



Indoor lighting for the Metrodome in Minneapolis, MN. Light levels of 200 to 300 footcandles are necessary for good color rendition of television transmission.

ights are to night time sporting events what coffee is to breakfast. From professional athletic contests, with television revenue in the balance, to youth leagues that must run when parents and coaches are not working, night games are not just a pleasant reality — they're a necessity.

Sports lighting design philosophy is basic to quality lighting. A number of considerations must be balanced when determining the best design for a given facility. At the heart of these are two basic questions that must be addressed:

1. What requirements must the lighting system fulfill?

2. What outside factors need to be added to the design equation to make the project acceptable?

Lighting Level Requirements

Lighting levels are recorded in footcandles. Sunshine, for example, is generally 8,000 footcandles during summer daylight hours. Moonlight, on the other hand, is .01 footcandles.

Acceptable lighting for most athlet-

ic events, from the standpoint of participants, is 30 footcandles. Footcandle levels greater than 30 are generally implemented to fulfill other requirements, such as:

• 500 footcandles for boxing. Certainly, this level of lighting is not necessary for the participants, but necessary for the spectators' requirements for viewing high-speed action.

• 200-300 footcandles for network television. This helps provide good color rendition for television transmission.

100 footcandles for large stadium



facilities.

• 70-50 footcandles (standard) for Class A or below-minor-league baseball franchises.

• 30 footcandles for recreational participation lighting and smaller athletic facilities where there are less than 2,000 spectators, and the mounting structures are located less than 80 feet from the area to be lighted.

On some athletic field, notably baseball and softball, there are two levels of lighting—one for the infield and one for the outfield. A major league stadium may be 300 footcandles infield and 200 footcandles outfield. The newest minimum standards for minor league baseball are 100 footcandles infield and 70 footcandles outfield for AAA and AA levels. All other levels are 70 footcandles for the infield and 50 footcandles for the outfield. Little League has upgrade its recommended lighting levels for tournament sites from 30/20 to 50/30. Recreational lighting is 30/20.

Uniformity Of Lighting Levels

The other factor in determining good lighting quality is the uniformity ratio, which establishes the "smoothness" of lighting. Uniformity is based upon the comparison of the darkest location to the brightest location of the area to be lighted.

Recreational and participant requirements are met with a 3:1 ratio. When the facility requires 50-plus-footcandle lighting, it should have a uniformity ratio of 2:1 or better.

The newest AAA baseball lighting level requirements of 100 footcandles in the infield has a 1.2:1 uniformity ratio. Generally speaking, a uniformity ratio of 3:1 is necessary for smaller facilities and recreational facilities, while 2:1 is acceptable for larger facilities.

Once lighting and uniformity levels are established, lighting design for a facility can proceed. However, but there are two other primary factors to consider: economics and environment.

Economics

Sports lighting has use has grown and improved steadily since the first fields were lighted in the 1930s. Initially, the objective was to provide sufficient light for players to see and participate in the game. The major cost producers were power and the number of floodlights required. Major League stadiums, for example, required more than 1,000 floodlights, even before the advent of television.

All this changed with the introduction of the metal halide lamp. A rule of thumb for conversion from 1,500-watt incandescent lamps to 1,500-watt metal halide lamps is twice the light level with half the number of flood lights.

The other benefit of the metal halide lamp is the increase in lamp life. Incandescent lamps are frequently run above their average voltage to get more light and reduce the number of floodlights. This results in lamp lives from 300 to 600 hours. The lamp replacement cycle varies, but is usually less than five years. Metal halide, 1,500-watt lamps last 3,000 hours—translating to lamp life of 25 to 50 years. For sports lighting systems where the annual usage is around 100 hours, the lamps may never require replacement

The metal halide lamp requires a ballast. A well-designed ballast, operated within its design temperature, can last 100,000 hours. The manufacturer will guarantee the ballast for a minimum of *continued on page 12*



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Field Lighting: Illuminating Experiences

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five years. The reduction in systems power and maintenance cost has been a bonanza for municipal park and recreation departments that are short on funds.

One notable trend with economic ramifications in sports lighting is the packaged system. Sports lighting system suppliers offer standard systems to suit fields of various shape and sizes. All the necessary equipment and installation instructions are provided. A reduction in overall cost is realized through this system design approach, which integrates poles, floodlights, crossarms, and wiring into a package. This eliminates "duplication" that might result if the pieces were bought separately and enables the contractor to install the system in less than two days, providing that direct-burial poles are used.

At this point, it's important to address a major issue facing the sport lighting industry. Several major suppliers of sports lighting have created definitions utilized in lighting design that are contrary to existing lighting standards. Until recently, the accepted definition of the lighting industry's standard were established by the Illuminating Engineering Society of North America. Now there are several standards, which once again have significant economic ramifications.

SPORTS LIGHTING SYSTEM SUPPLIERS OFFER STANDARD SYSTEMS TO SUIT FIELDS OF VARIOUS SHAPE AND SIZES.

This confusion can be both illustrated and remedied very easily by addressing two items that are vital to establishing a design criteria:

1. In determining the lumen (light) output of a lamp, calculations should be based

upon the established lumen output of the lamp manufacturer *after* 100 hours of operation. This is critical because there is a greater lumen loss in the first 100 hours than in the next 2,900 hours. Therefore, to measure light levels attained *in the initial hours of operation is a gross distortion of the lighting levels at which the system will operate during the majority of the life of the system.* Calculations should be based on the manufacturer's published lumen output after 40 percent of the life expectancy of the lamp. This is called "Maintained Footcandles" by lighting industry standards, but not all sports lighting manufacturers follow this definition. That makes it necessary to define terms such as "maintained" and "initial" by stating that design calculations should be based upon lumen output at a specified time in of the life span of the lamp.

2. In some sports, notably baseball, softball, and tennis, the playing areas include spaces outside the actual playing area. Therefore, the entire area to be covered in the design should be spelled out. And again, the I.E.S. standards call for a baseball area to include territory outside of the actual playing area, both the infield and the outfield. Though it may be decided in recreational facilities, as an example, that this is overlighting, some clearly understandable definition of the area to be lighted should be applied.

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There are several things happening to improve sports lighting systems. For example, metal halide lamps are being designed specifically for sports lighting. This has resulted in greater efficiency and higher light output. The 1,650watt metal halide lamp uses 10 percent more power, but reduces floodlight requirement 20 percent, compared to 1,500-watt lamps. Other lamp improvements increase the lamp life and are useful for high-use systems. Newer types of lamps being designed produce higher floodlight efficiency and better beam control.

Environment

"Spill light" into adjacent properties from lighted ball fields is a continuing problem. Many sports, particularly baseball and softball, require some light above the height of the pole. Without this light, a ball hit high over second base will only be lighted by the reflected light off the field, which is usually very low. Although sports lighting systems are being designed to minimize the problem, it will never disappear completely. Pole locations, aiming, and control features all help alleviate spill light.

Floodlights are being designed for

BEAR IN MIND THAT A LIGHTED SPORTS FIELD IS 1,000 TIMES BRIGHTER THAN A RESIDENTIAL NEIGHBORHOOD.

reduced "spill light" into adjacent property and lower brightness for the players. Other innovations have been used to alleviate various problems. Special lamp shields, for example, were used on the infield poles for the new Camden Yards Stadium in Baltimore, home of the Orioles. The shields reduced glare for the outfield players, making it easier to follow the ball.

Computer-aided design makes it possible to calculate the light level on the ball from any direction and location within the playing area. Lighting designs can now address the visibility of the ball from any player location. The reduction of visibility due to floodlight brightness can also be estimated, but at present time no specific visibility standards exist. Computer programs exist that could make these calculations once the parameters are established.

Bear in mind, however, that a lighted sports field is 1,000 times brighter than a residential neighborhood and at least 30 times brighter than a well-lighted commercial parking lot. That makes the very presence of a ball field in a residential setting a problem. And there is no single answer to it—the best solutions to the problem come from knowing the location of surrounding homes and solving stray light problems individually.

Developments in sports lighting will surely continue. The push will come from sport lighting system manufacturers, complimented by recommendations from the Illuminating Engineering Society Sports Lighting Committee. The result will be better visibility for the players and fans, without inconveniencing surrounding communities, so that sports action can continue after the sun goes down. \Box

Editor's Note: Chuck Lindstrom is the president of Universal Sports Lighting, Inc., based in Lincoln, IL.

