light by orienting LEDs in a preset direction based on their intended use. For asymmetrical lighting, CBT reflectors direct the LEDs to maximize the total luminance efficiently. The large, freeform reflectors are configured based on the desired lighting distribution.

Configurations: Avanza 450, Avanza 600, and the Avanza 450/600 combined configuration.

Lighting Distribution: The Avanza 600/450 may be used for roadway and walkway illumination. The Avanza 450 is suitable for asymmetric light distribution for city arterials with slower speed requirements. The Avanza 600 can produce asymmetric light distribution for major roads with dense traffic as well as parking lots and areas with strict lighting regulations. Its forward-throw light distribution is suitable for parking lot illumination.

Height and Spacing: The Avanza 600 and 600/450 may be mounted up to 10 meters (32 feet) high and have a maximum SHR of 6. The Avanza 450 may be mounted 4.5- to 6-meters high and has an SHR of up to 8.

Housing: Die-cast aluminum with non-reflecting safety glass.

Thermal Management: Integral heat management

Color Temperature Options: 3000K and 4500K

Additional Features:

- Optional comfort feature widens the light density at beam edges.
- Control options can be integrated in the fixture.
- International Dark Sky Association (IDA) compliant.



Name: Aeroblades

Manufacturer: Cree

Website: cree.com

Overview: Speirs + Major spent three years developing an exterior luminaire—initially for BetaLED/Ruud Lighting, and then Cree, (which acquired Ruud in 2011)—that would combine Cree’s LEDs with Ruud’s NanoOptic controls. While Aeroblades’ side profile doesn’t depart noticeably from the proportions of a typical streetlight, its distinctive form quickly becomes apparent when looking at it head on. The fixture head comprises multiple, modular blades, each containing an array of 10 LEDs. The tapered metal blade serves as the diodes’ heat sink.

Configurations: The Aeroblades luminaire can be combined in two-, four-, or six-blade configurations.

Lighting Distribution: Using NanoOptic Refractor Control, Aeroblades offers 20 optical distributions and may be used for a variety of exterior lighting applications.

Height and Spacing: Aeroblades may be mounted 4 to 10 meters (13 to 32 feet) high, depending on how many blades are used, and has a maximum SHR of approximately 6. As all of the luminaires featured in this article, the mounting height and pole spacing depends on the application and use.

Housing: Die-cast aluminum

Thermal Management: Passive system via the Aeroblades’ blades

Color Temperature Options: 3000K, 3500K, 4000K, and 5700K

Additional Features:

- Zero-to-10V dimming
- Aeroblades can be used for retrofit exterior luminaires.
- IDA compliant



Name: VFL500 LED series

Manufacturer: We-ef

Website: we-ef.com

Overview: The optical system for this series of roadway luminaires is based on the company’s One LED Concept (OLC) technology. Instead of pointing LEDs in multiple directions to produce uniform light collectively, OLC follows a multilayered approach in which each LED and lens produces the identical light distribution. When stacked together, the light distributions create a uniform illumination even when individual LEDs are off. The contoured, butterfly-shaped lens over each LED limits internal reflection while increasing illuminance at the 60- to 75-degree angle.

Configurations: The smaller VFL530 LED luminaire uses 12 or 24 LEDs, while the VFL540 LED street-and-area luminaire uses 24, 36, or 42 LEDs.

Lighting Distribution: The VFL500 LED series offers lens types for five distributions—three for streetlighting, one for asymmetric forward throw, and one for rectangular forward throw.

Height and Spacing: The series has a recommended mounting height of 2.5 to 8 meters (8 to 26 feet) and a maximum SHR of 5.5 to 9, depending on the luminaire model and application.

Housing: Four-piece, die-cast, marine-grade, aluminium alloy.

Thermal Management: Integrated heat sink with an optional thermal switch.

Color Temperature Options: 3000K and 4000K

Additional Features:

- Basic, motion, advanced, and dynamic control options available.
- IDA compliant



PORTALS OF LIGHT

LEDs turn skylights into nightlights at the Stödel Museum.

text by Aaron Seward

photos by Norbert Miguletz







The Städel in Frankfurt is one of Germany's most important museums. Its collection of some 2,900 paintings, 600 sculptures, 500 photographs, and more than 100,000 drawings and prints represents 700-plus years of Occidental art history from the early 14th century to the Renaissance, Baroque, early modern, and contemporary periods. Highlights include pieces by Dürer, Rembrandt, Vermeer, Monet, Picasso, Beckmann, and Richter.

Founded in 1815 by banker and merchant Johann Friedrich Städel, the institution has acquired so much by continually expanding its holdings through an active acquisition policy. Recently, the museum's contemporary collection received a boost with the transfer of 600 works from the Deutsche Bank collection and more than 200 photographs from DZ Bank, adding such luminaries as Olafur Eliasson, Nan Goldin, Cindy Sherman, and Andreas Gursky.

To accommodate and display this new wealth of contemporary art, the Städel decided to undertake the largest expansion in its 200-year history. In the autumn of 2007, the museum invited eight architectural firms to enter a competition to design a new wing and renovate the existing facilities: Diller Scofidio + Renfro of New York; Gigon/Guyer Architekten of Zurich; Jabornegg & Pálffy of Vienna; Kuehn Malvezzi Architekten of Berlin; Sanaa/Kazuyo Sejima, Ryue Nishizawa & Associates of Tokyo; UNStudio of Amsterdam; and local Frankfurt firms Wandel Hoefler Lorch + Hirsch Müller and Schneider+Schumacher. In February 2008, an international jury chose the proposal by Schneider+Schumacher.

The firm's winning design put the 9,800-square-foot exhibition area in a volume beneath the museum's existing garden. This allowed the architects to maintain the cherished green space, regularly used by the museum and its visitors, with an intensive green roof. To indicate that more exists beneath the lawn than just earth and nature's critters, Schneider+Schumacher gave the extension's poured-in-place concrete roof a gently sloping convex shape, creating a domed hill that animates the landscape.

The firm studded the surface with a grid of 195 porthole skylights that range in diameter

The exterior view of the Städel Museum extension and its convex-shaped green roof is perforated by a grid of 195 porthole skylights (previous page). The skylights bring natural light into the subterranean exhibition space (this page).

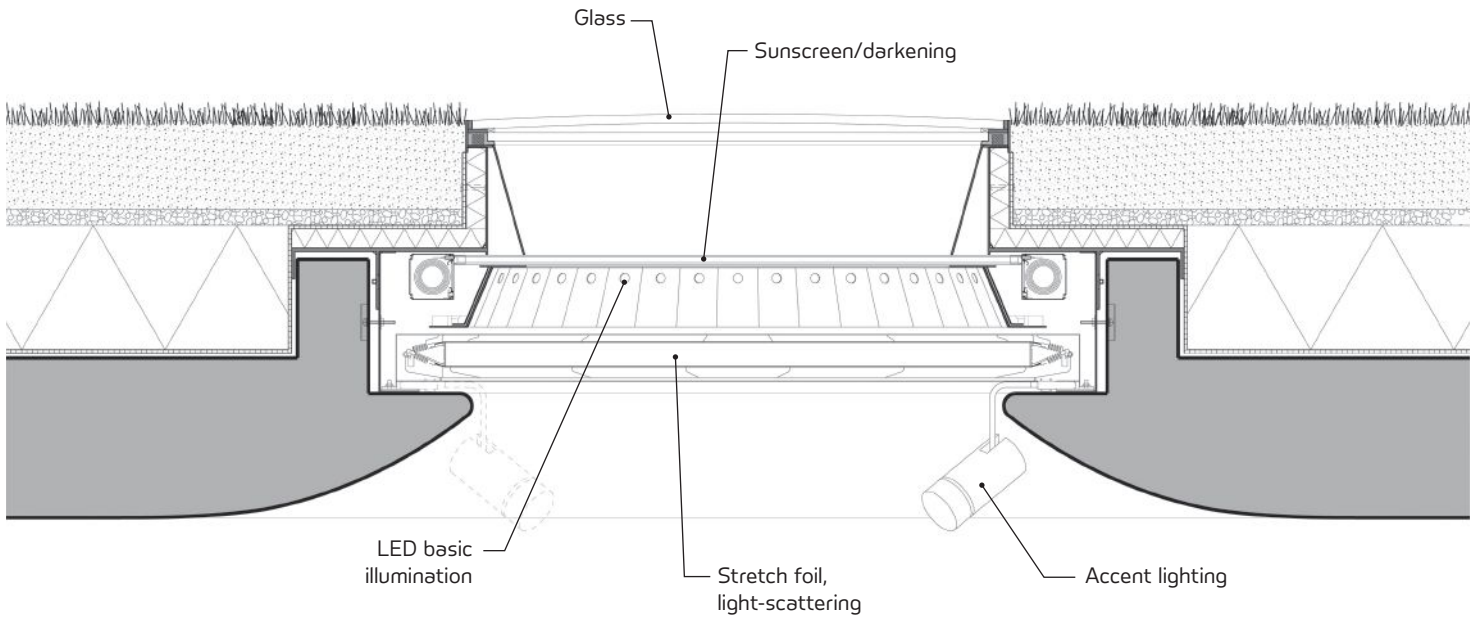


Above ground, a new entry foyer and stair leads down to the new exhibition space.



The new entry stair, with its sculptural form, is as much a piece of artwork as the other objects on display. LED spotlights in a semi-recessed ceiling slot illuminate the mixed media on display.

Cross section of skylight with LED spotlights



from 5 feet at the perimeter to 8 feet in the middle. Underground, a mere 12 columns support the roof, which reaches as high as 28 feet, providing an open, flexible space that can be reconfigured to fit the museum's evolving needs. Kuehn Malvezzi Architekten of Berlin designed the first exhibition presentation, laying out a system of interlocking galleries that allows visitors to choose their own path through the contemporary art holdings.

The skylights also provide illumination for the exhibition spaces below. The architects worked with Berlin- and Bonn-based lighting design firm Licht Kunst Licht to develop a natural and electric lighting scheme that would be as flexible as the space itself, and thus capable of meeting the needs of individual artworks—whether they be sunlight-loving sculptures or light-sensitive drawings. The arrangement of the different-diameter skylights, with smaller ones on the fringes and larger ones in the center at the raised dome, provides the first method of controlling daylight, organizing the interior into smaller, easier-to-control compartments. Each skylight is outfitted with an automated shading system that provides four levels of allowable light penetration and a fifth level for total blackout, so that, throughout the exhibition area, the skylights can be adjusted to the requirements of the artworks below.

The design team integrated the electric lighting scheme into the skylights using custom-designed LED ring fixtures that sit inside the skylight housing. Each fixture features both warm-white (2700K) and cold-white (4500K) LEDs, which can be tuned to match daylight conditions, while daylight sensors and a control system adjust the levels of the LEDs, raising light levels as clouds pass overhead or as evening approaches—thus ensuring a constant level of light. Each skylight also features a diffuser foil system that makes it indistinguishable to decipher whether the sun or the LEDs are providing the illumination. As needed, specially fabricated LED accent spotlights with a variety of optics can be inserted into sockets in the skylights to add to the ambient illumination or to highlight individual artworks.

At the Städel, light and architecture come together so completely that it is difficult to tell where one begins and the other ends. On the interior, the porthole skylights and profile of the domed ceiling create a lively environment in what would otherwise be a hole in the ground outfitted with white walls. In the garden above, the skylights let the world know that this is a piece of architecture, an impression that only grows as the sun goes down and the field of polka dots begins to illuminate the outside from within. •

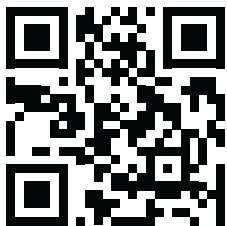
Details

Project: Städel Museum Extension, Frankfurt, Germany
Client: Städtisches Kunstinstitut, Frankfurt **Architect (extension and renovation of old building):** Schneider + Schumacher, Frankfurt **Architect (collection layout):** Kuehn Malvezzi Architekten, Berlin **Lighting Designer:** Licht Kunst Licht, Berlin and Bonn, Germany
Electrical Engineer: Delta-Tech, Weiterstadt, Germany
Electrical Contractor: Imtech, Rüsselsheim, Germany
Photographer: Norbert Miguletz, ©Städel Museum, Frankfurt **Project Size:** 9,800 square feet **Project Cost:** €34 million (approximately \$43.2 million) **Manufacturer:** Zumtobel

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AD INDEX

PAGE	ADVERTISER	CIRCLE NUMBER
16	AAMSCO Lighting, Inc.	215
30	AL ENewsletter	-
1	Alanod	214
11	Amerlux	99
C3	B-K Lighting	66
3	Columbia Lighting	39
C4	Eye Lighting International	216
20	Hanley Wood University	-
C2	ioLED	84
5	Ledtronics, Inc.	200
9	Lighting Science	169
7	Lumenpulse	76
2	No. 8 Lighting	244
19	Shanxi Guangyu LED Lighting	249
4	USHIO	179
13	WAC Lighting	221

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Ann Reo

interview by Elizabeth Donoff
 portrait by Jimmy Fishbein

“The lighting industry as we all knew it is gone—the days of walking Lightfair, knowing everyone and the history of lighting companies—it’s not the mom-and-pop industry that it used to be. On the other hand, it’s very exciting to be involved in an industry that is changing so fast.”

Ann Reo never imagined that her architecture education would lead her to luminaire design and to the launch of her own business, but it did. After graduation, Reo worked in the electrical engineering department of an architecture firm. The work required a lot of custom luminaire design, and she was hooked. Time at Indy Lighting and then Focal Point, as vice president of product development and marketing, gave her the necessary business insight. Then in 2000, she wrote a business plan, designed fixtures, and secured funding for the launch of her company, io Lighting, which was established in 2002. From the start, io has been recognized as a leader in the LED field, first as an independent company and now as a brand of Cooper Lighting, which acquired io in 2007.

What makes a great luminaire?

It’s that sweet spot of very good luminaire efficacies. But you have to respect that a person is going to use the space and be mindful of discomfort glare and visual cut-offs.

What excites you about LEDs?

Their small scale. They allow you to redefine the architecture of a light fixture and deliver powerful, controlled illumination.

Why have LEDs faced a different level of scrutiny than other light sources?

Some manufacturers created false expectations about longevity and color shift over life. As a manufacturer, you have to be truthful about what to expect from the fixture and be honest with the designer.

Are LED standards—such as LM-79, LM-80, and TM-21—helpful, or are they buzzwords that people don’t really understand?

They are incredibly helpful. What does drive me crazy is the term “delivered lumens.” Just because a light fixture is more efficient than the next doesn’t mean it’s a good one. It has to serve the application properly. A good lighting designer is going to know the difference.

How do we get away from “lumens per watt”?

You have to know how to balance the components. A 1W LED that provides 220 lumens per watt is incredibly bright. You have to go down a half watt or a quarter watt—offer a lower-wattage solution that is proportional to the light output. Quality of light is critical beyond luminaire efficacy.

HOW MUCH LIGHT DO YOU NEED?

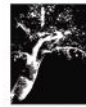


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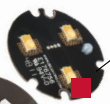
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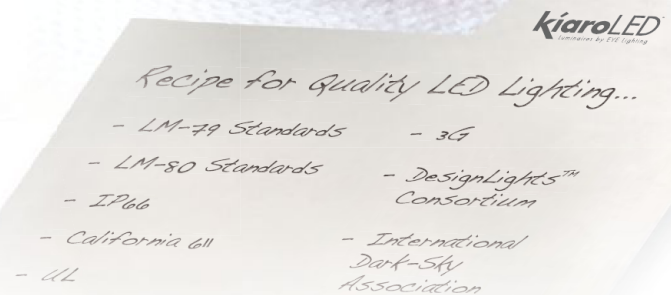
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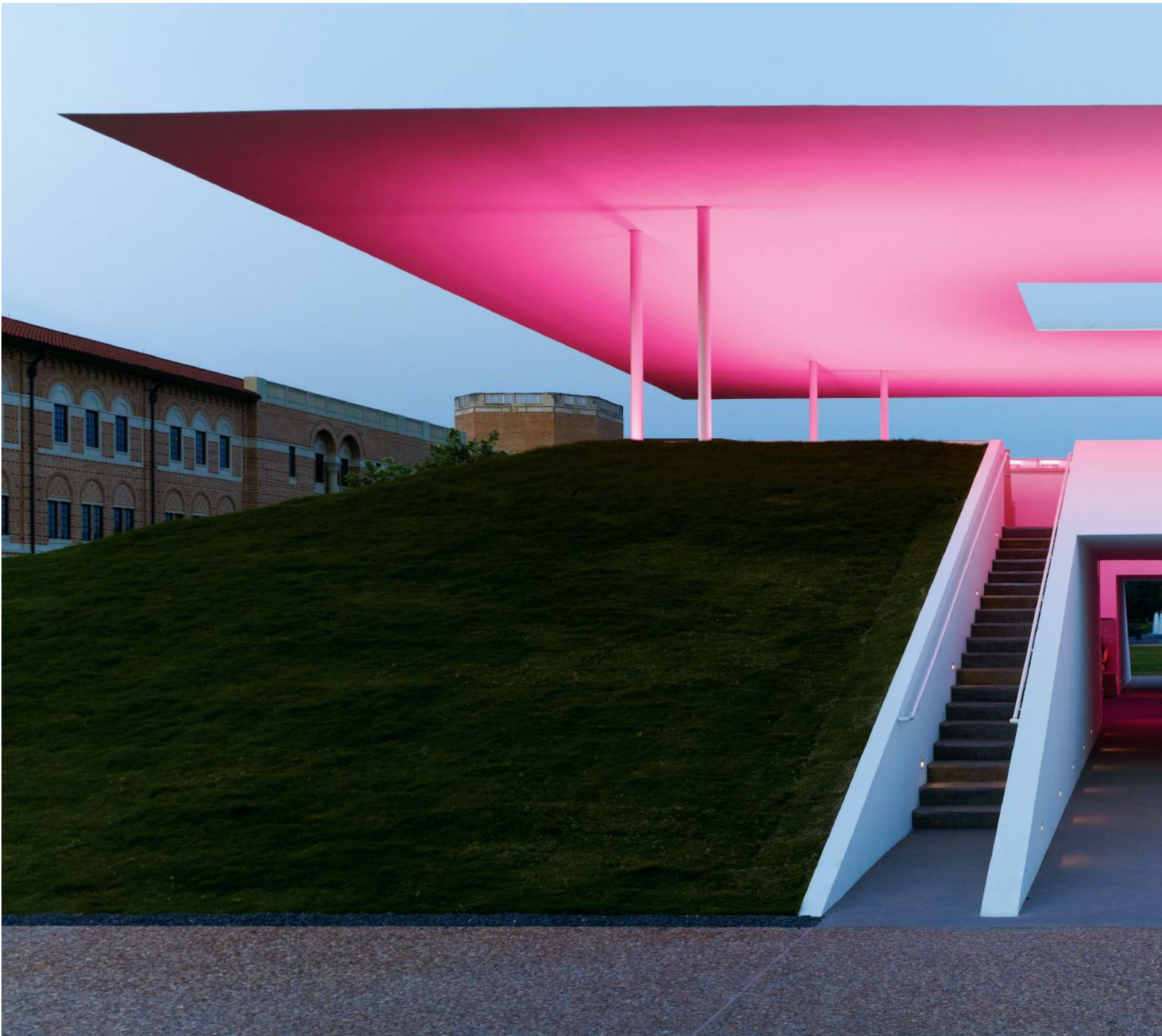
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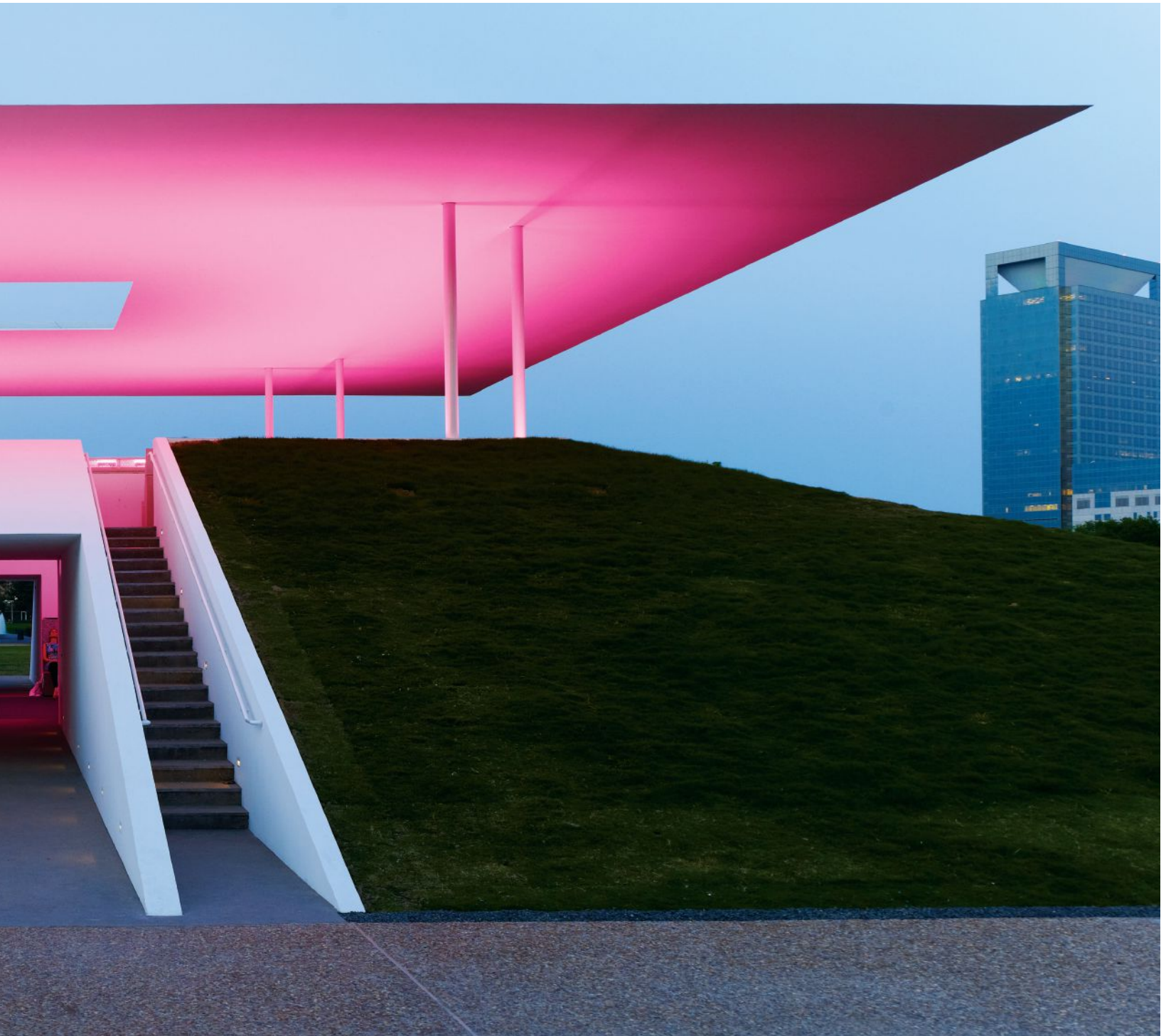
LIGHT AND LIGHTNESS

An enigmatic new presence at Rice University, James Turrell's latest "skyspace" bedazzles with radiating displays of color at dawn and dusk.

text by Stephen Sharpe

photos by Ian Allen







Throughout his long career, artist James Turrell has explored light both as a medium and as a metaphor for personal introspection. All of his work extends an invitation to greet the light—an approach inspired by his Quaker grandmother who taught him the importance of seeking one's own inner light to understand one's place in the larger world.

Turrell's artistic explorations have led him to create his signature work, what he calls "skyspaces." These intimately scaled enclosures invite his audience to view the sky through an opening in the roof while programmed lighting subtly washes the interior's white surfaces with a slowly unfolding cycle of colors. At dawn and dusk, as the celestial dome brightens or darkens, the changing light gradually alters the viewer's perception of the patch of sky floating above; and juxtaposed with the two-dimensional ceiling plane, the sky's infinite depth appears to flatten and its color modulates in complement to the chromatic sequence. Each viewer's experience is unique, requiring patience and a willingness to concentrate on the space and on the light. In fact, to fully appreciate the experience of a skyspace, one must take an active role and become fully immersed in the art. The popularity of Turrell's creation has led to scores of commissions—from both public institutions and private clients—to design and build site-specific skyspaces around the world.

Twilight Epiphany at Rice University in Houston is Turrell's 73rd skyspace, and with its design he introduces elements—a pyramidal form, multilevel viewing, an open-air configuration, and audio components—that heighten the metaphorical thrust of his invitation to greet the light. The project is a permanent installation on the Rice University campus, made possible by a multimillion-dollar gift from alumnus Suzanne Deal Booth to commemorate the university's centennial this year. *Twilight Epiphany*—a sublime work of light and lightness—opened in June, following a year of construction.

Turrell's successful experimentation with new formal properties imbues *Twilight Epiphany* with a sense of timelessness by merging modern architectural characteristics (e.g., complex infrastructure purposefully yet subtly hidden from

view) with aspects that recall the longing among earlier civilizations to understand their place in the vast universe.

To realize the project, Turrell collaborated with New York-based architect Thomas Phifer and his firm Thomas Phifer and Partners. The first-time pairing of artist and architect proved a particularly enlightened decision. Phifer designed the popular and highly praised Brochstein Pavilion, completed in 2009 on the Rice campus. Raymond Brochstein, co-chair with Deal Booth of the Rice Art Committee, suggested the pairing. As with Turrell's work, Phifer's 6,000-square-foot student center represents a sophisticated use of light—in this case the abundant sunshine of Texas's coastal plain, which filters through sculptural rooftop skylights and an elegant horizontal trellis made of aluminum tubes, to shade the outdoor perimeter seating.

Turrell located this skyspace on axis with Phifer's pavilion, which stands approximately 1,200 feet away in an adjacent quadrangle. Both free-standing structures share a similarly graceful silhouette and a modest scale, as well as a primarily white palette. But the commonalities end there.

The enigmatic form of *Twilight Epiphany* appears to emerge directly out of the ground as a truncated pyramid, conjuring impressions of mysterious architectural monuments built by earlier skywatching societies. Four grass-covered berms make up the exterior walls, each sloping at a consistent 19 degrees to a height of 12 feet, and terminating at an intermediary level. Eight slender steel columns, set in pairs at each corner, rise above the tops of the berms to support a 72-foot-square canopy, which appears to hover over two levels of open-air seating. At the center of the roof is a 14-foot-square aperture—the focal point of the skyspace. Viewers observe the sky and their surroundings from seating that is aligned on the four sides of the pavilion's two levels. On the lower level, granite benches seat 44 people; on the upper level, cast-concrete benches seat 76 people.

From outside, one might mistake the structure—a hybrid of minimalist architecture and earth work—as being the principal art object, especially when flashes of brilliant light emanate from the object at dawn and dusk. The

computerized displays illuminate the surrounding quadrangle and draw onlookers from across the campus. Yet from both the berm-concealed atrium and the parapet-level viewing area, the entire design scheme becomes clear: In the minutes before sunrise and sunset, 244 synchronized LED fixtures, located in a recessed trough in the parapet handrail wall, throw vivid colors across the white surfaces of the atrium's walls and ceiling, and occupants are transfixed by the mesmerizing light show and its effect on their view of the sky above.

Turrell consulted with long-time colleague Matthew Schreiber, of Baltic Studio in Brooklyn, who oversees the technical details and installation of Turrell's work. And, as with several previous skyspaces, the team asked the German company Feno to develop the LED fixtures. (Turrell's first use of LEDs in a skyspace was with *Tending, (Blue)* at the Nasher Sculpture Center in Dallas, which opened in 2003. The LED fixtures emit four colors (royal blue, true green, super red, and warm white), and they afford Turrell the high level of color control that he desires.

Turrell's addition of an audio component enhances the hypnotic atmospherics of *Twilight Epiphany*. Unique among his many skyspaces, audio was essential to the program for this project, due to its being located just a few feet away from Rice's Shepherd School of Music. Turrell has embedded 12 audio speakers in the atrium's smooth interior walls to broadcast musical works, some of which will be composed by Shepherd School of Music faculty and students, to accompany the light shows. Arup, the acoustic consultant, tuned the project for both live performances and digital playback.

With *Twilight Epiphany*, Turrell has extended the range of his earlier skyspaces. Here, he and his design team have seamlessly brought together myriad elements—light and sound, art and architecture, age-old archetypes and state-of-the-art technology—to evoke humankind's eternal yearning for communion with the cosmos. •

Stephen Sharpe served as executive editor of Texas Architect magazine from 2000 to earlier this year. He lives in Austin, Texas, and writes about architecture.

At night, a vivid wash of colored light, in this instance magenta, uplights the underside of the roof plane at *Twilight Epiphany*, James Turrell's most recently completed skyspace on the Rice University campus in Houston (previous spread). The 244 LED fixtures are tuned to a color sequence that is played at dawn and again at dusk (top). The skyspace incorporates two seating levels; concrete benches line the upper viewing area (far left) and granite benches line the lower level (left, bottom). Visitors make their way to the interior seating space via a simple passageway (left, middle.)

Details

Project: *Twilight Epiphany* skyspace at Rice University, Houston

Client: Rice University, Houston

Artist: James Turrell, Flagstaff, Ariz.

Architect: Thomas Phifer and Partners, New York

Consultant: Baltic Studio, Brooklyn, N.Y.

Project Size: 5,184 square feet

Project Cost: \$6 million

Manufacturer: Feno





DAYDREAMING IN LIGHT

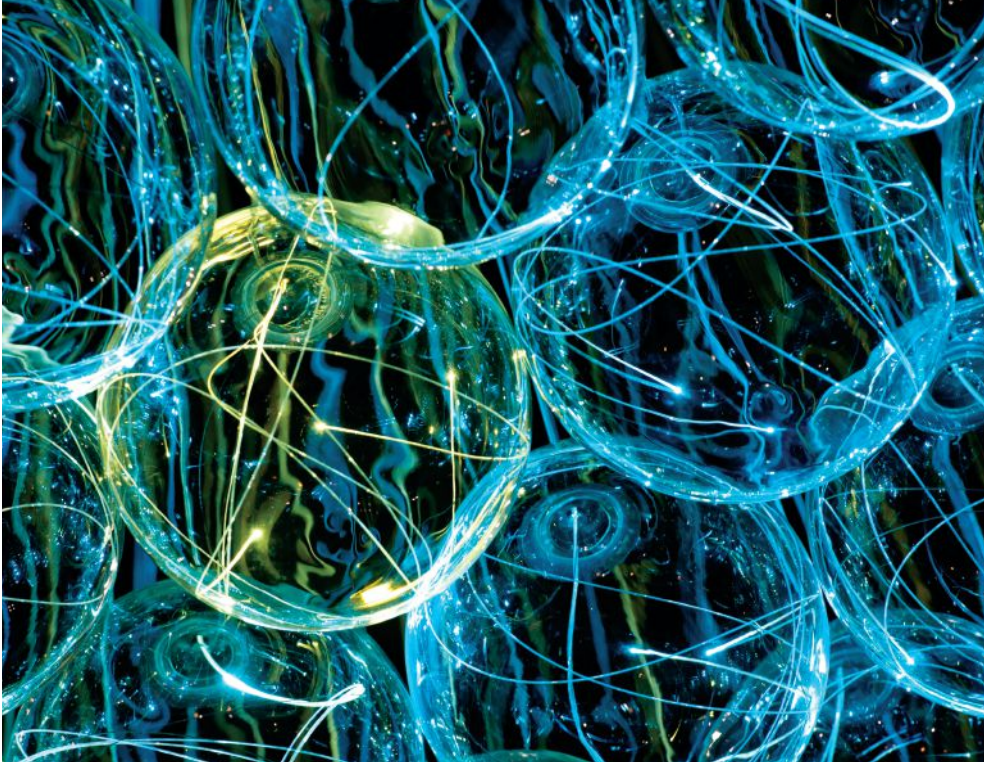
Bruce Munro's magical light installations transform Longwood Gardens into an illuminated landscape that celebrates nature.

text by Elizabeth Donoff

From June through September of this year, Longwood Gardens in Kennett Square, Pa., was transformed into a magical lightscape due to the creative imaginings of artist Bruce Munro, who is known for his inventive explorations of light. At Longwood, which was originally purchased by Pierre S. du Pont in 1906, a full range of Munro's work was on display. Nine installations of various scales and materials including *Field of Light* (this spread), celebrated different areas within the 1,077-acre site that is home to 20 indoor and 20 outdoor gardens, meadows, and woodlands. Munro, long intrigued by the play of light and shadow, first saw how light could be a medium of artistic expression after graduating from art school in the United Kingdom and moving to Australia in the mid-1980s for work. "For me, light is an aesthetic medium to express ideas," Munro says. "I see spaces for what they are and try to apply the appropriate lighting aesthetic to make the space sing." And sing the work does at Longwood. "It's enabled people to see Longwood in a whole new way," garden director Paul Redman says. "The work is about storytelling and uncovering the different layers of the garden." The overall project, *Light Installations by Bruce Munro*, took 14 months to plan and prototype and another two months to install. (Dismantling will take about two weeks and most of the materials will be recycled or reused for future projects.) Each of the installations has its own interaction with the landscape and creates a different viewing experience for the visitor, which is further enhanced depending on the time of day and the weather conditions. Surrounded by the summer heat and a symphony of crickets providing their own sound track, Munro's work is meditative as it transcends the boundaries of time.

To view slide shows of the light installations at Longwood Gardens, go to archlighting.com.





In the Orangery area of the garden's Grand Conservatory, Munro's installation *Snowballs* comprises six chandeliers—grouped in threes—that hang above the lawns to each side of the main conservatory walkway. Each chandelier measures more than 9 feet in diameter and is composed of 127 individually hand-blown glass spheres (left). During the day, the glass reflects and refracts the surrounding natural light. At night, the glass balls, illuminated by fiber-optic strands carefully laced inside, come to life. The chandeliers change color in unison, sweeping through a subtle palette of white, blue, green, magenta, red, orange, and yellow, using six RGB DMX color-changing light sources and a hand-painted color wheel (above, top). For *Arrow Spring* (above), located just past the formal flower gardens to the south of the Peirce-du Pont house, Munro has created a 300-foot-long serpentine trail of four different types of sage plants. Designed to recall the form of a flowing river stream by day, at night it transforms into a shimmering thread of greenery. Munro takes advantage of the sage's silvery-blue quality and highlights it using 16 LED flashlights, staked in the ground, along with bare optic fiber that is weaved and hidden among the plants to create the luminescent glow.

Mark Pickhold (previous spread); Corriette Schoenaerts (left and above); Hank Davis (top right)



Water Towers (above) is located in the area of Longwood known as the Meadow at Hourglass Lake. According to Munro, this piece “marks the transition between Longwood’s formal gardens and its natural landscape.” The light installation is composed of 69 structures, each built out of water-filled 1-liter recyclable plastic bottles stacked on plywood boards for intermediary support. Fiber-optic strands are threaded through all 17,388 bottles and connected to an LED projector with a hand-painted color wheel. During the day, the combination of plastic and water has the appearance of glass, and the towers take on different levels of transparency in the natural light. At night, in the darkness of the summer sky, the towers take on a completely different personality and resemble vertical haystacks of colored light (above). The experience is further enhanced with a sound track of choral music. *Forest of Light* (opposite and right), is composed of 20,000 illuminated glass spheres and rods that weave themselves through the part of the gardens known as Forest Walk, a forest of tulip trees, white oaks, and sugar maples. The strands of bare optic fiber that illuminate the glass spheres total 86.9 miles in length, and they carpet the forest floor as they run up and over rocks, ground cover, foliage, and other plantings. As with all of the installations that are part of this celebration of light, the piece has one persona during the day and another at night. By day, the light rods read like a plant species all their own, popping up randomly from the forest floor. At night, when illuminated by 80 halogen light sources with hand-painted color wheels, the rods and spheres gently pulsate in a rainbow of colors that makes it feel as if the forest has come alive (right). The experience pays tribute to the inherent beauty found in nature and the play of light.

Mark Pickhold (above, opposite page); Hank Davis (right)







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AD INDEX

PAGE	ADVERTISER	CIRCLE NUMBER
15, C3	Acuity Brands	32, 222
44	American Institute of Architects	-
33	Architect Project Gallery	33
20	Barron Lighting	162
18	Cathode Lighting Systems	234
32	DIALux	29
13	DuraGuard	178
16a-b	Ecobuild America	-
3	GE Lighting Solutions	94
22	Gotham	75
2	ILEX Architectural Lighting	195
27	Juno Lighting Group	93
28	Litecontrol	27
11	Lumenpulse	197
C4	Lutron Electronics	37
47	Manning Lighting	98
21	MechoSystems	78
6	Nora Lighting	243
14	NoUVIR Lighting	71
5	Peerless Lighting	34
C2-1	RAB Lighting	219
26	SELUX	53
47	Signcomplex	163
19	SPI Lighting	50
9	Sylvania	237
13	TE Connectivity	199
25	USGBC Greenbuild	211
4	Vision Quest Lighting	201
32	WattStopper	57
7	Winona Solutions + Light	64

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Mariana Figueiro

interview by Elizabeth Donoff

photo by Sioux Nesi

"I always try to bridge the science to the application. I see research as design—and as an art, the same way lighting design is design and an art. The key is to be able to match these two areas and make them work together. If you do research without thinking about the application, it's probably going to be shelved in a manuscript somewhere that nobody will read."

Had it not been for a design research seminar while a graduate student at the Lighting Research Center (LRC), part of Rensselaer Polytechnic Institute in Troy, N.Y., Mariana Figueiro might never have pursued a career in lighting education and research. The class, taught by Mark Rea, has since served as the foundation for her work in the field of light and health. Figueiro began researching light's effect on performance and alertness—what has become her area of expertise—while enrolled in the seminar. Rea was looking for someone to spend the summer at a South Bend, Ind., hospital doing field work, and approached Figueiro. There, she collected data from rotating shift nurses exposed to bright lights while working in the neonatal intensive care unit. Studying the non-visual effects of light, Figueiro knew there was real science behind light's effect on human biology—and discoveries to be made.

What fascinates you about light?

It touches all aspects of our lives, yet it's taken for granted by most everybody.

What text has influenced your work?

The Art of Scientific Investigation by William I.B. Beveridge. He talks about the mind of a researcher and the art of conducting research.

How has the practice of lighting research evolved since you started teaching in 1996?

LEDs have changed the way we think about light, especially in terms of metrics, such as color rendering and lamp life. Additionally, researchers have always tried to link productivity to lighting by looking at how light affects visibility. Now there is a move away from that to include other benefits of lighting, such as well-being.

Light and health issues seem to have caught the attention of the design community. How do you tailor the conversation to a lighting audience versus a scientific audience?

It's about making the bridge between science and application, so people understand the issues as more than just sound bites.

How do you encourage students to pursue teaching and research rather than work for a design firm or a manufacturer?

Starting the LRC's Ph.D. program has helped because it is easier to obtain an academic position if one has a Ph.D. But that still doesn't mean it's easy. Finding a teaching position is difficult, and even more so if it's tenure track.

What advice do you give to your students?

No matter what you do—design or research—do it with two things: passion and excellence.

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National September 11 Memorial and Museum, New York

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Category: Exterior Lighting

Architect: Michael Arad, New York

Landscape Architect: PWP Landscape Architecture,
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Lighting Designer: Fisher Marantz Stone, New York



The United States Institute of Peace, Washington, DC

OUTSTANDING ACHIEVEMENT

Category: Whole Building

Architect: Safdie Architects, Somerville, MA

Lighting Designer: Lam Partners, Cambridge, MA



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