

## Wellesley Sports Lighting Questions

5/6/2021

Can you outline what the various impacts are that folks should be concerned about: Point source glare, spillage, etc.

*There are many considerations regarding sports lighting, but I'll address those specifically related to lighting. These include glare, light trespass, skyglow, and ecological.*

### **Light trespass**

The most often cited negative impact is light trespass, which is defined as light that impedes on neighboring properties. This can be measured with a light meter in lux or footcandles, but its negative impact is subjective, meaning that the same amount of light level can be perceived differently by different individuals. While light trespass can be mitigated by lighting design and blockage (Manmade (walls, fabric, etc.) or natural (trees, buildings, etc.)), it is primarily a matter of distance from the source and topography.

The range of impact varies from mild (noticeable glow on vertical surfaces) to high luminance that creates a distraction that reduces the enjoyment of being outdoors at night and requiring opaque drapes in bedrooms to sleep.

### **Glare**

Glare is a sensation of discomfort produced by a very high contrast light source. At night this is commonly caused by looking at the pinpoint light source in a lighting fixture (a bulb or LED lens). It is characterized by its intensity and measured in candelas. While there is no agreed metric for glare, it is categorized on a range from mild discomfort to disability. Like light trespass it too can be mitigated by lighting design and blockage (Manmade (walls, fabric, etc.) or natural (trees, buildings, etc.)) Unlike light trespass, its ability to be perceived as a nuisance at great distances can impact viewers in the direct line of sight from its source.

### **Skyglow**

Skyglow is the brightening of the night sky from artificial light sources. This occurs due to the scattering of light by particulate matter and moisture in the atmosphere and is exacerbated by elevated levels of both. Skyglow can be mitigated by focusing the light from fixtures below the horizon and reducing the total quantity of lumens emitted. While the majority of skyglow is created by light focused at or above the horizon, it can also be created by the reflection of light off surfaces like concrete and snow. The result of skyglow is the blotting out of stars and other celestial features like the Milky Way.

### **Ecological Impact**

Ecological impact is much harder to quantify but research shows is equally important. Light at night can significantly modify the nocturnal behavior of animals in foraging, migration, predation, mating, and the viability of offspring and mortality. Light at night can simultaneously advantage some species while disadvantaging others. It can create circadian disruption in all species of flora and fauna, including humans. Mitigation is difficult but can be reduced by using the proper spectrum of light and reducing the dose, timing, and duration.

*How are these measured and what are the current vs. proposed levels?*

Each issue has different metrics, but our report will focus on minimizing negative offsite impact while meeting IES RP-6-20 recommendations. <https://store.ies.org/product/rp-6-20-recommended-practice-lighting-sports-and-recreational-areas/>

*What is the anticipated energy savings converting from the existing to proposed fixtures? How would new stadium lights factor into the overall energy consumption? I know this would depend on schedule and controls, but in essence an average hourly energy consumption rate or savings?*

The energy savings will vary by field. Energy savings over tradition Metal Halide (MH) is typically 50%. However, LED is dimmable and adjusting the light output based on class of play may increase this savings substantially.

*Please outline the various controls available, and the importance of the commitment to monitor and adapt the controls.*

As mentioned in #3, reducing the light level to match the class of play (practice, competition, etc.) can reduce light levels and energy by up to 50% more than the base reduction using LED. In addition, the scheduling application can minimize unnecessary energy waste and neighborhood impact by making sure the lights are only on when needed.

*Could these be powered completely by renewable energy?*

Probably economically unfeasible for on-site, but many utility companies offer the customer to choose green energy source alternatives.

*How can we address the tree along 1<sup>st</sup> baseline of the multi-use field?*

I have discussed this with Musco and asked them to respond with options. As of now only one light on that pole is being blocked by foliage. It would be good to redesign the plan to remove or redirect it.

*How will pole placement impact existing features, including ground disturbance and the trees along Smith Street?*

That is also a question that I have posed to Musco. Both will probably need to move somewhat from the proposed locations.

*Can you summarize the impact on new lights on those houses along Smith? The new graphics show lights of >900. What does that mean in terms of new light?*

Unlike the other fields being converted to LED, the new installation at the stadium will produce new sources of potential glare and light trespass to residents on Smith Street. This will be exacerbated by the proximity of the pole locations. While the design that Musco is proposing should theoretically meet the IDA Community Friendly Outdoor Sports Lighting Program Design requirements, I believe that the “glare” metric of <1000 candelas at 150’ being used is too high.

Musco LED sports lighting fixtures are a significant improvement in controlling off-site light trespass, but any direct view of the light sources will be problematic and will be perceived as nuisance glare. This is another reason to strive to reduce the lighting levels to meet the class of play and only have them on when needed.

*Are existing lights dangerous/overly bright/cause too much glare for kids playing softball/baseball on those fields looking up in the outfield to catch a ball? (I've heard this mentioned at the PFTF)*

While lighting designs for sports fields try to place poles to minimize glare to the players, fans, and surrounding neighborhoods, each fixture produces very high luminance, and the direct view of a lamp will cause a sensation of glare due to the very high contrast ratio. While fans can avert their view, players will sometimes not be able to avoid looking in the direction of the lights while following the ball. This is unavoidable and something players will learn to adapt to over time.

*Can the glare/spillage of light onto the sidewalk and street be reduced/avoided altogether?*

Light trespass and glare from LED lighting fixtures will be reduced over traditional MH fixtures, but will not be eliminated in most cases.

*How significant an issue is the glare/light spillage of light onto the sidewalk and street in terms of safety for people driving and cycling by? (My sense is the light is quite a distraction/so overly bright it means people need to look away/wait for their eyes to adjust so can't fully see the road. It also seems particularly bad on foggy nights.)*

As the drivers and pedestrians are normally looking at a task area 90 degrees or more away from the direction of the lighting, it should have a minimal impact on distraction. I witnessed that the current light trespass from the tennis courts and multi-purpose field are increasing the light levels above IES RP-8-20 recommended minimums on the road so to probably make the streetlights nearby redundant. Fog exacerbates light trespass and skyglow considerably. Headlights also are less effective in fog.

*I've asked before, but some would like a definitive answer whether a few games with temporary lighting is possible. Can you confirm?*

I contacted Musco who is one of the few companies that advertise temporary events lighting but never got a response. They said that they sent a quote to the Playing Fields Task Force in October 2020. My conversation with several lighting designers that have used temporary lighting revealed that they were unhappy with the amount of glare produced by the lower mounting heights available with temporary lighting. It would also be expensive to install and pay daily rent on them for an extended period. They are really designed for single, limited duration events.

*Confirm whether you can pre-certify Dark sky compliant lights, or whether you would have to take measurements in the field post installation. In other words, are the new candela measurements purely theoretical?*

I plan to measure all aspects of the design after installation. If desired, you can contact IDA to apply for certification. My understanding is that it costs ~\$8000, plus travel.  
<https://www.darksky.org/our-work/lighting/lighting-for-industry/apply-osl/>

*Discuss ecological impact of new lighting in the wetland area to the east of the stadium?*

Adverse ecological impact from sports lighting is difficult to assess in general. It is somewhat mitigated by the limited hours of operation, but the blue-rich white light makes it a circadian disruption risk to animals close to the lighting. In rare instances, it could cause migratory bird attraction. There is available research that shows that exposure to all light at night can negatively impact flora by interrupting natural rest cycles. This impact varies from species to species but is evidenced by trees that either drop leaves early or are delayed. Both are attributed with negative impacts on tree health.

*What would be the cost of making each of the 3 fields 'dark sky' compliant vs. cost of just replacing lighting on existing poles, as well as his assessment of how far off we are from being compliant (not sure how he could describe so all could understand but it would help when we weigh cost of replacement.*

It is not possible to update existing MH installations to meet the IDA Community Friendly Outdoor Sports Lighting Program Design requirements. They were designed around LED lighting fixtures. The Reid Field installation was a later version of the MH technology that was about as good as you could do with MH to be dark sky friendly. This field would see minimal improvement with a LED retrofit, and it is still under the original warranty by Musco.

*Why are pre-qualification standards being established and/or what are pre-qualification standards going to be used for?*

We are developing the pre-qualification standards to ensure any bids meet our requirements designed to minimize off-site negative impact and quality lighting on the field.

*When I think of complaints, many centers around lights not going off when not in use and/or at the scheduled time. So, I'm interested in more sophisticated options for controlling lights including who can have control.*

Musco has a very good remote control and scheduling application that you currently are using for the existing fields. However as with many things, the devil is in the details. To minimize adverse impact and save the most energy it requires diligent maintenance of the calendar to make sure that the lights only come on when needed. This is an administrative issue best assigned to a paid staff person who can be held responsible for its accuracy.

*The life span of all the equipment is going to be of interest, as well as maintenance needs and costs.*

The Musco systems come with a 25-year warranty but LED systems may last longer than this with minimal repair costs.

*I've heard that taller poles allow for better control over where the light lands. I'm interested in the pros and cons of higher poles.*

There is an optimum pole height for every field, and they vary with each sport and topography. The fields that were installed previously and being proposed all are designed to this standard. Reducing the height will increase off-site glare and potentially reduce the quality of the lighting on the field. Increasing the height more than has been proposed will degrade the lighting on the field or potentially require more fixtures to meet RP-6-20 recommended lighting.

Regards,

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