

Solid State Lighting Design

Applications, design and technology news from across the industry

The Mission of Solid State Lighting Design is to help foster the technical and architectural design innovation needed to propel LEDs and solid state lighting into mainstream lighting applications.

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Editorials

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Most public, and many commercial lighting projects are typically over-lit by about 30-60% to account for the future depreciation of the lighting sources due to lamp aging, lamp failures, and environmental factors (dirt, dust and such). While the lighting and transportation engineers usually have time-proven answers to how much light is comfortable, or which creates a safer roadway environment, there probably hasn't been much of a discussion about the drawbacks of over-lighting the site, since up until LED lighting's arrival, there hasn't been much of an option. In a recent discussion with Stephen Horner of [Tillett Lighting Design](#), that company's approach to providing functional art highlighted some of the issues, plus it was a pretty neat application success story for solid state lighting.

The background of the story is set on the historic Brooklyn Bridge that connects Brooklyn to Manhattan in New York City. In the past, if someone were to stroll across the bridge to Brooklyn, they would walk down a set of steps that takes them to the street level, give a quick look around the dark and somewhat foreboding underside of the structure, and head back up to get out of there and back to "where the action is". A group of merchants in the "DUMBO" (Down Under the Manhattan Bridge Overpass) got together to try and change that with a sort of "there is more than just the bridge here in Brooklyn" messaging strategy. The concept was for an artistic treatment and information presentation that enticed people to take a few more steps, and enjoy some interesting shopping and dining as part of their 'beyond the bridge' experience. Working with [Emphas!s Design](#) and artists [Linnaea Tillett & Karin Tehve](#) the DUMBO Improvement District subsequently commissioned the design of a functional art project entitled "This Way".

The project consisted of a few key elements, including walkway lighting down to the street, signage that gave a bit of the Brooklyn pitch, roadway lighting to keep it all enticing, and most importantly, some striking light-tube designs that both pointed towards the stairway entrance, as well as visually took the arriving bridge strollers 'out this way' to see the sights. (The [South Brooklyn Network](#) website has a neighborhood-oriented overview of the project as well as a good picture). We'd all love to hear that the whole project was an LED winner, but alas, only part of the project was served by LEDs this time around. Low profile and side emitting metal halides grabbed the stairway and 'this way' arrows (maybe chevrons is a better word), while [Beta LED's](#) Edge luminaire took the downlight honors. According to Mr. Horner, who was responsible for the lighting implementation, two key decision factors made the difference to the designers. First was that the LED-based fixtures did a good job of keeping the light going where they were supposed to, pretty much eliminating undesirable glare levels. The second draw was that the Beta luminaires offered a two-level setting for their output, which allowed them to operate now at a level that didn't wash out the artistic features.

That's a very interesting development, as it provided a method of assuring a minimum specified light level now, along with a mechanism to accommodate increasing the light level in response to future degradation, presumably due to an accumulation of dirt, mud and dust that historically affects all kinds of light fixtures. Previously, luminaires met the Department of Transportation's requirement by providing at least 60% more light than actually needed, basically in response to the fact that any other form of high-efficiency lighting has just a single light output level when first installed, which will then depreciate from there as the lamp fades. The 60% margin is what the DOT has found gives them an acceptable service life without having to do frequent bulb changes, or to regular a cleaning cycle. The drawback is that it starts too bright, and wastes energy. LEDs provide a simple answer... when more light is needed, they can turn themselves up. As far as other challenges, Mr. Horner said, "Incorporating the LED lighting really just required us to convince the DOT that it was a viable approach, and that we'd done the due diligence required for that. They were positive about the reduced maintenance, and were very pleased to have an opportunity for an LED-based pilot program where someone else was covering the upfront costs."

While it's a simple concept, it is a revolutionary change to the high-efficiency lighting realm (incandescents do this well, albeit with a notable shift to the warm side of the color spectrum, but fluorescents resist dimming, and most others types of light sources simply can't dim). According to [Beta LED's](#) East Coast Regional Sales Manager, [Michael Winegard](#), who started his career with [Kramer Lighting](#) prior to it becoming part of the [Ruud Lighting](#) family as [Beta-Kramer](#), "We can finally get away from over-lighting our environments. The incumbent technologies never gave us the kind of control over the target efficacy that allowed us to deliver

the light only where it was needed, and only in the amount that was needed. Compared to the sharp lumen depreciation curves in metal-halide and other systems, LEDs provide us with something more like 1/2% per year, pretty much eliminating source depreciation as a concern.”

In the case of the “This Way” project, the two-level system on Beta’s Edge offered a built-in contingency plan should the source depreciate more than predicted, or if it gets really crudded over. In other installations, such as parking structures, they make use of the two-levels to reduce the power consumption when there is no activity going on around the garage. A motion sensor is employed in those cases, allowing the luminaires to standby in a lower consumption power mode, then switch instantly to full brightness when activity is detected. Other manufacturers make use of feedback techniques to maintain output levels as the LED fixture reaches into that last third or so of its lifetime when the actual LED source depreciation may become noticeable. In those cases, the compensation circuitry directs more power to the LEDs to simply “turn them up” to a brightness level that maintains the spec, until they reach a point where the amount of power needed makes it more cost-effective to replace the unit. At that point, it switches them off (darkness being the universal signal recognized by maintenance crews worldwide that a light should probably be replaced). In interior architectural applications, we see similar techniques employed to maintain color accuracy. Cree’s LR-6 retrofits, and their recently announced PAR lamp are examples of that capability as they add or subtract some red intensity to compensate for any changes to the tone or intensity of the white LEDs that are responsible for the blue-green-yellow portion of the fixture’s output.

Regardless of the implementation, the understanding of this “target efficacy” concept is going to continue to be an important driver in SSL adoption. In a sense, it will take us back to searching out the truly basic criteria of, “How much light do you need, where do you need it, and under what conditions do you need it?” Lighting engineering manuals will see some major revisions as lighting implementors won’t have to think in terms of how to overlap in order to minimize the hotspots or how much extra light you need to plan for degradation or how to compensate for re-lamping schedules that lead to a certain number of fixtures being dead at any particular point in time. In fact, we’re not far from the time when the LED luminaire sends a text message to the maintenance group to inform them of when it will be failing, so they can efficiently schedule in the replacement before the darkness comes. (But that’s another story...).
