PLACEVIEWS

PlaceWorks | Updated September 2016 (Previously November 2002)

BUILDING A NEW STADIUM?
CONTROL THE LIGHTS AND KEEP THE NEIGHBORS HAPPY

No matter where a school district builds a sports facility—established neighborhood, new residential development, rural area, or urban/wildland interface—lighting impacts are a concern. However, advances in lighting technology give school districts better options for reducing light and glare impacts. This PlaceViews discusses some of the strategies school districts can use to meet on-field lighting standards while reducing impacts on surrounding sensitive land uses.

LIGHTING 101

Measuring light is not like measuring water; it's more like measuring the effect of water—i.e., wetness. The total visible output of a light source is measured in *lumens*. This is similar to volume because if you obscure one side of the source, blocking part of the light, the amount of light radiating from the source decreases, and so do the lumens. Luminous intensity, measured in *candelas*, is (roughly) how bright a light shines in a specific direction. Lasers have high candelas in one direction but low lumens. Finally, illuminance is the amount of light on a surface and is measured in *foot-candles* or *lux*.[1] Distance from the source reduces foot-candles and candelas, but not lumens.

LIGHTING IMPACTS UNDER CEQA

Lighting impacts fall into three categories—spill light, glare, and sky glow.[2]

Spill Light is light that illuminates beyond the intended area and trespasses on adjacent property, usually because it has not been efficiently directed; it is generally considered unwanted light. Spill light is measured in foot-candles or lux.

Glare is an excessively bright light that reduces one's ability to see and can be uncomfortable and/or disabling. The severity of glare depends on the brightness, size, and position of the light source and on the contrast between the brightness of the light source and the surrounding environment. Glare is measured in candelas.

Sky Glow is light that is reflected into the night sky and reduces visibility of the sky and stars. It is particularly a problem in areas with observatories, but many other jurisdictions discourage or regulate it. Sky glow is measured in lumens.

The CEQA Guidelines address lighting impacts under aesthetic impacts. "Would the project…[c]reate a new source of substantial light or glare which would adversely affect day or nighttime views in the area?"[3]

Most jurisdictions do not have established thresholds for spill light or glare. When evaluating a proposed lighting project, school districts must first determine what constitutes "substantial light or glare" and then work to reduce those impacts.

Spill light and glare can also affect biological resources, particularly threatened and endangered wildlife. Lighting can confuse migrating birds, mammals, and fish; interfere with navigation by moon- and starlight; and even disrupt breeding patterns. Therefore, lighting impacts may need to be addressed with both aesthetic and biological impacts in a CEQA document.

Photo credit: Musco Sports Lighting LLC

LED LIGHTS

The latest technology for outdoor venues uses light-emitting diodes (LED), which have some advantages over metal halide and high-pressure sodium lights. They are more energy efficient and longer lived, give more consistent coverage, and don't release toxic substances. Their costs have come down over the years, but this is somewhat offset by the need for cooling systems, since heat decays LED performance and energy efficiency.

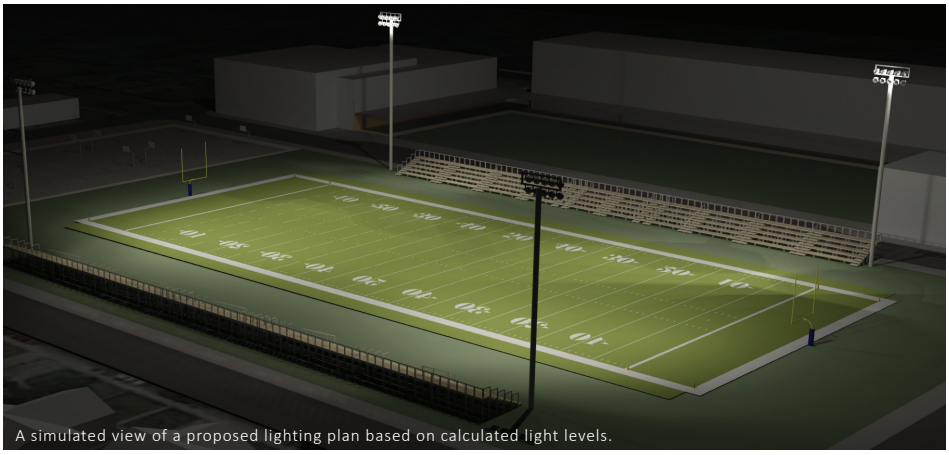
Another problem that only emerged after actual use involves color. The most energy-efficient LED white lights are typically heavy in the blue-light range, which makes them more resemble daylight, but has adverse effects at night. Blue light scatters more (that's why the sky looks blue) and travels farther, which intensifies direct and reflected glare, spill light, and sky glow. In general, people have reacted badly to LED lighting with a correlated color temperature (CCT) of 4000K and higher (i.e., high in the blue range), even in urban areas that already have high light levels at night.[4] Residents complain of glare and that the harshness of the light creates a "prison atmosphere."[5] In response, cities have had to add shielding, install dimming switches, or completely replace the lights.

Blue light also upsets circadian rhythms, which can have serious physiological effects. For people, this means sleep interference and lower-quality sleep. For animals—60 percent of which are nocturnal—this can be catastrophic. Blue light exacerbates the harmful effects of light pollution on wildlife and ecosystems described previously; it can even render habitat unusable.

For these reasons, LEDs should be chosen and installed with great care. Fixture angles and shielding should be appropriate for LEDs and specific to the CCT. Although high-blue LEDs are the most energy efficient, use the least amount of blue that will still serve your purpose. The American Medical Association's maximum recommended level is a CCT of 3000K for community lighting.[6]

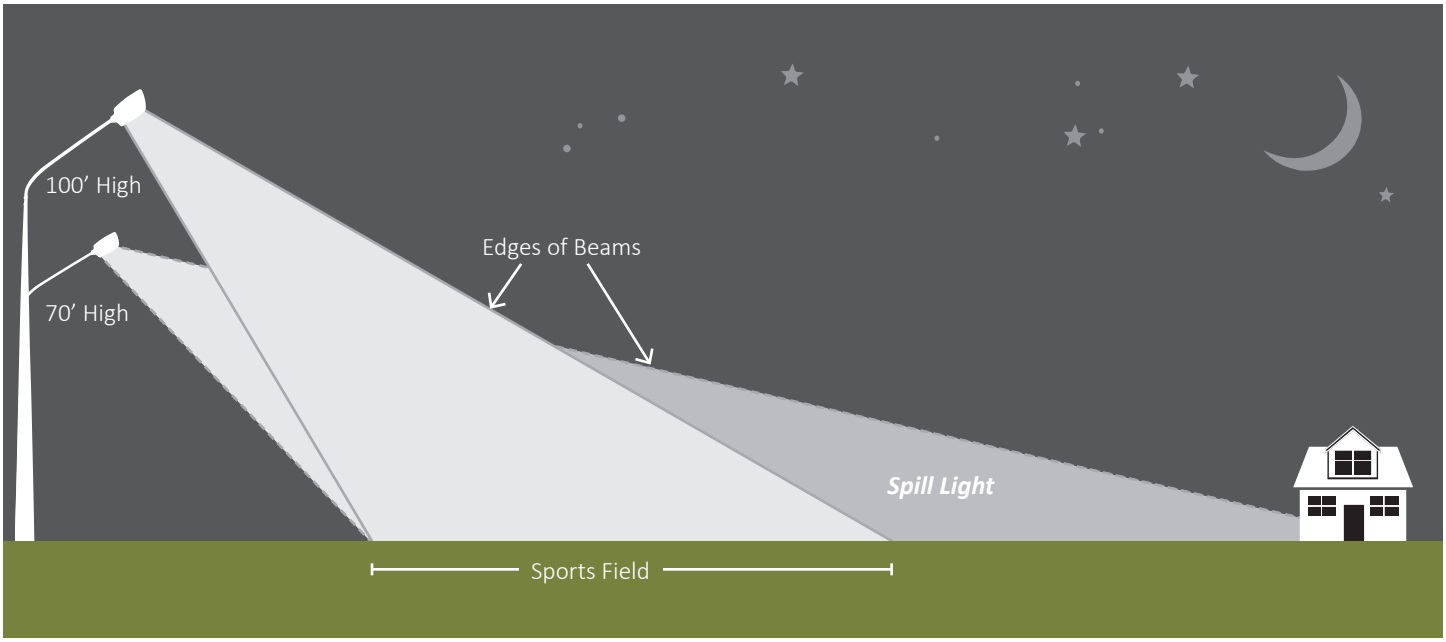
STRATEGIES TO REDUCE LIGHTING IMPACTS

Districts can control lighting impacts with a combination of technical and operational strategies, which have the added benefit of reducing costs for installation, infrastructure, and energy.



A simulated view of a proposed lighting plan based on calculated light levels.

Figure 1. Spill Light

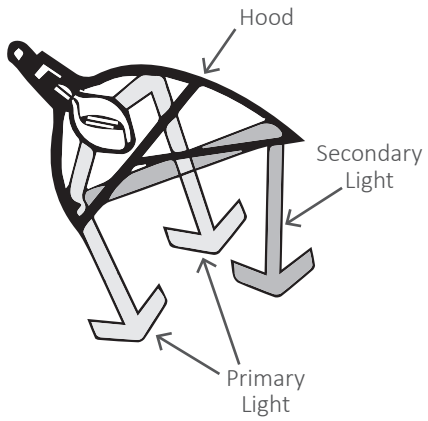


Technical Strategies. The type of light fixture, the height of the light poles, and the number and placement of the light poles on the play field can all be adjusted to control lighting impacts. One of the most effective ways to control spill light is to increase the height of the light poles. This gives more control in aiming light downward and away from surrounding properties (see Figure 1). However, taller poles may be more visible during the day. Districts can control glare by modifying fixtures with reflectors, hoods, and side shields that reflect light downward more effectively (see Figure 2).

Reflected light can also cause glare, so the surface of the play field is a factor in your lighting choices. The least reflective surfaces are grass and artificial turf, which are equally reflective (for all practical purposes). Asphalt is about twice as reflective as grass and turf, and concrete is about twice as reflective as asphalt.

Operational Strategies. School districts can also reduce light and glare by curtailing hours of operation to the heaviest nighttime use of the fields. Remote-controlled or automatic dimming and shut-off also reduce energy costs and lengthen lamp life. Regularly scheduled maintenance (cleaning reflectors and changing lamps) ensures the maximum possible lighting over the life of the lighting system.

Figure 2. Shielded Lighting

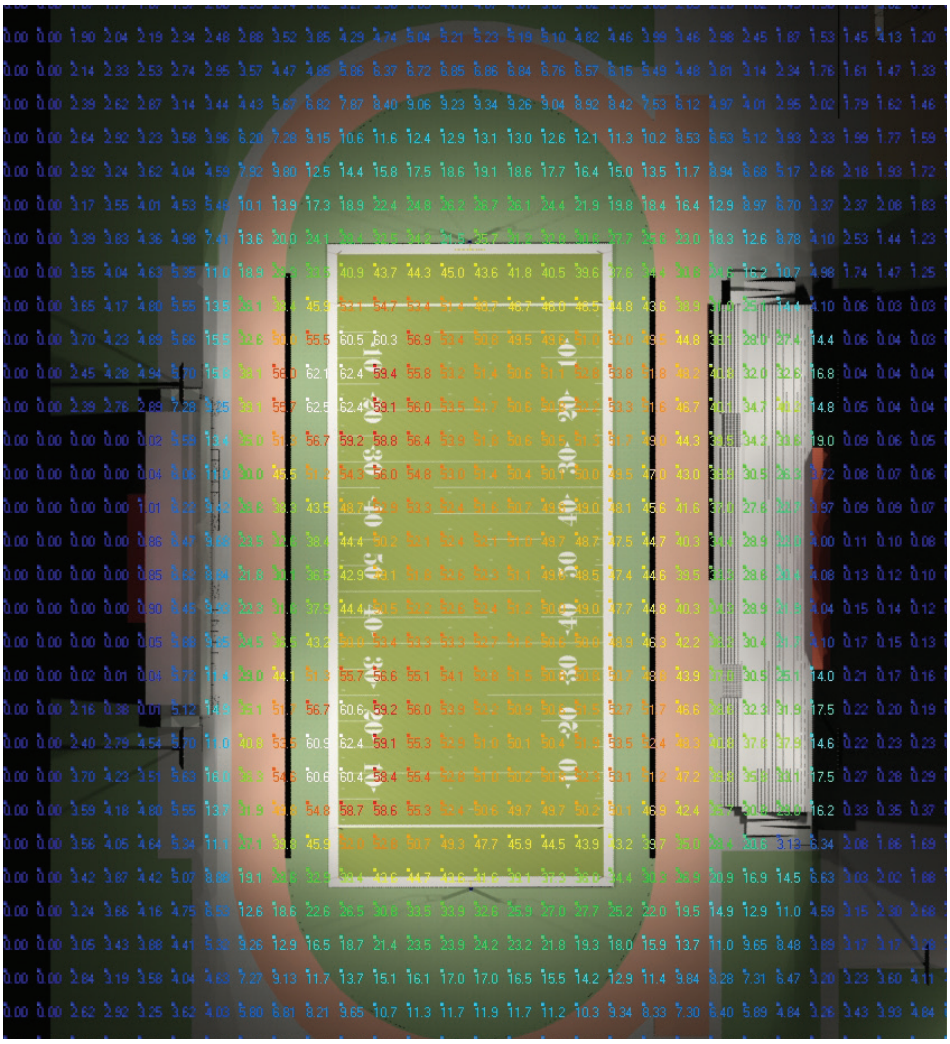


Source: Musco Sports Lighting LLC

RECOMMENDATIONS

- Adopt standards for field lighting and significance criteria for spill light and glare based on scientific and other professional standards.
- You will need a lighting specialist with the technical expertise to help choose lighting systems that minimize adverse light impacts. Specialists should be able to install and adjust light fixtures and work with contractors and civil engineers to reduce impacts.
- Match on-field lighting with the specific field use. Don't waste energy and create unnecessary impacts by overlighting for the expected use.
- Identify areas of potential conflict with neighboring sensitive uses in both man-made and natural environments.
- Calculate the illuminance at the property lines and across the play fields to adjust the location of poles, direction of light, and light intensity. Follow-up calculations can confirm that impacts are reduced to the maximum extent feasible and can be used in the CEQA document to illustrate analysis conclusions (see Figure 3).
- For effective mitigation measures, specify lamp types and the number and placement of light poles that maximize lighting on the field and reduce spill light and glare.

Figure 3. Simulation with Calculated Light Levels



PLACEWORKS

3 MACARTHUR PLACE, SUITE 1100
SANTA ANA, CA 92707

RETURN SERVICE REQUESTED

Endnotes

1. A lumen is a unit of light energy. A candela equals the light of one candle, approximately. A foot-candle is one lumen of light over one square foot. Lux is a metric unit, equal to one lumen per square meter.
2. Lighting definitions based on Musco Lighting's Technical Bulletin #TB0005.
3. Question I(d) in Appendix G of the State CEQA Guidelines (California Code of Regulations, Title 14, Chapter 3, Article 20).
4. CCT describes the color of a light source by temperature in degrees Kelvin (K). The lower the temperature, the warmer the color. Daylight is about 5780K; a standard incandescent light is about 2400K. Wikipedia, "Color Temperature," https://en.wikipedia.org/wiki/Color_temperature.
5. Council on Science and Public Health, "Human and Environmental Effects of Light Emitting Diode (LED) Community Lighting," CSAPH Report 2-A-16, American Medical Association, 2016, p. 3, http://darksky.org/wp-content/uploads/bsk-pdf-manager/AMA_Report_2016_60.pdf.
6. Council on Science and Public Health, "Human and Environmental Effects," p. 5.

PLACE**VIEWS** is published by PlaceWorks as a service to our clients and friends. This material is provided for general information purposes only and does not constitute legal advice. We are a private firm providing planning and environmental consulting services for both governmental agencies and the private sector. This newsletter and others are available on our website at **placeworks.com**.

This PLACE**VIEWS** was originally published in 2002, then revised and updated in 2016. PlaceWorks wishes to thank Karin Anderson of Musco Lighting for her expert input. For more information about Musco's services, contact:

Musco Lighting
15311 Barranca Parkway
Irvine, CA 92618
www.musco.com

Thanks to Barbara Heyman and Alice Houseworth, environmental planners, and Gina Froelich, editor, for assistance in writing this PLACE**VIEWS**.

Questions related to this PLACE**VIEWS** may be directed to:
Dwayne Mears, AICP, at 714.966.9220
dmears@placeworks.com