

Outdoor Lighting and Dark Skies

Message Points

- Illumination is fundamental to effective outdoor advertising, a round-the-clock mass communication medium
- Unreasonable limits on lighting hurt the traveling public, advertisers and public safety
- Billboard lighting is a tiny fraction of the overall ambient light level

In a mobile society, outdoor lighting is an essential part of commerce and security. Anti-lighting proponents seek to damage the effectiveness of illuminated outdoor advertising by placing arbitrary lighting limits. Restrictions on lighting undermine the business of outdoor advertising by requiring costly retro-fitting of sign structures or elimination of lighting fixtures.

Lighting on outdoor advertising structures is a tiny fraction of the overall ambient light level. A previous report by Lighting Sciences, Inc. concludes that most sky glow – some 96 percent – is produced by sources other than billboards. A summary of this report is enclosed as a reference.

Plus, a new generation of halogen lights is more efficient, requiring only two fixtures to illuminate a standard bulletin (14-by-48 foot billboard) rather than three or four fixtures. These new fixtures also direct the light more evenly onto the face of the bulletins, reducing ambient light spillage around a bulletin edges and also cutting energy consumption.

Digital Billboards

Based on a March, 2008, report by Lighting Sciences, Inc, Phoenix, AZ, the OAAA has recommended brightness criteria for digital billboards, suggesting that light produced by digital billboard structures should not exceed 0.3 footcandles over ambient light levels. Eight states have adopted this standard. Using the industry standard of 0.3 footcandles over ambient light levels, provides reasonable, objective method to achieve a site specific lighting requirement for digital billboards.

States with 0.3 foot candle criteria include:

- Colorado: 0.3 foot candles over ambient lighting levels*
- Massachusetts: 0.3 foot candles over ambient lighting levels
- Michigan: 0.3 foot candles over ambient lighting levels
- New Mexico: 0.3 foot candles over ambient lighting levels
- Oregon: 0.3 foot candles over ambient lighting levels
- Puerto Rico: 0.3 foot candles over ambient lighting levels
- Tennessee: 0.3 foot candles over ambient lighting levels
- Wyoming: 0.3 foot candles over ambient lighting levels

*(includes a back-up measurement of 300 Nits at night)

States with Candelas/Square meter (Nits) criteria or have proposed criteria include:

- West Virginia: candelas per square foot (note, not a nit), as follows:

Candelas/Sq Ft	Day	Night
Red	300	100
Green	600	200
Amber	450	150
Blue	800	350
White	550	50
All Color	650	250

- Arizona: 342 nits at night
- Missouri: 300 nits at night

States with Custom Criteria:

- Delaware: no maximum brightness level, but sign must adjust to ambient light changes
- Illinois: No brightness standards, but a letter from the manufacturer discussing the malfunction mechanism and hold time is required
- Mississippi: Sign must have “capability to adjust its intensity in response to ambient lighting conditions”

Light equals security

Illumination enhances public safety and security. Lack of adequate lighting can compromise safety, promote criminal activity, damage consumer confidence, and depress nighttime commerce.

State legislatures have rejected lighting restrictions

Numerous law-making bodies have considered, but rejected these proposals. (Michigan, Montana, Oregon, Washington, and Wyoming).

In 1999, New Mexico enacted the Night Sky Protection Act, which sought to strike a balance of preserving and enhancing the state's dark sky while promoting safety, security, and conserving energy. The Act exempts outdoor lighting fixtures on advertisement signs on interstates and federal-aid primary highways, as well as other lighting such as navigational lighting systems at airports.

References

OAAA Recommended Brightness Guidelines, based on a report from Dr. Ian Lewin, Principle, Lighting Sciences Incorporated, Scottsdale, AZ, March, 2008

“General Outdoor Advertising Lighting Guidelines,” Illuminating Engineering Society of North America (IESNA), 2003

“A Preliminary Estimation of the Impact of Billboard Lighting on Sky Glow,” *Executive Summary*, Ian Lewin, Ph.D, FIES, L.C., Lighting Sciences Inc., Phoenix, AZ

New Mexico Night Sky Protection Act, 1999

OAAA Recommended Brightness Guidelines

A. OAAA Guidelines: The OAAA recommended brightness criteria for digital billboards is as follows:

- Light produced by a digital billboard should not exceed 0.3 Footcandles over ambient light levels.
- Measurement should be taken utilizing a Footcandle meter from the following distances (perpendicular to the face of the digital billboard):
 - Posters: 150 feet
 - 10'6x36 Bulletins: 200 feet
 - 14x48 Bulletins: 250 feet
 - 20x60 Bulletins: 350 feet

The measurement distances are based on the average minimum viewing distances for each type of billboard.

- Digital billboards must have automatic dimming capability.

B. Basis for the Guidelines. These guidelines are based on recommendations by Dr. Ian Lewin of Lighting Sciences Inc. (Scottsdale, AZ) in a March, 2008 report to the OAAA. Dr. Lewin developed brightness criteria to meet the following general guidelines:

- Appropriately Legible Copy. Digital advertising copy is appropriately legible and not overly bright.
- Simplicity. Provide a guideline that can be easily implemented and enforced. Measurement of the ambient light level of the sign on and off is conducted by a footcandle meter. If the difference in measurements is less than 0.3 footcandles, the digital billboard is in compliance.
- Established Guidelines. The criteria is based on established scientific methodology and established industry standards from the Illuminating Engineering Society of North America (IESNA) publication TM-11-00 “light trespass” theory which is an accepted standard in the lighting industry.
- Flexibility. Ensure proper brightness levels in a variety of lighting environments.

C. Additional Issues/Clarification

- **Automatic Dimming Capability.** A digital billboard must be able to automatically adjust as ambient light levels change. An automatic light sensing device (such as photocell or similar technology) should be utilized for adjusting the digital billboard’s brightness. Sunset-sunrise tables and manual methods of controlling brightness are not acceptable as a primary means of controlling brightness.
- **Brightness Measurement Methodology.** The brightness standard requires the use of a Footcandle meter (also known as a “Lux meter”; ~\$100-1000). A Footcandle meter measures the amount of light arriving at the meter (illuminance), as opposed to an absolute measurement of the amount of light emanating from a light source or light sources (luminance). A Footcandle is a measure of lumens (light rays) that fall on one square foot area; Lux is the metric equivalent of a Footcandle.

- In contrast, a Candela Meter / NIT Gun (~\$3,000) measures the amount of light emanating from a specific light source (luminance). A NIT gun measures candelas (a measure of luminance or brightness) per meter squared (also known as “NITS”), which is a measure of the brightness emanating from a specific light source. It excludes ambient light (which may include light from many sources) from the measurement. Standard NIT levels and/or utilization of a NIT gun are not a part of the OAAA recommended brightness guideline.

General Outdoor Advertising Lighting Guidelines referenced by the Illuminating Engineering Society of North America (IESNA)

A billboard can be illuminated either by fixtures located in front of the sign (front lit), from behind the sign (back lit) or from fixtures mounted away from the sign (remote). Each mounting location will present different issues:

Front lit / Top Mount

- May increase installation cost due to need for additional structure elements.
- Orientation of the fixture may create veiling glare and direct glare to the viewer.
- May possibly reduce the sky glow.
- Increased maintenance cost.
- Location interferes with changing of the sign message.
- Interferes with use of embellishments or cutouts.
- Daytime shadowing will detract from the readability of the sign.

Front lit / Bottom Mount

- Ability to mount fixtures to catwalks eases maintenance.
- Properly designed optical system will minimize sky glow.
- Does not interfere with changing of the sign message.
- Does not interfere with the use of embellishments.
- No daytime shadowing.
- Light source less likely to create veiling glare.

Remote

- Light source able to cover larger sign surface.
- Maintenance may be easier when mounted on the ground.
- May require additional wiring and installation cost.
- May contribute to sky glow.

Back lit

- Requires significantly more luminaires to illuminate the sign.
- Depends on the transmittance characteristics of the vinyl.
- Increase maintenance and installation cost.

- Cost to produce the translucent vinyl media for backlight signs may be more expensive than traditional methods.
- Lamp sources used are typically less efficient and consume more energy.
- Sign face brightness depends on the transmittance characteristics of the vinyl or other face material.

The vast majority of outdoor advertising signs use a front-lit configuration. The proper position of the luminaire (either top or bottom) is greatly determined by the associated costs of owning and operating the billboard. The current standard light fixture for a billboard needs to be mounted 4 to 6 feet out and 1 to 3 feet above or below the display face and is designed to be mounted on 1-1/4" rigid conduit. (The differences in distance have to do with the size of the display area.) The use of catwalks to provide safety to the crew responsible to perform placement and removal of advertisements affords the billboard company a secure structural mounting location. These catwalks are, by need, 3 to 4 feet wide. The fixture is mounted just below the catwalk so that it does not interfere with the worker's movement in front of the billboard. This arrangement also serves to further support and brace the luminaires to hold them in proper positioning. All electrical gear is integral to the fixture thereby providing for ease of installation and maintenance.

The following points explain further the pros/cons of mounting of fixtures on signs.

The current design of the billboard structure does not provide a similar mounting method if the fixtures were to be mounted on top of the billboard. When the fixtures are placed on top of the display area a new set of engineering issues are created. Since there is no catwalk above the sign the light fixtures must be supported by another means. However the conduit is mounted to the structure it must be able to support the weight of the fixture on an arm that is long enough to position the fixture in its proper location (above and in front of the sign face). In this application the amount of weight placed on the base of the conduit would run from 192 lbs to 288 lbs. The inherent vibration of the structure from any wind movement will increase substantially the deflection of the fixture creating a "live load." This will multiply the load on the conduit by a factor of 50%. This increase in weight and stress will accelerate the metal fatigue and may more frequently result in failure.

Another issue that must be taken into consideration when placing luminaires is the use of embellishments. The embellishment, or cutout, most always used at the top of the billboard, may extend the graphic surface up to an additional 4 to 5 feet. The use of top mounted lights will be in direct conflict whenever trying to use embellishments.

The location of the luminaires will also impact the ability of the outdoor company to change the messages on the sign. Traditionally, the sign message is "rolled" across the sign face. The ability of the installers to

perform this task quickly and safely (on signs that could be up to 150' in the air) will be hindered if fixtures and/or additional hardware are positioned at the top of the sign.

The presence of overhead lighting will also create a shadow on the sign during daylight hours. This shadowing will detract from the message and therefore diminish the economic value the sign offers to the customer.

A top mounted fixture will also increase costs of operation due to servicing issues. The fixture can either be installed on a retractable arm or installed on a permanent basis. The first method increases installation costs substantially while the second suffers from the challenges mentioned in the switching of the message and the proper support of the luminaires. In some instances, such as a remote location that does not provide access, a bucket truck may not be able to gain access to the permanent top mount fixture. Changing any of the components becomes a safety issue. The traditional location of the fixture allows for maintenance to be performed without increase risk to the installer as well as no additional costs in equipment by the owner. Any other method will increase operating costs and therefore cost to the consumer.

Types of luminaires

When choosing the type of fixture to use for billboard lighting it is important to understand the performance features of the type of fixtures available. The ability to control light is accomplished by the types of reflectors and refractors used.

A Preliminary Estimation of the Impact of Billboard Lighting on Sky Glow

(Executive Summary), Lighting Sciences Inc., Phoenix, AZ

By Ian Lewin, Ph.D, FIES L.C.

Sky glow is caused by lighting at night entering the atmosphere and being scattered by airborne particles. Sky glow may result from the use of lighting fixtures that emit light above a horizontal plane so that it enters the atmosphere directly. The effect also is caused by light reflecting from lighted objects, such as road surface or a billboard.

This study has evaluated the amount of light entering the atmosphere from a variety of lighting installations. Measured in “sky lumens,” the results allow a comparison to be made of different lighting systems relative to sky glow. Specifically, calculations have been made to compare the sky lumens produced by a typical billboard lighting system to the sky lumens caused by roadway and parking lot lighting.

Various scenarios have been used for the roadway lighting, combining residential and major highway lighting in a typical neighborhood. Areas have been considered that consist only of roadway lighting, as well as areas that contain both roadway and parking lot lighting.

The results of the study support a conclusion that the vast majority of sky glow is a product of urban development. Even where full cut-off fixtures are used on all roadway and parking lot fixtures, and if there is an average of one billboard per square mile, over 96% of the sky glow produced per urban square mile is from those sources and not billboard lighting, for the conditions examined. For the examples considered, a single three fixture billboard lighting systems produces approximately 2 to 3 % of the sky lumens caused by roadway/parking area lighting in a typical one square mile area. For a four fixture billboard lighting system, the range becomes roughly 2.5 to 4 %. These figures can be prorated. For example, if there are two such billboards per square mile, the percentages are doubled; if there is one such billboard per two square miles, the percentages will be halved.

The exact percentages of sky glow are affected by the density of roadways/parking areas, the type of lighting fixtures used and the lighting level provided, among other factors. However, it is apparent that for the scenarios considered, the contribution of billboard lighting to sky glow is small in comparison to that from other sources of lighting. The other sources produce 96 to 98% of sky glow, compared to the 2 to 4 % produced per billboard in the example urban square mile.

Highlights of the New Mexico Night Sky Protection Act

Enacted by the 1999 Legislature and signed into law by Governor Gary Johnson on April 6, 1999, the Night Sky Protection Act regulates outdoor night lighting fixtures to preserve and enhance the state's dark sky while promoting safety, conserving energy and preserving the environment for astronomy. Outdoor lighting fixtures includes permanent or portable outdoor artificial illuminating devices such as searchlights, spot and floodlights, architectural and landscape lighting, parking lot, billboard, and street lighting. In addition to the specific provisions outlined below, the Act specifically prohibits the sale and installation of mercury vapor outdoor lighting fixtures after January 1, 2000.

Provisions of the Night Sky Protection Act will impact night lighting as follows:

MERCURY VAPOR LIGHTING FIXTURES

No new mercury vapor outdoor lighting fixtures shall be sold or installed after January 1, 2000.

SHIELDING OF OUTDOOR LIGHT FIXTURES

All outdoor lighting fixtures installed after January 1, 2000, shall be shielded, except incandescent fixtures of one hundred fifty watts or less and other sources of seventy watts or less.

A shielded light fixture is shielded such that light rays emitted by the fixture, either directly from the lamp or indirectly from the fixture, are projected below a horizontal plane running through the lowest point on the fixture where light is emitted.

NONCONFORMING LIGHT FIXTURES

In addition to other exemptions provided in the Night Sky Protection Act, an outdoor lighting fixture not meeting these provisions shall be allowed if the fixture is extinguished by an automatic shutoff device from 11:00 p.m. to sunrise.

No outdoor recreational facility, whether public or private, shall be illuminated after 11:00 p.m. except for a national or international tournament or to conclude any recreational or sporting event or other activity conducted, which is in progress prior to 11:00 p.m. at a ballpark, outdoor amphitheater, arena or similar facility.

EXEMPTIONS

The following are exempt from the requirements of the Night Sky Protection Act:

1. An outdoor lighting fixture on advertisement signs on interstates and federal primary highways.
2. Outdoor lighting fixtures existing and legally installed prior to the effective date of the Night Sky Protection Act. However, when the existing lighting fixtures become unrepairable, their replacements are subject to all provisions of the Night Sky Protection Act.

3. Navigational lighting systems at airports and other lighting necessary for aircraft safety.

4. Outdoor lighting fixtures are necessary for worker safety at farms, ranches, dairies, feedlots or industrial, mining or oil and gas facilities.

The provisions of the Night Sky Protection Act are cumulative and supplemental and shall not apply within any county or municipality that, by ordinance or resolution, has adopted provisions restricting light pollution that are equal to or more stringent than the provisions of the Night Sky Protection Act.