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FIRST UP

IN THIS ISSUE

IN EVERY ISSUE

Photo: Andrew Latreille

FEATURES

On The Cover
The debut of Chicago Transit Authority's first all-LED train station (p. 16).
Photo: Bob Elmore & Assoc. Photography

EDITOR'S NOTE

Things Come in Threes

Three recent episodes over the past month speak to the power of lighting to spark inspiration, controversy and inquisitiveness. First, here in New York, several local news outlets reported on the innovative use of illuminated lines on the surface of new indoor tennis courts. The LED lines are meant to help the visually impaired better enjoy the game (see *LD+A*, January for more). It's a true, feel-good lighting story.

Three thousand miles away, an art installation titled "Spinning Chandelier" hangs under a bridge in Vancouver, British Columbia. The reviews have been mixed, reports CNN: "Some think the display is mesmerizing. Others think the garish display is grotesque and out of place in a city facing a housing crisis." My vote—the chandelier is too jarring in that application. I wouldn't want to see a Jackson Pollock painting splayed across a pedestrian bridge over the Cross Bronx Expressway. Just one man's opinion. Google it and see what you think.

> "The reply was a puzzled look. The idea of using lighting to enhance occupant satisfaction hadn't occurred to her

Last, and a little closer to home, I recently spent the better part of a morning renewing my driver's license at a New York State DMV office. A two-and-a-half hour visit meant ample time to look around. . . and up, at the low ceiling and uninspired troffer lighting. Not a hint of daylight to be found. When I reached the counter, I got to chatting with the customer service agent and offered my sympathy that she had to spend the entire day with no connection to natural light. The reply was a puzzled look. The idea of using lighting to enhance occupant satisfaction hadn't occurred to her, but she and a colleague mentioned that another DMV office nearby might, in fact, have windows. They seemed intrigued. Time to request a transfer?

Three instances of people celebrating, debating and questioning lighting. We need more of this.

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LD+A
LIGHTING DESIGN and APPLICATION

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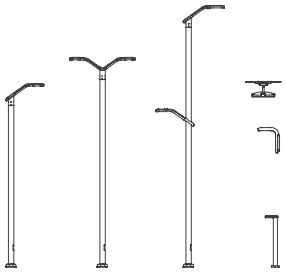

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INSIGHTS

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Photo: Courtesy of Forum Groningen

LEDs maintain the linear design concept, which originally called for fluorescent fixtures.

In Tune With The Times

One thousand LEDs unite various facilities into one experience

The original design for the Netherlands' newly opened Forum Groningen—described by NL architects as a "cultural department store" for the city of Groningen—called for 1,500 fluorescent luminaires...but that was in 2007.

By 2015, when the design team was finally ready to specify lighting for the interior of the 45-meter (148-ft) tall structure, the initial concept had become outdated. LEDs were better suited for the space, which is meant to unite various cultural facilities—including the city's library, two exhibit spaces, five cinemas, restaurants and retail—into one cohesive, living room-like atmosphere for the community.

To that end, more than 1,000 tunable-white luminaires (TDE-lighttech) were specified across the interior of the 10-story mixed-use complex. The LED upgrade maintains the linear nature of the original fluorescent design while improving sustainability. The fixtures also produce effects that wouldn't have been possible using fluorescent luminaires, with an eldoLED control system enabling the system to be dimmed to 0.1% and providing continuous dynamic adjustment of the light from 2500K to 4000K throughout the day.

DLC Launches Online Tool for Networked Lighting Controls

The DesignLights Consortium (DLC) has launched a searchable online Qualified Products List (QPL) for networked lighting controls (NLC), adding to its existing online QPLs for solid-state lighting and horticultural lighting fixtures.

The new tool comes on the heels of research published by the DLC illustrating the potential of NLCs. A 2017 study showed that NLCs can boost the energy efficiency of stand-alone LED commercial lighting projects by up to 47%. A subsequent 2019 study found that utility energy-efficiency programs that capitalize on system-level lighting efficiency measures—combining lighting technology upgrades with NLCs—could see an additional 22% lifetime energy savings on average.

The online NLC QPL includes filters tailored to identify product features such as manufacturer, ease of installation, wired or wireless communication, energy monitoring and advanced capabilities. Through a customized column menu, users can also search for options appropriate for specific projects, such as color tuning and cybersecurity features.

1 MILLON

Solar lamps delivered through the social initiative Little Sun, established in 2012 to bring clean, affordable solar energy to the world's 1.1 billion people living without electricity

MERGERS AND MORE

- **Luminii**, a manufacturer of specification-grade architectural LED lighting systems, has acquired Calgary-based lighting manufacturer **Senso Lighting**.
- **Pfingsten Partners, L.L.C**. has acquired **Environmental Lights**.
- **Selux AG**, a Berlin-based provider of sustainable, smart lighting solutions, has been acquired by an equity fund represented by **Capital Management Partners**.
- **Myers Emergency Power Systems**, a designer and manufacturer of back-up power solutions, has acquired **Low Voltage Systems, LLC**, a manufacturer of emergency lighting control solutions.
- **Acuity Brands, Inc.** has entered into a strategic partnership with **CIRCADIAN ZircLight, Inc**., an international leader in evidence-based circadian lighting.
- **Telensa** and **LIGMAN** have entered a partnership to provide smart street lighting and smart city sensing technology to the Asia Pacific market.

Photo: Courtesy of Speirs + Major

Mark Major Recognized as Master by Royal Society of Arts

Pioneering lighting designer and Speirs + Major Principal Mark Major (pictured) was named Master of the Faculty of Royal Designers for Industry (RDI) at a ceremony at the Royal Society of Arts (RSA) in November, assuming the role through 2021.

Major was awarded the prestigious RDI distinction—regarded as the highest design honor in the U.K.—in 2012, and commented on his new appointment as an opportunity to promote the lighting design profession as a whole: "I am hugely honored to have been elected to the role of Master, not least because it allows me to act as an ambassador for what can still be considered a nascent design profession—architectural lighting," Major said. "In this sense, my appointment recognizes the widening and evolving scope of design professions that have both aesthetic value and are of benefit to society. Lighting impacts everyone, and it has always been a major focus of my work to improve the quality of light for people within the urban environment."

Crème de la Cover

LD+A considered three different cover ideas for January's dual-themed issue which included our "2020 Emerging Markets Report" and a look at "Lighting History—Museums, Exhibits & Monuments." Then, we asked readers to comment on our cover contenders.

Covers 1 and 2, showcasing historical projects, received the most votes. However, *LD+A* took the road less traveled in January, diverting from an installation shot to kick off the New Year with Cover 3, which highlights our special report on key industry sectors.

One reader had a clever explanation for his choice. **Xavier Varghese** selected Number 1, "as it shows an historic monument. In this picture, there is a stair which takes you up to the door to see a wider view of open sky and world around from a top view, clearly expressing the market outlook for 2020...so both themes are embedded in this cover."

EVENTS

1. March 3-5:
NALMCO's 2020 Spring Seminar will be held at the Georgian Terrace Hotel in Atlanta. The interactive, two-day training seminar will focus on technology and hands-on learning. Topics include lighting trends, safety, maintenance, tools and energy efficiency.
www.nalmco.org

2. April 18-25:
The 65th Annual Maritime Regional IES Conference will take place at the Luxury Bahia Principe Ambar Resort in Punta Cana, Dominican Republic. The conference will include events, speakers and presentations for continuing professional education.
www.maritime.ies.org

3. April 19-22:
NAILD Innovation 2020 will be held at the Scarlet Pearl in Biloxi, MS. Hosted by the "Get a Grip on Lighting" podcast, the convention brings together distributors and manufacturers, offering opportunities for one-on-one engagement, networking, speakers, roundtable discussions and board panels.
www.naild.org

4. April 27-29:
The 2020 IES Research Symposium, "Light + Quality: Meaningful Metrics Beyond Energy," will take place at the Hilton Orlando Lake Buena Vista in Orlando. The symposium will consolidate the current evidence on how lighting quality issues affect measurable human responses and define future research priorities.
www.ies.org

5. May 3-7:
LightFair 2020 will be held at the Las Vegas Convention Center. The event is the world's largest annual architectural and commercial lighting trade show and conference. This year it will feature over 500 exhibitors, hundreds of industry-related courses and networking opportunities with industry leaders.
www.lightfair.com

6. August 6-9:
The IES Annual Conference will take place at the Hilton New Orleans Riverside hotel in New Orleans. The event will offer a range of educational programming on the art, design, science and research of lighting. A broad selection of CEU credits will be available.
www.ies.org/events/annual-conference

HOW THEY DID IT

Inspired by a whiteout snowstorm, ***Paramedia LLC*** *combined hundreds of illuminated spheres into one art installation in New York City's Madison Square Park to earn an* **IES Illumination Award of Merit**.

Whiteout by Erwin Redl

1. White LEDs within 900 transparent spheres are programmed to display dynamic, large-scale light patterns.

2. Like a pendulum, each suspended orb sways based on wind conditions, creating an additional layer of movement.

3. Changing parameters—such as the amount of daylight, surrounding urban illumination, seasonal foliage and weather—demonstrate how complex designs can arise out of multiple simple interactions.

Photos: Moorehart Photography

ENERGY

Willard Warren

Bring It Home Another opportunity to shave load

Distributed Energy Resources (DERs) and microgrids are being installed on-site in commercial and institutional (C&I) buildings and on campuses all over the country to generate electricity (some from renewable sources) and to store battery power, both of which are needed to sustain them for the duration of a grid outage.

The typical lighting load of a new or recently upgraded C&I building accounts for about 10% or less of its total connected electrical load, compared to the majority of older, not-yet-upgraded C&I buildings, where lighting consumes about 20% or more of the total electrical load.

Every facility must identify the "critical load" needed to survive a grid outage, which includes most of the lighting, so the more energy a building or campus conserves, the less generated and battery storage power (kWh) the DER needs to sustain it, and the better the ROI. The objective is to make upgrades that reduce the total electrical load as much as possible and use more renewable sources for generating power, thereby increasing the resilience of all our buildings in the event of a grid outage.

Surprisingly, the residential sector in the U.S. consumes as much electrical load as the C&I sector does, with lighting accounting for about 12% of the total load. However, the residential sector has yet to be regulated by the Department of Energy and energy codes, presenting a great opportunity to shave load in these properties. To survive during a power outage, many single-family homeowners install emergency generators on a cord and plug, but they'd be much safer by forming or joining a community DER.

In some areas, the focus has already shifted toward residences. California, for example, is mandating that solar panels be installed on all newly constructed homes to increase the generation of clean power. At the same time, the electric vehicle (EV) and aircraft industries—at home and abroad—are working on developing a new electric motor that is smaller, lighter and more efficient than our existing ones to drive the wheels of electric vehicles, fly airplanes and upgrade home appliances. Similarly, a new Belgian startup company called Magnax has developed an "axial-flux" electric motor (or generator), with five times the torque of the electric motor that now drives the wheels of the new BMW EV.

Not only can we conserve energy in residences, but we can also make them safer. Author Jane Brody, in her "Personal Health" column for the *New York Times*, recently reminded us that the most frequent cause of death and injury of seniors is the result of falls in their own homes. More than 25% of seniors fall each year due to poor vision, sleeping in totally dark bedrooms, physical loss of balance, orthopedic problems and medications that make them woozy.

> "The residential sector consumes as much electrical load as the commercial and institutional sector

With LEDs that can be easily dimmed, we can adapt all existing switched luminaires in residences to double as nightlights, rather than leaving them full-on both night and day. In apartment houses, hotels, motels, dorms and assisted-living residences, the lighting of corridors and stairways can be upgraded with occupancy sensors and bi-level dimming to provide a lower light level when no occupant is present and conserve energy.

This issue also reaches offices, as many aging employees don't upgrade their corrective lenses. For better perception and the reduction of visual errors, we need lighting that's suitable for the size of the space, contrast with an illumination level recommended for the tasks at hand, and sufficient ambient light for occupants to move about safely. The Europeans are doing this as well—and we should follow their example.

Willard L. Warren, PE, LC, Fellow IES, DSA, is principal of Willard L. Warren Associates.

CONTROLS

Gary Meshberg

Demystifying Tunable White Product knowledge and design intent are key

The color appearance of light sources can have a big impact on spaces and is therefore an important design decision. With traditional lighting, color was relatively fixed after installation, but in the LED era, we gained the capability of dynamically producing virtually any color, including any shade of white light. The key to this capability lies in the interaction between LEDs and dimming controls, which together we call tunable-white lighting. This technology has provided new value and markets for manufacturers and new applications and tools for designers and users, from circadian lighting strategies to using color in schools to signal activity changes and mood along with adjusting intensity for A/V-based learning.

While some consider it complex, it needn't be. "Demystifying Tunable-White Lighting" is the topic of a talk I'll be giving with Steve Mesh at LightFair 2020, with key highlights covered here.

First, some background. The visible light spectrum is made up of wavelengths associated with colors, with the primaries being red, blue and green. Combined, these wavelengths form white light and the basis of color perception. This is often modeled using the 1931 CIE Color Space, which plots color on an X-Y graph as a ratio of the three primaries. Color perception of white light is commonly measured using correlated color temperature (CCT), which describes the hue of a light source and its emission compared to an idealized blackbody radiator. Visually warm (<3000K), neutral (3500K-4000K) and cool (>4000K) white light is plotted on the Color Space as the blackbody locus, a curved line defining the convergence of red, blue and green. Light appears natural if its coordinates fall along the locus, with deviation tolerances recommended for general lighting based on ANSI C78.377. Too far above or below the locus, the light takes on a greenish or pinkish tint.

Again, with traditional lighting, color choices were relatively fixed after installation without changing the lamps or adding a color filter. With LED, we have three main choices of color-tunable products: full-color-tunable, dim-to-warm and tunable-white. Full-color-tunable products provide myriad saturated colors ideal for architainment and similar applications. They can also produce white light, though adoption has been limited for general lighting. Dim-to-warm products automatically reduce CCT during dimming to imitate an incandescent lamp, providing a simple option where incandescent dimming is valued.

> Like any other new technology, tunable-white lighting requires some adjustment, but it need not be complex

For general lighting, we will primarily be concerned with tunable-white products, mainly luminaires. This is typically achieved by combining separately controllable arrays of warm- and cool-white phosphor-coated LEDs. Relative dimming of these two primaries produces a range of CCT values while also allowing intensity adjustment. Other primaries can be added to enhance spectrum and ensure color fidelity.

The simplest approach is to use a warm-cool gamut, where the relative dimming of warm- and cool-white LEDs produces a linear path between two points on the CIE Color Space graph, producing a range of CCTs from 2700K or 3000K to 6500K. A more sophisticated approach uses a triangular/area gamut, where the warm and cool primaries are supplemented via one or more additional colors controlled via response algorithms. The result is a triangular area in which the LED product can be tuned.

Tunable-white lighting is typically deployed using an LED driver that communicates via a manufacturer-specific or standard wired or wireless protocol, with most products controlled using 0-10-V, digital protocol, or a wireless method. Typically, the user interface communicates separate instructions for the intensity of each LED color to the driver either directly or through an inter-

mediary device. For example, this might involve a dimming control operating with a dimmable LED driver featuring two 0-10-V or digital (DALI or proprietary) control channels. One control input is dedicated to intensity and the other for CCT control. The driver must be capable of dynamically mixing the output from two or more primaries. In this approach, the set CCT remains constant when intensity is adjusted.

A variety of systems and interfaces are available. LED color control is a relatively recent phenomenon in lighting controls, which evolved from a focus on saving energy with ON/OFF/Dim, though more sophisticated color control capabilities are in the offing. A basic approach was to repurpose a dimming channel for CCT control. Specifying tunable-white with 0-10-V can be as simple as specifying two zones of 0-10-V control with a 10-V driver and 0-10-V wallbox dimmers. More sophisticated and precise control is available with DMX and digital. As always, the right choice depends on the application, with 0-10-V and digital working well for common applications and DMX being well suited for custom and other atypical applications requiring more flexibility.

During the design phase, the designer should ask the right questions: Who are the intended users of the tunable-white lighting? How sophisticated does the solution need to be or can it be? Where will the controller reside? How smooth do the intensity and CCT changes need to be, how quickly must the luminaire respond to the control signal, and how precise does the dimming need to be? What dimming range is needed, and does the product dim to OFF? Will the driver-dimmer pairing produce objectionable flicker? Are all system devices compatible with the application and each other? What dimmer and driver dimming curves (linear, square law) and curve pairing will work best for the application? What hardware is needed? Does the system need to be integrated with other control systems?

Like any other new technology, tunable-white lighting requires some adjustment, but it need not be complex. Gaining familiarity with the technology and available products is a natural first step to using it as a tool. After that, by answering basic questions about the application, the designer will understand what it needs and the type of system and interface that will best serve it.

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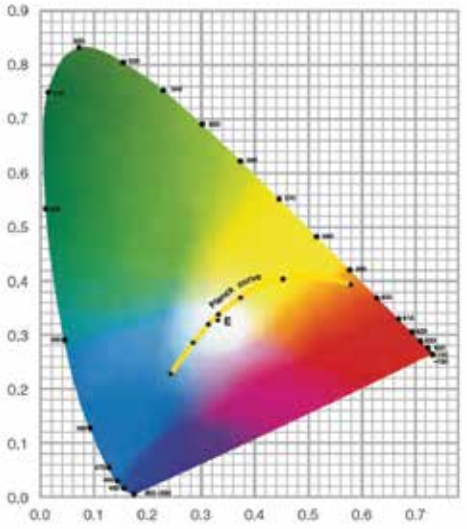
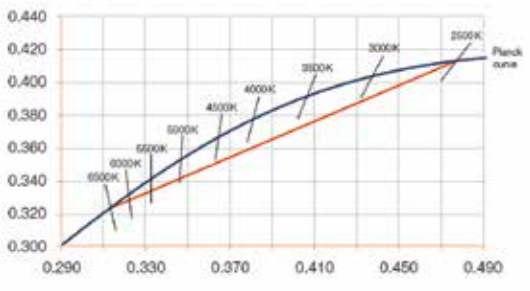


Color Space

The Color Space Chart shows all visible colors that can be perceived by the human eye. Color temperature corresponds to the light emission of a solid body at a certain temperature. The color locations that lie on the Planck Curve, or are less than 10 threshold units away, are considered to be "white light."



Color Mixing in Color Space

SSL

Naomi J. Miller and Anne (Lia) Irvin

M/P Ratios—A Call for Consistency Times change and so must calculations

Although they've become ubiquitous lighting metrics, the candela and the lumen are based on only one form of human spectral sensitivity, which is characterized using the weighting function known as V(λ) (called "V-lambda"). But V(λ) was derived under a very narrow set of experimental conditions way back in 1924, and today there are many alternative sensitivity curves or action spectra that can be applied to a lamp or luminaire's spectral power distribution (SPD) to yield more-relevant measures of color sensitivity, off-axis visibility at night, potential circadian stimulus, potential blue-light hazard, scene brightness or even potential for damage to artwork. Soon, practitioners may need to learn to evaluate SPDs using various weighting functions or action spectra that are most pertinent to the application, and to evaluate a lighting system's energy effectiveness using a different kind of radiant watts per electrical watt used.

In this column, we'll address the weighting functions that are applied to an SPD for calculating lumens and then discuss how that same concept is applied to calculate both melanopic (M) and photopic (P) content from the light source. Those of you who want more background, context and detail can find them in our IES FIRES article "M/P ratios – Can we agree on how to calculate them?" which also has tables listing the M/P ratios for a wide variety of familiar light sources.

You may have heard mention of M/P ratios to evaluate the appropriateness of a light spectrum for either alertness, relaxation or sleep. According to some research, the more energy in the spectrum (measured in radiant watts) emitted in the spectral range to which the intrinsically photosensitive retinal ganglion cells (ipRGCs; nonvisual photoreceptors that play a role in circadian response) are most sensitive, the more the light source's alertness potential. The M/P ratio simply compares that melanopic (ipRGC) potential to the light source's ability to produce light for daytime detail vision (photopic vision).

However, there's one catch: There are four different ways to calculate these M/P ratios! Those ways depend on how the weighting functions are determined. (Note that the authors use the term "radiant watts" to denote the resulting effective radiant energy of an SPD when it is multiplied by a melanopic or photopic weighting function.)

> "There's one catch: There are four different ways to calculate these M/P ratios

Method 1

This is based on normalizing the melanopic and photopic response functions so that they coincide at 555 nm (**Figure 1, first plot**). The maximum values of the curves are called "K-factors" and are based on the lumen being defined at 683 lumens per optical watt.

- Take the measured SPD values for a light source received from a manufacturer's laboratory test, or measure the light incident on an observer's eye using a spectrometer.
- Multiply the value of the SPD at each wavelength by the value at the same wavelength of the *melanopic efficacy* function (with its maximum at 4,215 lm/W). Sum the values.
- Multiply the value of the SPD at each wavelength by the value at the same wavelength of the *photopic efficacy* function (with its maximum at 683 lm/W). Sum the values; this is the number of lumens delivered by that SPD.
- Divide the summed melanopic radiant watts by the summed lumens. This gives you the *M/P* 1 ratio, which is comparable to the S/P ratio used in the past.

Method 2

The K-values from Method 1 can be very confusing, because the resulting values of melanopic lumens and photopic lumens are not in the same range. So an alternative approach is described by Sam Berman and Robert Clear in a recent IES FIRES article.

Normalize all sensitivity functions for all photoreceptors and the photopic sensitivity curve, to a maximum of 1, as shown in the **second plot of Figure 1.** Then convert the M/P to a value with units of melanopic milliwatts per lumen, as follows:

- Take the measured SPD values as described in Method 1.
- Multiply the value of the SPD at each wavelength by the value at the same wavelength of the *melanopic efficiency* function, normalized so that its maximum value is 1; this occurs at 490 nm. Sum the values to a total melanopic radiant watts. Multiply the result by 1,000, which allows reporting the value in mW.
- Multiply the value of the SPD at each wavelength by the value at the same wavelength of the *photopic efficiency* function, normalized so that its maximum value is 1; this occurs at 555 nm. Sum the values to a total of photopic radiant watts. Then multiply by the Km value of 683 lm/W to get the number of lumens delivered by the SPD.
- Divide the summed melanopic radiant watts by the summed lumens. This gives you the *M/P 2* ratio.

Method 3

This method is used by the WELL v2-2019 Standard and is similar to Method 2, except that instead of normalizing the sensitivity functions to a maximum of 1, the different functions are normalized to a total area under

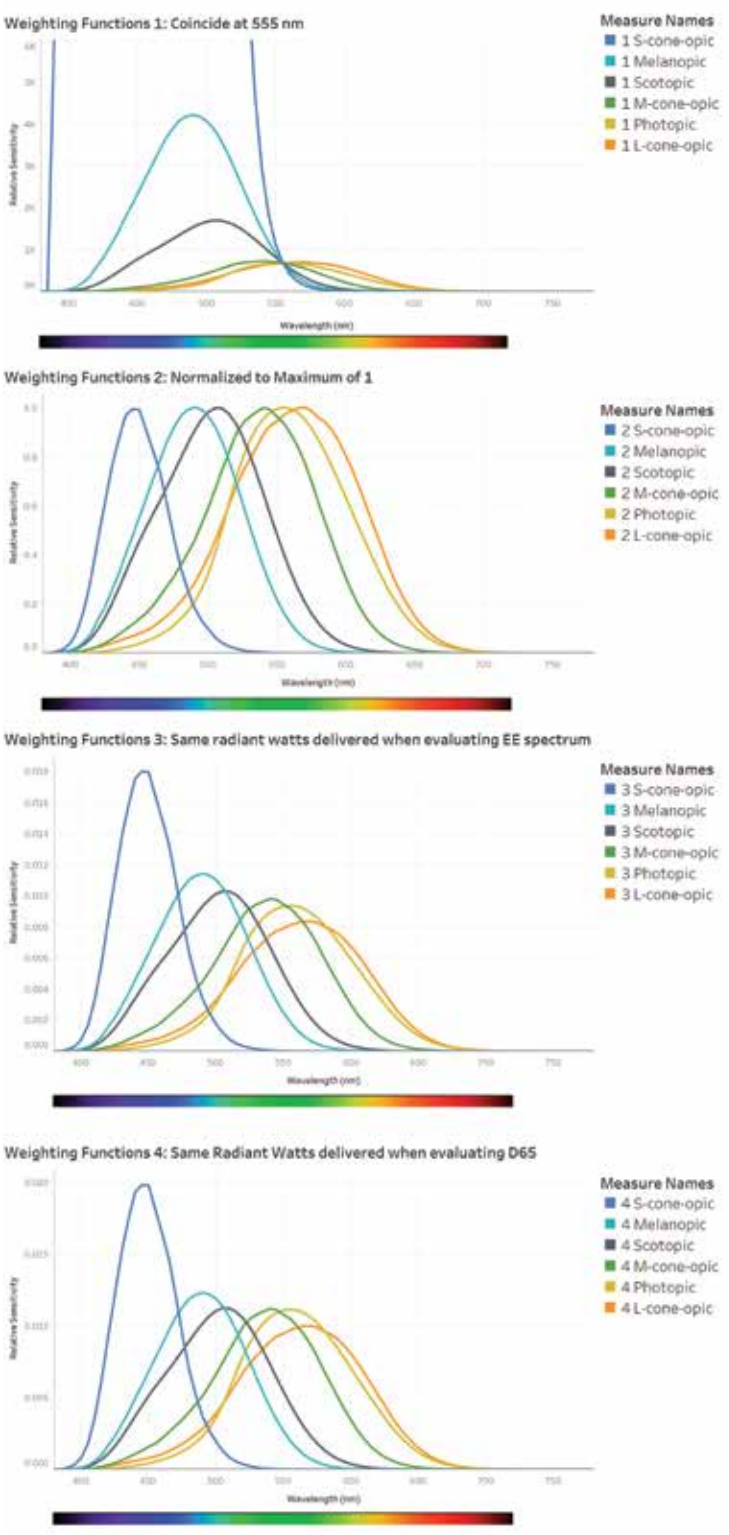


Figure 1. Spectral weighting functions for the four methods, each with different normalizations for the photoreceptor responses and the photopic function. Method 1 is at the top, Method 4 at the bottom.

each curve of 1 radiant watt when evaluating an equal-energy (that is, flat) spectrum (**third plot of Figure 1**). Because some of these sensitivity functions are broader than others, the maximum values don't all align, but the areas under each curve are the same. The steps are then:

- Take the measured SPD values as described in Method 1.
- Multiply the value of the SPD at each wavelength by the value at the same wavelength of the melanopic weighting function normalized so that its area under the curve equals 1 when evaluating the equal-energy spectrum. Sum the values to get melanopic radiant watts.
- Multiply the value of the SPD at each wavelength by the value at the same wavelength of the photopic weighting function normalized so that its area under the curve when evaluating an equal-energy spectrum is 1. Sum the values to get photopic radiant watts.
- Divide the summed melanopic radiant watts by the summed photopic radiant watts. This gives you the M/P 3 ratio.

Method 4

This method was recently recommended by the CIE and is covered in the CIE S026-2018 *System for Metrology of Optical Radiation for ipRGC-Influenced Responses to Light*. It is similar to Method 3, except that instead of using an equal-energy spectrum for calculating area under each sensitivity curve, it uses the standardized CIE daylight spectrum called D65 (**bottom plot of Figure 1**). The steps are then:

	To convert from /to			
	M/P 1 to 1	M/P 1 to 2	M/P 1 to 3	M/P 1 to 4
Multiply M/P 1 by	1.00	0.24	0.20	0.18
	M/P 2 to 1	*M/P 2 to 2*	*M/P 2 to 3*	*M/P 2 to 4*
Multiply M/P 2 by	4.25	1.00	0.84	0.76
	M/P 3 to 1	*M/P 3 to 2*	*M/P 3 to 3*	*M/P 3 to 4*
Multiply M/P 3 by	5.06	1.19	1.00	0.91
	M/P 4 to 1	*M/P 4 to 2*	*M/P4 to 3*	*M/P 4 to 4*
Multiply M/P 4 by	5.55	1.31	1.10	1.00

Table 1. Multiplying factors for converting from M/P methods 1-4 to all other method numbers.

- Take the measured SPD values as described in Method 1.
- Multiply the value of the SPD at each wavelength by the value at the same wavelength of the melanopic weighting function normalized so that its area under the curve equals 1 when evaluating the CIE D65 SPD. Sum the values to get melanopic radiant watts.
- Multiply the value of the SPD at each wavelength by the value at the same wavelength of the photopic weighting function normalized so that its area under the curve equals 1 when evaluating the CIE D65 SPD. Sum the values to get photopic radiant watts.
- Divide the summed melanopic radiant watts by the summed photopic radiant watts. This gives you the M/P 4 ratio, also called "melanopic Daylight Equivalent Ratio," or "m-DER," by the CIE.

The calculated M/P values from each method are quite different, and we don't blame you if your head is spinning at this point. It's not possible to determine what a desirable or undesirable light source is, based on M/P value, unless you know which calculation method was used. But there's good news. As you can see by the M/P conversion columns in **Table 1**, there's a constant ratio between any two of the four methods, which means that you can easily translate from one method to another.

We suspect that few practitioners will opt for M/P 1, because the numbers for melanopic "lumens" are not comparable to photopic "lumens," plus the units are not SI-compatible. The values of Method 2 yield the highest M/P values, Method 3 the second-highest values and Method 4 the lowest values. If a designer is given a target of M/P ratios of >0.9 for daytime and <0.35 for nighttime, for example, it will be important that that advice is given with a specific calculation method cited. Alternatively, to reduce confusion, it would make sense to get the light and health community together to settle on a single approach.

Naomi J. Miller, Fellow IES, Fellow IALD, is a designer/scientist at the Pacific Northwest National Laboratory. Anne (Lia) Irvin is a post-Bachelor's research associate at PNNL.

MODEL TRAIN

LEDs are the only stop for a transit station in Chicago that could be an archetype for the future

Photo: Bob Elmore & Assoc. Photography

By Paul Tarricone

Photo: Michael Muraz

Left: The rib-tip luminaires extend over active track, while luminaires integrated within the "spine" of the station light the platform.

Right: LED linear fixtures were integrated into the handrails to provide even stairwell illumination.

A new train station has ushered in a new light source in Chicago. The $75-million elevated Washington/Wabash station opened in 2017, as two century-old stations were consolidated into one. The new station—which saw an estimated 3.2 million passengers in 2018—is also the Chicago Transit Authority's first all-LED station and should serve as a model for the city going forward. "This is a new gold standard for what a new 'L' station should look like," said then-Mayor Rahm Emanuel.

Local firm EXP designed the station lighting. Their scope of service included lighting of the platform, stairs and handrails, mezzanine and accent lighting. While the LEDs broke new ground for the CTA, it's the architecture that's front and center. "The overall approach was simply to express the station architecture as purely as possible without drawing undue attention to the lighting design itself," says Aram Ebben, EXP principal and director of lighting design. Indeed, the gleaming, modern architecture—from the illuminated handrails to a wave-like glass canopy over the 450-ft-long platform—is juxtaposed against the historic Jewelers Row neighborhood.

Photo: Tim Klein

Photo: Bob Elmore & Assoc. Photography

The modern architecture and wave-like canopy over the platform are set against an historic backdrop.

At A Glance

- The project earned a 2019 IES Illumination Award of Merit, a 2019 IALD International Lighting Design Award of Merit and a 2018 Award of Excellence from the American Institute of Architects, Chicago Chapter.
- The installation is all-LED.
- Footcandle levels range from 2 to 35.

To further enhance the architectural expression, the luminaires throughout the station were fully integrated into the physical structure wherever possible, as "to not detract from the clean lines of the structure. This approach required substantial coordination between the CTA, Chicago DOT, lighting designer, architects, structural engineers, electrical engineers, contractors and luminaire manufacturers to ensure that all services and devices would fit within the allotted spaces."

The central spine of the platform structure is home to drains, data and power conduits, as well as the luminaires themselves, which were recessed to provide even illumination of the custom lenses. The rib-tip luminaires also presented a unique challenge in coordination as they are suspended over active train tracks located on an elevated steel platform. "Like any truly collaborative process, the lighting design evolved through several iterations before developing into the final realization," says Ebben.

Going all in on LEDs essentially came down to the right technology at the right time. "Timing played a key role in being able to exclusively use LED as the light source," Ebben adds. "The technology had matured to a point that it would be able to meet CTA and CDOT's requirements. Certainly, LED fixtures have been slowly incorporated into other CTA station lighting renovations, but this was the first new all-LED station on the LOOP."

CTA has detailed illuminance requirements for each space that range from 2 footcandles (average) for parking lots, to 20 fc for platforms and stairs to 35 fc in kiosk and customer service areas. The previous CTA master specification and design criteria were based on fluorescent sources. However, since completion of the Washington/Wabash station, CTA has revised their criteria to require 100% LED lighting.

Finally, the control system is fairly simple, Ebben says, as most of the station lighting is required to be on 24/7. Non-regularly occupied spaces are controlled via vacancy sensors. Even though CTA stations are exempt from having to adhere to energy codes, this station maintained close to 1 watt per sq ft. ◎

THE DESIGNER | Aram Ebben, IALD, CLD, LEED AP, Member IES, is principal and director of lighting design for EXP.

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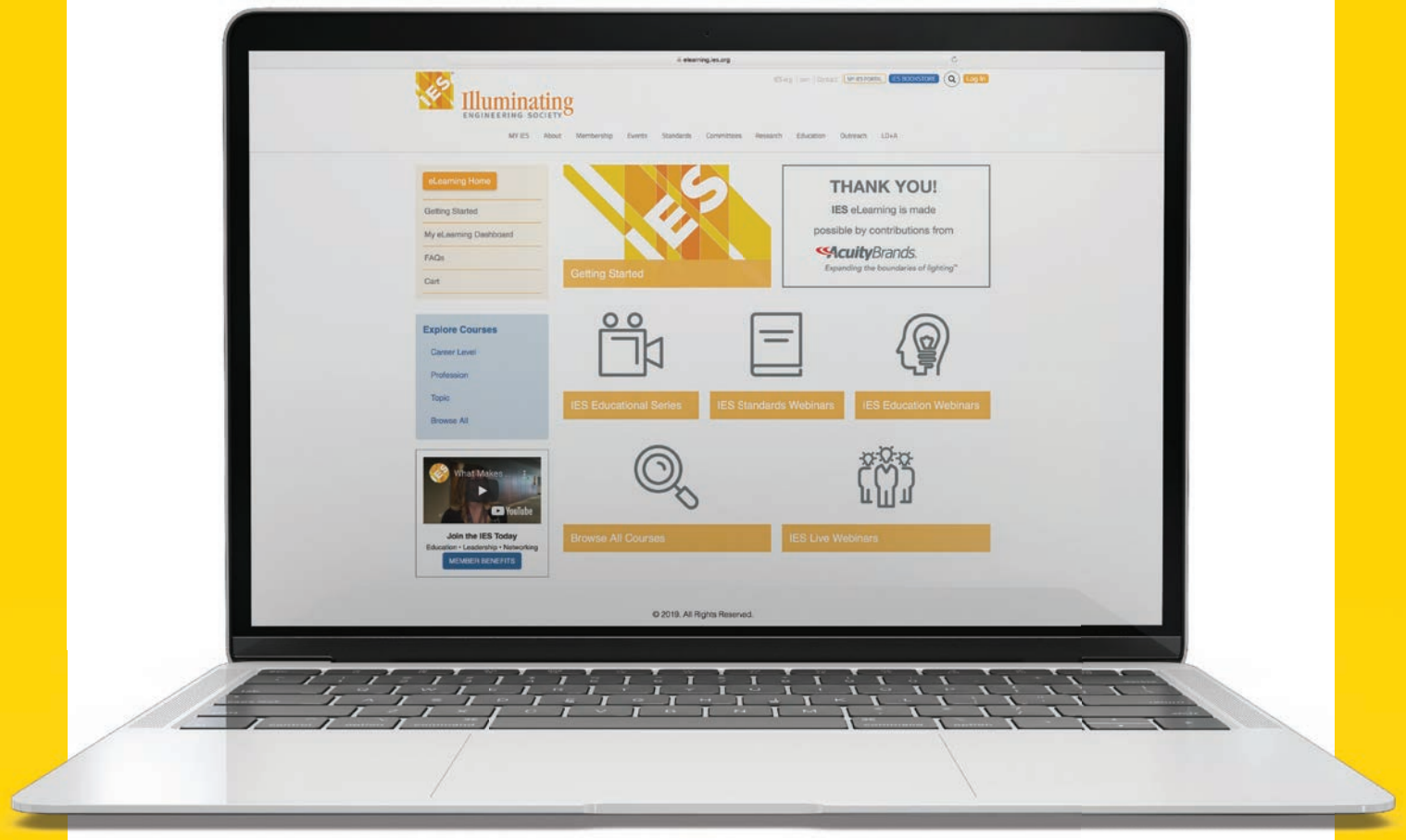

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Photos: Andrew Latreille

ONE BRUSH STROKE

A single luminaire solution helps a bus shelter welcome visitors to Whistler, British Columbia

By Naomi Fisher

The countdown is on. Having planned your getaway months ago, tonight you begin the task of packing your outdoor life essentials into a checked bag and one filled-to-the-brim carry-on. Destination known—Whistler, British Columbia. It's merely hours now before you're transported to a world-class, year-round mountain oasis.

The plane touches down. The sun grazes the horizon as you transfer from aircraft to highway coach and onto the next leg of your journey. Winding along the road where the Pacific Ocean meets colossal coastal mountains, the bus climbs north through the heart of the Sea to Sky Corridor. The sunlight's magic hour fills your eyes and nighttime falls; the hum of the engine allows your wearied eyes to rest and you dream of the outdoor playground that awaits. Before long, you feel the bus shift as it turns off the highway. A voice comes over

Linear LED luminaires integrated into the glulam triangular cells showcase the wood grain while pushing light downward.

the loudspeaker, "*Welcome to beautiful Whistler, British Columbia*." Your eyes open as the bus pulls into the Whistler Gateway Loop. You've arrived.

You step off the bus and breathe in the crisp mountain air. There is a chill of excitement, yet you feel warm under a glow of honeycomb light. A timber shelter covers you as you take in the village and unobstructed mountain view; it's just what you imagined.

This is the Whistler Gateway Loop: an estimated $6.8-million redevelopment project completed in the fall of 2018. For many, this is the first point of entry into the internationally renowned mountain town and a main transportation hub to thousands of daily visitors.

The city of Whistler awarded Public Architecture + Communication the task of designing the landmark structure. No stranger to working in the civic and public transportation realm (UBC Transit Shelter), the award-winning architectural firm designed what would become an iconic focal point for the resort municipality. To reinforce the outdoor shelter against seasonal weather conditions, Public partnered with structural engineering firm, Fast + Epp. Together, the team developed a structure that would ultimately "make visitor shuttle services to and from Whistler more efficient and attractive," notes Whistler's then-Mayor Nancy Wilhelm-Morden.

Public designed an expansive 154-ft long by 42-ft wide fractal-inspired timber shelter composed of 78 triangular glulam wood cells and limited vertical support columns to maintain site lines and ease of pedestrian passage. The Gateway Loop sits in a central location—neighboring the

Illuminating the interior cells provides a warm glow in contrast to the winter conditions.

At A Glance

- The shelter is composed of 78 triangular glulam wood cells.
- The fixtures are concealed within a notch to prevent light trespass.
- A photocell activates the shelter lighting when ambient light levels are 1 fc or less.

Whistler Visitor Centre, public parking, pedestrian walkways, storefronts and lodging—thus a key component of the project, says Martin Pardoe, manager resort parks planning, was to "improve Whistler's nighttime lighting experience." Enter lighting artist, Victor Quezada of AES Engineering, who was added to the team by Brian Wakelin, a principal with Public Art + Communication.

Though Quezada was brought into the fold with two weeks lead time, it was an easy yes. "Brian and I have an ongoing relationship and have collaborated on many projects in the past. This was an expedited, large-scale light integration, involving a unique interior ceiling structure on a limited budget. But I saw the potential of minimalist design, with maximum impact. I knew what lighting I wanted to use right away," he says.

Taking into consideration Whistler's transit illumination requirements, achieving Dark-Sky compliance and a requisite placement of the luminaires to the structure only, Quezada's concept consisted of utilizing LED linear encapsulated luminaires (from Skylla TV) to illuminate 27 portions of the 9-ft by 9-ft triangular ceiling cells. Playing off the geometric aesthetic of the structure and wood, Quezada created his own playful, dramatic pattern to set the lighting tone. "It was a one brush stroke strategy," says Quezada, referring to his creative use of just one luminaire specification to light the entire structure.

Recognizing Whistler's year-round environmental conditions, Quezada selected a 2700K LED luminaire with a 95 CRI. When filtered through the luminaire's waterproof encapsulation, the light appears as 3400K CCT to the naked eye—emitting a slightly cooler tone. The luminaire seamlessly showcases the architect's design and the natural wood graining, while matching the ground plane with existing ambient lighting conditions. A photocell activates the shelter lighting when ambient light levels are 1 footcandle or less.

To comply with zoning bylaws and solve the impact of light trespass onto adjacent properties, streets and lanes, while simultaneously providing safety of the ground plane, Quezada performed a series of calculations and renderings to determine a 1 fc on average light level, with a contrast ratio of 3:1. Public incorporated a 9-ft long notch to conceal the lighting at the glulam ceiling level. This strategic placement, says Quezada, "integrated lighting into the cells to mitigate the glare, not to mention making it vandal proof."

Quezada adds that the introductory narrative of our jet-set traveler *arriving* in Whistler is an important element in design and one he often considers when conceptualizing his work. "I want my work to evoke emotion and drama." This was Quezada's first project since joining AES—he did not disappoint. His contribution to the project emphasized Public's overall strategy and design. The Whistler Gateway Loop received a 2019 IES Award of Merit and a 2019 IESBC Award of Merit for Outdoor Lighting Design. The lighting design came in under budget, met the illumination requirements, achieved Dark-Sky compliance and reduced light trespass, all with the stroke of just one lighting brush. ◎

Naomi Fisher is a freelance writer based in Vancouver, Canada.

THE DESIGNER | Victor Quezada, MFA, Member IES, is a Vancouver-based lighting artist and the creative force behind innovative lighting designs throughout North America. Mr. Quezada joined AES in 2016, where he designs lighting solutions that integrate technology and sustainability, enhance the functional and aesthetic beauty of the architectural design, and create a positive impact for the end user.

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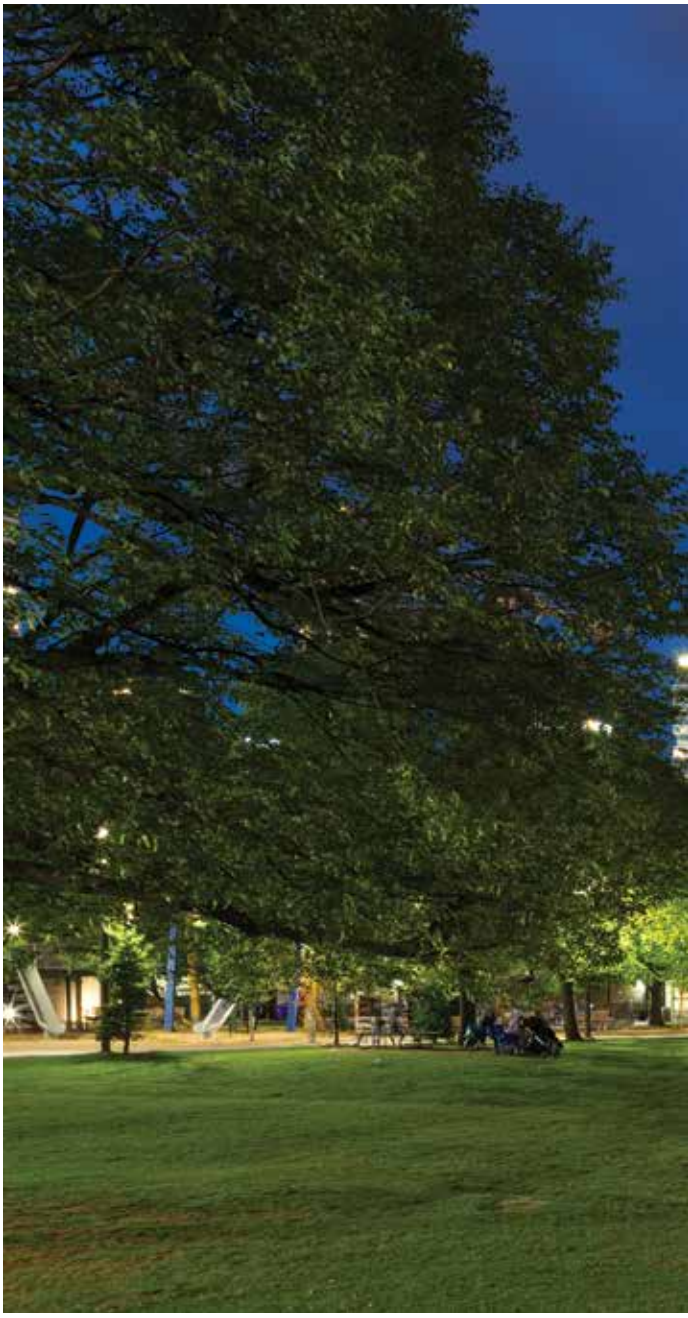


GOOD NEIGHBOR

The lighting design for a park in downtown Toronto succeeds by disappearing

By Samantha Schwirck

As far as neighbors go, a prestigious museum and an historic park sound like a match made in heaven—unless one of the two isn't pulling its weight. Such was the case for Grange Park in downtown Toronto, which had fallen into such disrepair that it took a $15-million rehabilitation project to bring it back into the community's good graces.

Originally the front lawn of a private estate built in 1817, the 1.8-hectare (4.5-acre) park was gifted to the Art Gallery of Ontario (AGO) and converted into a public park operated by the City of Toronto in the early 1900s. Over the years, however, the neighborhood staple steadily declined, prompting local representatives to form the Grange Park Advisory Committee (GPAC) in 2008, which partnered with the City of Toronto and the museum to undertake its renovation.

Pole fixtures with individually adjustable and dimmable heads highlight a renowned Henry Moore sculpture.

"The park had fallen into neglect and become a very unsafe place to venture," explains lighting designer Katherine MacKay of WSP (Toronto), who worked with landscape architect PFS Studio (Vancouver) on the 15-month project. "The city wanted the design team to bring it back to a beautiful, safe, well-lit and accessible city park that could once again be enjoyed by local residents, visitors

Photos: Tom Arban

to the AGO and tourists. They wanted the park to become a destination point and a place to host concerts and art shows."

Unveiled in the spring of 2018, the modernized Grange Park is anchored by a large, central lawn enclosed in a circular promenade and surrounded by meandering paths and gathering spaces. A sculptural water feature at the south end marks the new public entry, while the front of the AGO building defines the park's northern edge. Additional upgrades include a display of the museum's famed Henry Moore sculpture, *Large Two Forms*; a replenished grove of historic trees; a children's play area and splash pad; and a dog park.

Spoon-shaped optical lenses prevent light spill from 3000K LEDs used throughout the park.

For the pathways and seating areas, 18-ft tall light columns and 42-in. matching bollards—both using 3000K LED sources with a CRI of 80—address everything from safety to environmental impact. "The lighting was selected for sustainability—low energy costs and longevity—as well as for its simplicity, modern appearance, and ability to be unobtrusive and disappear into the background," MacKay says.

The location of existing trees informed fixture placement. "The park has a large volume of old trees that needed to be protected," MacKay

Bollards follow new, meandering pathways, boosting safety and security.

explains. “Working with the city’s arborist, we were extremely careful where the new light poles and bollards could be positioned so as not to harm the roots of the trees, while at the same time providing uniform and safe illumination along the pathways and event space of the circular green.”

Dark-sky compliance and the lighting’s effect on the surrounding community were also paramount. “The park is nestled adjacent to the AGO on one side and a dense residential neighborhood of houses, condominiums and a school on the other three sides, so we had to be highly mindful of glare and any stray uplighting that could potentially find its way through the windows of all these homes and school,” MacKay says. To that end, the bollard and pole fixtures contain spoon-shaped optical lenses positioned over the LED diodes, which direct light downwards to control glare and spill.

All of the park’s fixtures are dimmable via one control system that can be scheduled based on time of year as well as motion and daylight sensors. “The control system was selected to provide maximum flexibility and take advantage of daylight harvesting and energy savings,” MacKay says. “The lights are preset to 50% output and can be raised or dimmed from 100% down to 50% in three steps.”

Ensuring the renowned Henry Moore sculpture become one of the park’s highlights—a request made by the museum—required an additional layer of control. “We specified three light columns, each with four individual LED heads,” MacKay says. “Each head is fully adjustable and rotatable and can be dimmed separately from

At A Glance

- Pathways are lit to 3 fc; playgrounds and the dog park are lit to 5 fc.
- All fixtures are 3000K except those lighting wooden structures, where 2800K brings out the texture.
- The project received a 2019 IES Illumination Award of Merit.

Left: In-ground uplights add excitement to the playground's splash pad.

Right: Poles and bollards were positioned to avoid harming tree roots.

each other. This enables the curators of the museum to angle the lighting and tweak the intensity falling onto the sculpture."

The team deviated from the park-wide pole-and-bollard technique at the entrance as well, illuminating the sculptural water feature with in-ground IP68-rated LED uplights. "A donor wall was also added at the last minute, so we provided a minimalist solution of 2-in. wide in-ground adjustable LED uplighting strips located at the base of the wall to highlight the inscription," MacKay adds.

Similarly, IP68-rated uplights illuminate the water feature and splash-pad component of the new interactive playground. "The children's playground was an important aspect of the park, and it was important to have it well-lit for safety and visibility," MacKay says. For that reason, additional dimmable LED columns and bollards in the area are aimed to avoid glare onto the playground equipment while still providing adequate light levels for nighttime activity.

The lighting design resulted in substantial energy savings for the park, with the site achieving 0.015 watts per sq ft. "Since the entire design consists of an LED solution, the city will also enjoy the longevity of a system with minimal maintenance requirements," MacKay says. Of equal importance is enhanced visual comfort, which benefits locals, tourists and even pets who frequent the new space, MacKay adds: "Dog owners asked us to make sure their pets would not be exposed to glare and wanted the runs well lighted, so we installed dimmable light poles with rotatable optics and special lenses to diffuse glare, which are also tied to the lighting control system." ◎

THE DESIGNER | Katherine MacKay is a lighting designer and head of the lighting studio for WSP/MMM Group in Toronto.

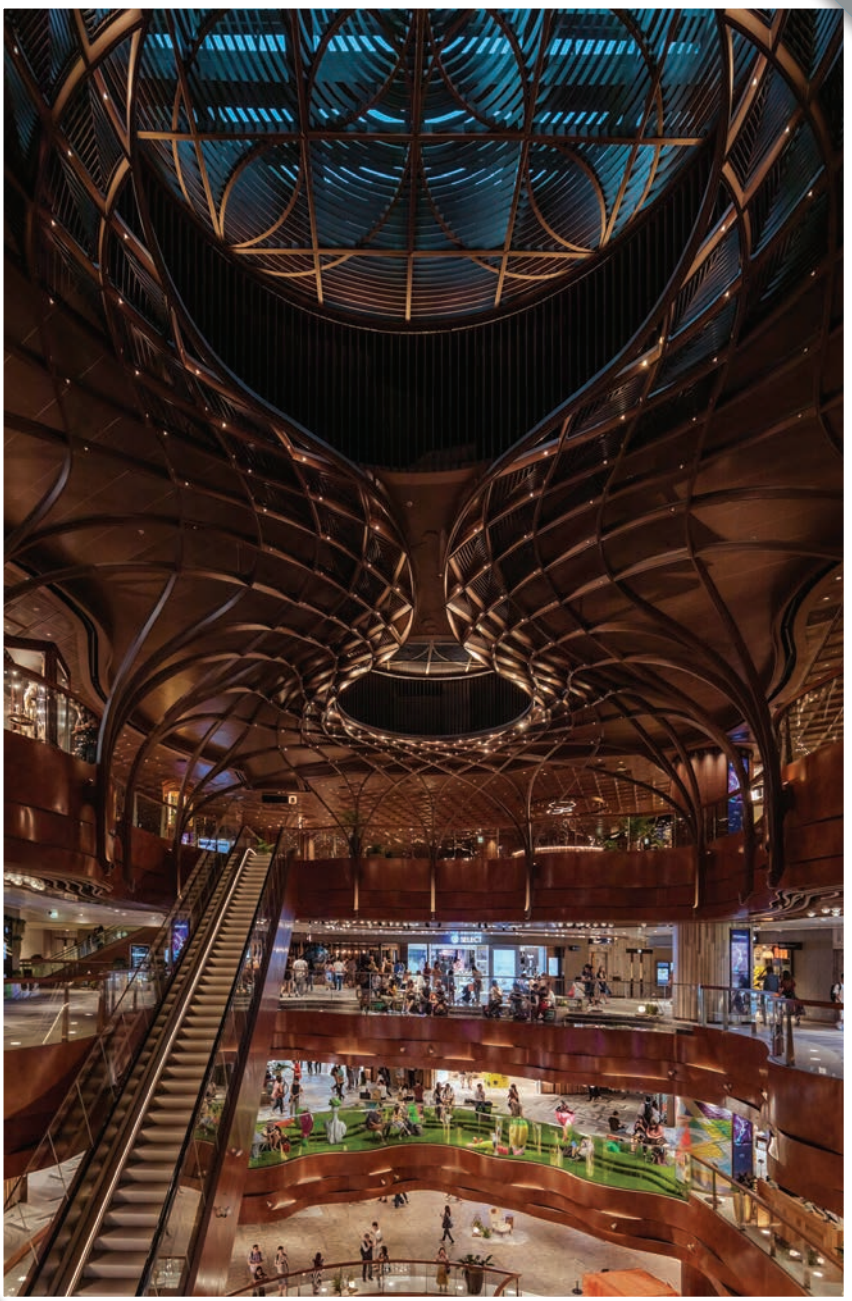
PROJECT IN PICTURES

Ebb and Flow

Located in the heart of the Victoria Dockside art and cultural district in Hong Kong, **K11 Musea** (named after the Muses in Greek mythology) fills 1.2 million sq ft with retail, contemporary art, dining and cultural experiences. In designing the light for the interior and exterior public spaces, **Speirs + Major** fashioned a concept based on the idea of a bespoke collection of luminous objects. While the lighting details in each space are distinct, a deliberate coherence in the design and materials unify the entire development. The lighting ebbs and flows throughout to create a sense of movement without detracting from art pieces and retail shop fronts.

Photo: Speirs + Major/Jackie Chan

Photo: Speirs + Major/Jackie Chan



Distinct but cohesive lighting unifies the experiences and activities taking place throughout the K11 Musea's **10 floors.**

Warm-toned **metal, cut glass** and **wood** create a sense of warmth and sparkle intended to put people at ease.

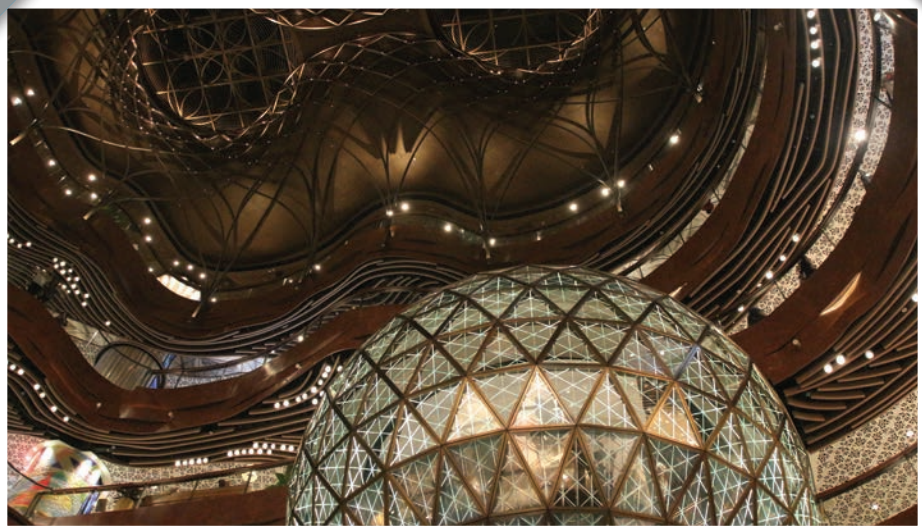


Photo: Speirs + Major

≪ A five-story-high glazed illuminated **"Golden Ball"** dominates the void while miniature cut-crystal luminaires cluster around the edges of the **atrium "galaxy."**

≫ Crystal ball light details link the **atrium spaces** with the **arcades.** The luminaires add to the baroque-inspired sense of glamour without losing the space's modern appeal.

Photo: Speirs + Major/Jackie Chan

Photo: Speirs + Major

≪ Daylight is simulated over an internal **"park."** The bright lighting serves as a "peak" in the overall design, which includes various lighting levels that shift harmoniously throughout.

SOCIAL FEVER

Social media has become an integral part of the lighting world, but does every sector of the industry treat it the same way?

By Katie Nale

Across the industry, companies and organizations are taking to social media, increasingly seeing it as an indispensable tool for self-promotion, connectivity and keeping up. We talked to five different organizations—a sales agency (The Dulanski Group), a design firm (Schuler Shook), a manufacturer (SPI Lighting), a research center (Lighting Research Center) and a government laboratory (Pacific Northwest National Laboratory)—to see how social is being used throughout the industry and what success looks like in this newly pivotal space.

Why do you use social?

The Dulanski Group:

Having a social media presence allows us to share updates about events and educational opportunities within our agency, as well as the latest industry news and, most importantly, the latest innovations and product releases from our manufacturers. Our employees are very active in the industry and we support a number of organizations, so having a social presence and sharing updates and events is a great way to help cross-promote.

Schuler Shook:

Posting helps to build relationships with people and firms in our industry. It helps us communicate information about upcoming events and news and allows us to share our knowledge, which helps establish us as experts or thought leaders. It also helps to raise brand awareness and increase our brand recognition. We know that compelling posts will drive more traffic to our website. Ultimately, this can increase customer loyalty and contribute to our bottom line.

SPI Lighting:

Lighting is very visual, and social is really designed around sharing visual content. Our primary focus is to inspire specifiers with new lighting ideas—we put a lot of work into researching and licensing application photos. We're fortunate that our fixtures are used in some pretty spectacular spaces, so we're able to share a lot of photos that reflect the latest trends.

We also use social to help convey the culture and personality of our company by talking about things like what it's like to visit the factory. Sometimes we give our followers a sneak peek at what we're working on. We've also started producing videos, which have been a great way to share the story behind our custom fixtures.

Lighting Research Center:

We use social media to promote LRC research and increase public awareness of the many ways that lighting can benefit society and the environment—from improving human health to enhancing food production to managing clean energy in the new electric grid. It is also a great way to engage with potential students who want to attend a graduate program at the LRC to earn their M.S. or Ph.D., and to connect with our sponsors, LRC Partners, Alliances and Members. Social media is also an excellent tool for outreach and education. We hear from people who

are struggling with depression or insomnia, or who want to help a parent who has Alzheimer's disease. We try to provide each person with suggestions based on LRC research findings.

Pacific Northwest National Laboratory:
The main reason we use social media is to share the science, technology and research that we do with fellow researchers, potential collaborators, sponsors and taxpayers. Because most of the work we do is government funded, we believe it's especially important that taxpayers understand what we're doing. The vast majority of American adults receive news via social media, so that's where we spend our time communicating with them.

Another reason we use social media is to show support for our partners and collaborators. As a U.S. Department of Energy national laboratory, PNNL has many partners including other research institutions, universities, national laboratories and private sector partners. We also use social media to inspire the next generation of scientists and engineers. We recognize that individuals from diverse backgrounds must see themselves represented before pursuing an education and career in STEM. We want to be part of a vision in which everybody is able to consider a future working at a DOE national laboratory.

Who is responsible for your social strategy and implementation?

The Dulanski Group:
Our social media strategy is to provide visibility to all of the manufacturers we represent, as well as to help support education and development within the industry. Given the amount of time it takes to properly manage and cover all of our manufacturers, we find value in utilizing the services of CFW Marketing Communications. CFW develops our social media strategy, and creates and implements content.

Schuler Shook:
We have a dedicated social media team that takes turns posting. The team consists of marketing staff, as well as theater planners and lighting designers who have volunteered to be a part of the social media team.

SPI Lighting:
Our marketing team is responsible for social media with input and support from our sales team.

> "We also use social media to inspire the next generation of scientists and engineers
>
> -PNNL

Lighting Research Center:
I [Rebekah Mullaney] am responsible for the LRC's social strategy and implementation. However, many of our researchers are active on social media, especially LinkedIn—you can connect with almost all of our researchers there.

Pacific Northwest National Laboratory:
I [Jessica Wisse] set the social media strategy for PNNL under the leadership of our digital media manager, Greg Kunkel, with buy-in from PNNL leadership and stakeholders. We have a small but mighty team that helps implement the strategy and execute social media campaigns throughout the year.

Are there any restrictions/policies in place?

The Dulanski Group:
There are not any formal policies in place—we rely on good business sense and post items that are relevant to our audience, customers and agency as a whole.

Schuler Shook:
Schuler Shook provides guidelines on the Do's and Don'ts of posting content and provides a "safe content" checklist to employees. This helps us provide trustworthy and credible information that is not offensive or unwanted by our clients.

SPI Lighting:
It is important to make sure that your licensing is in place for images before you post.

Lighting Research Center:
No, we are free to use our best judgment and there have never been any problems. The LRC is a mission-driven organization, we adhere to a set of core values, so we don't imagine having any issues that would require restrictions or policies.

Pacific Northwest National Laboratory:
We have policies and procedures based on common best practices and an internal set of approvals posts go through to ensure they align with our strategy and are correct. Since we're often dealing with technical topics, we want to make sure our posts are scientifically accurate. We also have policies set in place, including comment, engagement and asset policies to name a few.

What are your metrics for success?

The Dulanski Group:
We currently do not rely on any metrics to measure success. Given that having a social media presence is basically paramount to any business' success in this century, keeping our accounts active and keeping our manufacturers and clients satisfied in seeing and interacting with our posts is our success barometer. If we are stimulating someone's imagination, answering a question, inspiring an idea and sharing the love of a product or great project, then we are doing our job.

Schuler Shook:
Content that engages others and generates buzz is what we want to achieve. These activities can be measured in the form of people liking and/or sharing our posts or commenting and starting up a conversation.

SPI Lighting:
We're looking at engagement metrics including reactions, clicks and comments. Impressions is another good indicator of reach. While different than engagement, it is evidence that you're staying top of mind. On one social platform, we've seen annualized growth of 25% in followers, which far outpaces the growth of our email list, so when it comes to building an audience, social is a really effective way to do that.

> "Having a social media presence is basically paramount to any business' success in this century
>
> -The Dulanski Group

Lighting Research Center:
I use typical audience engagement metrics, including the number of likes, comments, shares, retweets, impressions, etc. Personally, I feel like our social media efforts are successful when I can help someone who has a question about lighting, whether they need assistance with choosing the right LED light source for their kitchen, or want to know how to use light to help their child sleep better at night. If I am providing a positive benefit to humanity that aligns with the LRC mission to advance the effective use of light for society and the environment, then that is the real measure of success.

Pacific Northwest National Laboratory:
This depends on the campaign and what the goals are for that particular campaign. We are always creating content with engagement rates in mind. We do not do paid promotions—all of our social media efforts are organic. We're constantly looking at engagement rates to see what type of content our followers like and what they don't like. This means we're always reevaluating our content strategies and willing to try out something new. We know not everything will work and we're okay with that; our primary objective is to produce and share the content that our followers want to see. ◎

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Webinar Schedule

PRESENTER:
Shaun Fillion

Lighting Calculations Explained
Thursday, February 13th | 12:00 - 1:00 PM ET

Description: Shaun Fillion will provide an under-the-hood look at radiosity calculations and raytrace renderings. We will look at the methodology used by photometric calculation software to represent the performance of lighting in the built environment, tracking it from the roots of the Lumen Method and Inverse Square Law. Visual representations of illuminance versus luminance will be covered. The seminar will also diagnose and tweak example models to make the lighting calculations more accurate.

PRESENTER:
Chris Smith-Petersen

Designing Interior Space with Indirect Lighting
Thursday, March 19th | 12:00 - 1:00 PM ET

Description: Humans have evolved to prefer certain characteristics of light and interior spaces – we naturally gravitate towards and feel more comfortable in spaces that are coherent, that provide a clear view of how to move through them, that are well illuminated by full-spectrum light and where contrasts in light and colors are used to create emphasize what is most important, creating a visual hierarchy.

Indirect lighting makes use of the building's interior envelope and volume to modulate, amplify, and balance lighting from various sources. A layered approach to the lighting of interior spaces, which incorporates a balance of direct and indirect lighting improves visual coherence and wayfinding; articulates and highlights architectural elements, and positively impacts health and productivity.

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Obituaries

Theodore Ake, Member Emeritus

Theodore (Ted) Ake, an IES Member Emeritus who joined the Society in 1950, passed away in December at the age of 92. A U.S. Navy veteran, Mr. Ake graduated from Case Western Reserve University with a degree in electrical engineering. Over the course of his career, Mr. Ake was employed by Cleveland Electric, the Miller Lighting Company and Hubbell Lighting.

Mr. Ake was an active member of the IES, serving on both the Education Review Committee and the Security Lighting Committee. He also wrote a column on the topic of security lighting for *LD+A* magazine. Mr. Ake received the Distinguished Service Award in 1997 and the Section Meritorious Service Award in 2004.

"I had the privilege of working with Ted on several IES education projects," says IES Fellow and former *LD+A* Book Review Editor Fred Oberkircher. "Ted was always the consummate team player—passionate about lighting education and also passionate about how it should be taught."

Mr. Ake is remembered by those in his community for consistently participating in and supporting various local programs. In lieu of flowers, memorials may be donated to the Warm Hearth Foundation or the Warm Hearth Employee's Assistance Program.

Susan A. Zamos, SALC Member

Susan A. Zamos, a dedicated member of the Society's Street & Area Lighting Committee, passed away in December after a courageous battle with pancreatic cancer.

Ms. Zamos's lighting career included work for Thomas & Betts, Sunrise Technologies/FP Outdoor Lighting Controls and, most recently, Acuity Brands Lighting. Ms. Zamos's experience with controls and networked lighting for utility, commercial and industrial markets was evident in her speaking engagements at IES conferences, as well as her service on the Street & Area Lighting Committee, the SALC Planning Committee and the SALC Industry Interchange Committee.

Flowers may be sent to Ms. Zamos's family through Davis Funeral Home, Roxbury, MA (*www.davisofboston.com*).

MEMBER MENTIONS

Leigh Ann Vogel has been appointed associate partner/supervising engineer for **Syska Hennessy**.

Christina Raschko, Neha Sivaprasad and **Lindsay Stefans** have been named Professional-level members of the IALD.

Bold = Individual or Sustaining Member

NEW MEMBERS

The IES is pleased to welcome **58** first-time individual members.

Pamela Alexander
Christine Babcock
Harsha Banavara
Mandar Bankhele
Kristen Barrera
Claudia Barrett
Brian Berninger
John F. Briggs
Carl Canfield
Walter Cary
John Chalmers
Terry Cone
Ricardo Davila
Matthew Deloge
Ninad Deshpande
Yaniv Glikman
Steven Ha
Caroline Harrison
Ruskin Hartley
Ryan Hemphill
Carlos Hernandez Tamez
Eri Hino
Marc Hodges
Sharon Hollingsworth
Guy John
Shulan Kuang
Chris Langlais
Harry Lee
Raymond Lo
Rosemary Long
John Lynn
John MacDonald
Oshadhi Madihe Eshwarage
Mark McNally
Paloma Mendoza
Joseph Moyers
Ansari Anas Muhamed
Holly Nelson
Jennifer Pace
Frank Pagel
Brad Potter
Sunday Purselley
Tim Ryan
Mayra Salinas
Ron Schiller
Dawn Schram
Kristel Sherwood
Lyle Shute
Paula Slocum
Elyse Stemmler
Brian Sukkar
Heather Thomas
Laurent Thuillier
Warren Troy
Tanya van Uffelen
Robert Watson
Ali Yazdani
Zhengyu Zhang

*As of November 30, 2019

SUSTAINING MEMBERS

The following companies have elected to support the Society as Sustaining Members which allows the IES to fund programs that benefit all segments of the membership and pursue new endeavors, including education projects, lighting research and recommended practices.*

CHAMPION

AcuityBrands.

current

COOPER Lighting Solutions

HUBBELL Lighting

signify

AMBASSADOR

RAB Lighting, Inc.

BENEFACTOR

Atlas Electrical Corp.
Axis Lighting
Cree, Inc.
Crestron Electronics, Inc.
Finelite, Inc.
Focal Point, LCC
H. E. Williams, Inc.
International Lights, Inc.
Kenall Mfg. Co.
Legrand/Watt Stopper
Lutron Electronics
Musco Lighting

SUPPORTER

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A.L.P. Lighting Components Co.
Apogee Translite
Ascent Battery Supply, LLC
Barn Light
B-K Lighting
Associated Lighting Representatives, Inc. – Oakland
BIOS Lighting
Black & McDonald, Ltd.
Boca Flasher
Capital Tristate
Con Edison Company of New York
ConTech Lighting
Cree Canada
Crenshaw Lighting
Douglas Lighting Controls
Duke Energy Co.
DWM Holdings
e-Lumen International, Inc.
Eclipse Lighting, Inc.
Edison Opto USA Corp.
Edison Price Lighting, Inc.
EiKO
Elation Professional
EnduraliteLED, Ltd.
Energyficient Systems, Inc.
Enterprise Lighting, Ltd.
ETC, Inc.
EYE Lighting International of NA
First Light Technologies, Ltd.
Form Lighting and Controls
FortisAlberta, Inc.
Harman Professional
Healthe by Lighting Science
Hera Lighting
iGuzzini
Illuminart
Intense Lighting
The Kirlin Company
Kurtzon Lighting
LEDil, Inc.
Lee Filters USA
Legion Lighting Co., Inc.
Lighting Analysts, Inc.
Lighting Design Lab
Lighting Services, Inc.
The Lighting Quotient
Litelab Corporation
Los Angeles Lighting Mfg. Co.
Louis Poulsen Lighting, Inc.
Louvers International
LUMA Lighting Design/PAE Engineers
LSI Industries, Inc.
Lucifer Lighting Company
Lumenomics
LumenPulse
LumenWerx, Inc.
The Luminaires Group
Metalumen Manufacturing, Inc.
Moxie Lighting
Nanometer Lighting
National Grid
National Lighting Company
National Park Service
naturalLED
Optic Arts
P2S, Inc.
Pace Industries
Pathway the Lighting Source
Power & Lighting Systems, Inc.
Precision Architectural Lighting, Inc.
Prudential Lighting Corp.
PureEdge Lighting
Q-Tran, Inc.
Reggiani Lighting USA, Inc.
Richard McDonald & Associates Ltd–Calgary
Richard McDonald & Associates Ltd–Edmonton
RDG Planning & Design
Senso Lighting
Sentry Electric, LLC
Smart Engine|WTEC
SFM
SGM Light A/S
Spectrum Lighting Inc. San Antonio
SSG (Star Super Group)
Sternberg Lighting
Stresscrete Group/King Luminaire
Synapse Wireless
Tempo Industries
Tivoli, LLC
Touche Lighting Controls
Trinity Manufacturing
Truly Green Solutions
Ubicquia
Urban Solar
USAI Lighting
Velux America, Inc.
Vermont Energy Investment Corporation
Visa Lighting
WAC Lighting Company
Wayfair
XtraLight Energy Efficient Lighting Solutions
Zumtobel Lighting

*Contributor Sustaining Members are listed at *www.ies.org*.

PRODUCTS

1.

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1. Tivoli Lighting introduces the ADAPT Pendant Series of fixtures, anchoring hardware, glassware and LED light engines to offer multiple mix and match options. The series is available in various styles, shapes, materials and colors. It also provides three LED light engines that produce different lighting effects. All light sources operate at 120 volts and are dimmable.
www.tivolilighting.com

2. Eureka announces the Hex Area Interior Statement Luminaire. The geometrical fixtures, offered in different sizes, light outputs, mounting types and finishes, are meant to enable lighting design creativity from walls or ceilings. Hex Area is available in three mounting types: suspended, ceiling surface or wall mounted. The wall-mounted version is ADA compliant and there is an optional uplight module for the suspended version. The wall-mounted and ceiling-mounted versions have a built-in shadow line to compensate for uneven ceiling surfaces.
www.eurekalighting.com

3. LSI Industries announces an enhanced version of its edge-lit LED panel. The luminaires allow users to adjust both color temperature and wattage. Up to three different options for color temperature and wattage can be selected, resulting in a total of nine different light settings from a single fixture.
www.lsi-industries.com

4. Spring Lighting Group (SLG) introduces the Sparta Sports Light. Offered in 380-820-W versions that deliver 50,000-105,000 lumens, the Sparta Sports Light features a dynamically designed thermal management system that dissipates heat to increase lifespan. The Sparta Sports Light is compatible with Synapse Gateway Control, enabling scheduling and dimming functionality. It is available in 4000K and 5000K color temperatures and includes a 10-year limited warranty.
www.slgus.com

5. Fire Farm introduces its 3DP Collection of 3D-printed lighting solutions. The collection includes fixtures that range in scale from small, single 8-in. mini pendants to 32-in.

6.

7.

tall pod-shaped pendants. The fixtures are created with crystal-clear recyclable resin that sports a higher light transmission than glass and powered by standard E26, Edison-style base bulbs.
www.firefarm.com

6. 2nd Ave Lighting introduces the Amelia Crystal Flushmount. The ceiling fixture is made of Swarovski Crystals draped in multiple layers around the chrome-finished frame. Lens colors, metal finishes and sizes can be customized. It is UL and cUL listed for damp and dry locations.
www.2ndave.com

7. LEDtronics introduces the LED T5 Tube Bulb. The high-lumen bulbs are available in multiple base selections and serve as an alternative to intermediate-base incandescent bulbs. The design allows for quick installations and is ideal for enclosed fixtures and tight spaces. The LED16T5 series features an omnidirectional 360-deg, no-shadow beam pattern and the bulbs provide 6000K pure white illumination.
www.ledtronics.com

IN ACTION

Photo: Luke Hayes

Photo: Bill Cooper

KEEP CALM AND CARRY ON

Prior to staging The Munich Opera's production of Handel's opera *Agrippina*, London's Royal Opera House (ROH) received a request from lighting designer Benedikt Zhem for the placement of moving head LED units in the front of house. Historically, similar requests for moving heads have created issues due to a lack of space, sound control and restrictions placed on the auditorium by English Heritage, a charity that cares for historic monuments, buildings and places. To comply with the designer's vision, the ROH team researched possible solutions and concluded that **Elation's** Artiste Picasso luminaires met the opera's strict requirements. The units also produce minimal ambient noise, allowing them to be hung at Grand Tier level in the auditorium. "Being near silent, having consistent beam quality, great output and crisp shuttering, the Artiste Picasso units were impressive," says Simon Bennison, lighting manager at the ROH.

PRODUCTS

8. Universal Lighting Technologies announces the expansion of its EVERLINE family with LED Round High Bay Luminaires. The "UFO" style luminaires are designed to meet requirements for commercial applications with ceiling heights above 20 ft. Utilizing LED drivers with 0-10-V dimming, the luminaires include options of 21,000- and 28,000-lumen outputs. They are UL classified, IP65 rated and DLC Qualified.
www.unvlt.com

8.

9.

9. Acuity Brands announces the Juno AI Speaker Light with Alexa. The smart-home product integrates Alexa voice service, JBL speakers, lighting controls and Juno LED lighting into a single ceiling light fixture. Juno AI connects to any Alexa-enabled smart-home devices.
www.acuitybrands.com

10.

10. Modular Lighting Instruments announces the Pista track system in North America. The 48-V magnetic track rail system offers a myriad of configurations including a Linear LED, Night Light LED, as well as five other spotlight and suspended fixtures. Pista can be surface-mounted, suspended or recessed.
www.supermodular.us

11. Armstrong Ceiling & Wall Solutions announces its new lighting connection clips. The clips, along with low-profile light fixtures, allow for direct installation from a suspension system. The linear lighting solution is compatible with four WoodWorks linear ceiling systems: Grille, Grille Tegular, Linear Solid Wood Panels and Linear Veneered Panels.
www.armstrongceilings.com

11.

12.

12. ET2 Lighting announces the Chamber collection of LED pendants. The pendants consist of contrasting U-shaped gold structures that house the LED and are designed to illuminate an entire room. The integrated LEDs have a CRI of 90+ and a color temperature of 3000K.
www.et2online.com

13.

13. Structura introduces Metro, the low-profile outdoor luminaire designed for roadway, pedestrian, area and spotlight applications. Available in two sizes, Metro offers four standard mounting options and six different distributions. The adjustability feature, available on pole and wall mounting, allows light to be placed at the exact desired location. With the standard catenary mounting, users can have a continuous design from roadway to site lighting. If using a roadway distribution, Structura offers house-side shield on both the single and double module. While using the standard fixed mounting option, Metro has full cutoff for dark-sky applications.
www.structura.com

CLASSIFIEDS

LEUKOS

The journal of the Illuminating Engineering Society

What is LEUKOS?

LEUKOS, the official journal of the IES, is a global venue for technical developments, scientific discoveries, and experimental results of current interest or lasting importance in the applied use of light.

New Online Features!

LEUKOS is now published online by the Taylor and Francis Group. This enhanced online tool allows for downloadable pdfs, mobile access, highlighting and other annotation, integration with social media, full text search-ability, tracking of usage and downloads, & more...

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The technical material provided in each issue of LEUKOS includes both articles, which are unbiased and objective, as well as editorials, which can offer opinions and positions on certain topics.

LEUKOS contains five distinct types of articles - scientific research results, engineering developments, technical aspects of lighting applications, tutorial articles or critical reviews, and brief communications.

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Individual issues of LEUKOS are published online, four times a year. Once a year, the four issues are combined into a volume, which is then printed for distribution to its annual subscribers.

Each volume of LEUKOS is robust, consisting of 200+ pages of technical content, providing commentary and findings on the technology and discovery in the lighting industry.

Current Edition

Volume 15
Issue 1, 2019

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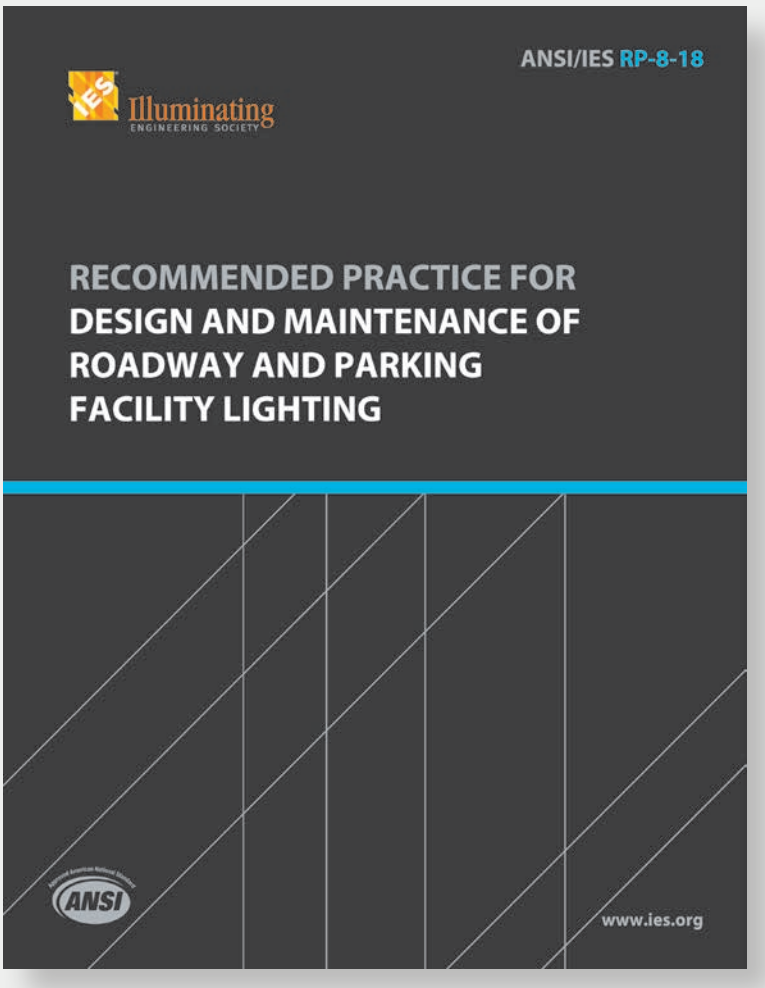
ON THE ROAD AGAIN



IES | THE LIGHTING AUTHORITY

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RP-8-18

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- DG-21-15
- DG-23-14
- DG-26-16
- DG-28-15
- LM-50-13
- LM-71-14
- TM-10-00(R2011)

Illuminating
ENGINEERING SOCIETY

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The companies listed below would like to tell you more about their products and services. To learn more, access the websites listed here.

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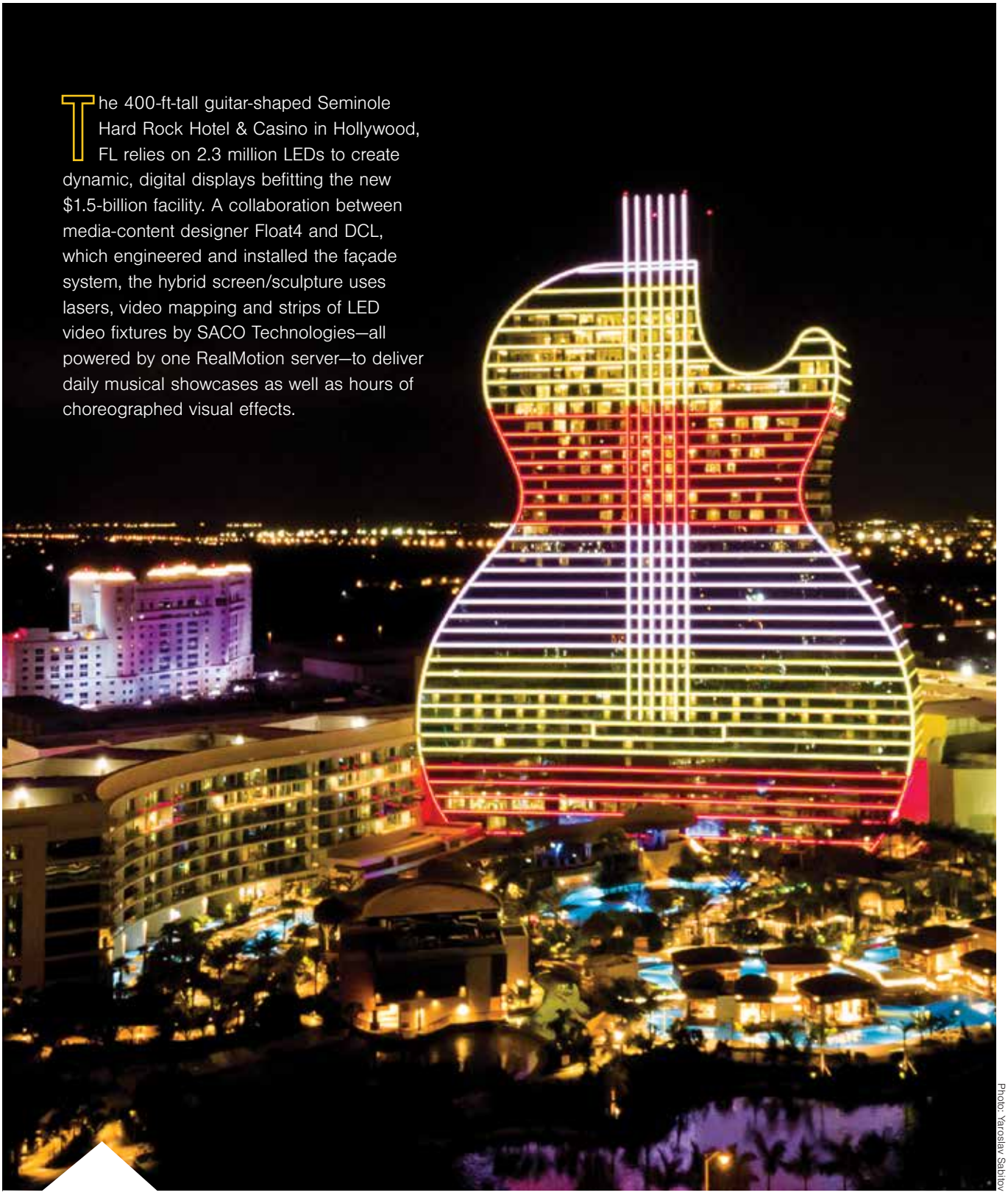

The 400-ft-tall guitar-shaped Seminole Hard Rock Hotel & Casino in Hollywood, FL relies on 2.3 million LEDs to create dynamic, digital displays befitting the new $1.5-billion facility. A collaboration between media-content designer Float4 and DCL, which engineered and installed the façade system, the hybrid screen/sculpture uses lasers, video mapping and strips of LED video fixtures by SACO Technologies—all powered by one RealMotion server—to deliver daily musical showcases as well as hours of choreographed visual effects.

Photo: Yaroslav Sabitov

LAST LOOK

Rock Out

Credit: Union Church of Robinson Township, McKees Rocks, Penn.

Grand Accent

Shown lit from 150 feet below by a single WAC Grand Accent light. Ideal for spotlighting monuments, statues, facades and other fine exteriors, our Grand Accent is constructed of solid cast brass, and offered in both 12V and 120V power. Superior output from 740-2000 lumens in a single fixture and respective power, 50W-150W, adjustable directly on board. Dial between beam angles ranging from 15°- 60°.

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WAC LIGHTING

waclighting.com