SSL Postings
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Coming to Grips with Glare

There's a growing awareness of glare these days, both within and beyond the lighting community. Glare can be a problem with any lighting technology, but the nature of LEDs as point sources makes glare an especially important consideration in designing and deploying the luminaires that use them. This applies particularly to exterior luminaires (mainly street lighting, pedestrian lighting, and parking lot lighting), which often emit far more lumens than interior luminaires and thus, when LEDs are involved, often pack a sizeable output into a very small area. This is exacerbated as LEDs continue to become increasingly powerful, enabling manufacturers to use fewer of them to generate the same amount of lumens. To address the issue of glare, a committee formed by the International Commission on Illumination (CIE) is meeting this week in Manchester, UK, and glare figures prominently on the agenda of an Illuminating Engineering Society (IES) committee that met for the first time earlier this month to consider lighting for outdoor public spaces.

Although glare is sometimes confused with light trespass, the two are not the same. Light trespass involves projecting light where it's not wanted, whereas glare is related to the intensity of the light source (luminance) directed toward the observer's eye, the adaptation state of the observer, and how the light is perceived against the contrasting background. For example, a car's headlights won't appear as bright during the day as they will at night, even though their luminance remains the same. Color temperature may also play a role, as increasing the CCT (i.e., moving it toward the "cooler" range) at a constant luminance could make the light seem brighter to a typical observer and thus could trigger a greater glare response in viewers. What's more, parallel rows of LEDs on the luminaire may be resolved in the viewer's brain to a series of stripes, which may be visually uncomfortable and contribute to the impression of glare.

One of the things it's hoped will ultimately emerge from the CIE and IES committees is a better metric for glare. Current glare metrics are based on the assumption that the luminaire aperture is evenly lit — an assumption that was a stretch even for metal halide and high-pressure sodium technologies and seems to apply even less to LEDs. A better metric would enable better prediction of glare, which would be of particular benefit to pedestrians. Right now, there's no glare metric that works for pedestrian lighting (see the DOE GATEWAY report

Pedestrian Friendly Outdoor Lighting).

That's because there's a difference between designing lighting for drivers — which has been the principal focus of manufacturers of outdoor lighting — and designing it for pedestrians. Pedestrians don't generally move as fast as drivers through the illuminated space, and their eyes are tracking across a larger area of the visual field. Pedestrians also usually sense glare from a different range of angles than drivers, who tend to encounter it from much further away due to the geometries of a typical vehicle and the characteristics of eye movement at higher speeds of travel. It used to be thought that glare couldn't be sensed from light sources above the field of view, but we now know that glare can be a problem at angles as high as 85° above a pedestrian's axis of view. Glare can be sensed even from directly overhead, if the pedestrian is glancing around the scene and looking upward (for example, at signs). So we need a different kind of glare standard for pedestrians than for drivers.

Various design and manufacturing techniques can reduce glare. For example, it can be accomplished with diffusers, although they decrease efficiency as well as the ability to tightly control the light distribution, which is one of the strong suits of LEDs. There's been some discussion about reducing glare in troffers by using more mid-brightness LEDs (MBLEDs) instead of fewer high-brightness LEDs (HBLEDs), thus spreading emission of the light over a larger area. But that may be harder to do with exterior lighting products, because of the larger quantities of lumens required. However, LEDs offer optical options and other opportunities that are brand-new to lighting, and it's even possible that, because LEDs are solid-state, they may end up enabling technological ways to mitigate glare that haven't previously been available with other types of lighting, and thus haven't even been conceived yet.

At LIGHTFAIR earlier this year, a number of manufacturers of LED outdoor lighting products told us that they consider glare to be an important issue and are working on improving visual comfort, and we saw some innovative products on display there that were clearly designed with pedestrians in mind — although admittedly we also saw quite a few glare bombs. With good luminaire design, glare can be very effectively controlled, and continuing gains in efficacy (DOE's SSL R&D Plan targets 250 lm/W by 2030) will only increase the ability of luminaire manufacturers to optimize both efficacy and comfort — addressing glare while still delivering high performance and exceptional energy efficiency.

As always, if you have questions or comments, you can reach us at postings@akoyaonline.com.