

# LIGHTING STANDARDS FOR PARKS AND RELATED PUBLIC FACILITIES

## 1. ATHLETIC FIELD AND COURT LIGHTING STANDARDS

### SUBJECT

LIGHTING STANDARDS FOR THE NEW CONSTRUCTION AND RETROFITTING OF OUTDOOR RECREATIONAL ATHLETIC FIELDS LIGHTS

### PURPOSE

To provide standards by which architects, engineers, City staff shall plan the lighting design criteria for recreational athletic fields such as baseball, softball, soccer, football, basketball, tennis and other similar facilities, which may be developed within the City of Moreno Valley. These standards are designed to:

- a. Provide a safe lighting system for the welfare of participants and spectators, and
- b. Mitigate the environmental impact of recreational athletic field lighting on the community, and
- c. Ensure that the standards established continue to be met over the life of the lighting system, as well as during the planning and initial installation.

### POLICY

The Director of Parks and Community Services or designee shall ensure that the planning and implementation of lighting for recreational athletic fields is in conformance with the following standards as they apply to facilities which may be proposed, developed, retrofitted, or constructed.

#### I. PLAYER/SPECTATOR SAFETY

To provide for the welfare of participants and spectators, the following guidelines shall apply:

##### A. Maximum Lighting

The maximum lighting value that shall be used in lighting recreational athletic fields shall be an average maintained 50 foot-candles (see Annotation A), as measured in the horizontal plane on the inbound portion of the playing field as defined in the City of Moreno Valley Parks and Community Services Athletic Field and Court Standards.

##### B. Minimum Lighting

The average minimum planned maintained light levels for recreational athletic fields are defined in the Moreno Valley Parks and Community Services Athletic Field and Court Standards.

**C. Guidelines**

Ninety-foot baseball fields are recommended to be lighted to a maintained level of 50 foot-candles horizontal on the infield and 30 foot-candles horizontal on the outfield. All other baseball and softball facilities are recommended to be lighted to 30 foot-candles maintained horizontal on the infield and 20 foot-candles maintained horizontal on the outfield. Tennis courts are to be lighted at 50 foot-candles measured at the net and 30 foot-candles measured at the baseline. Other types of recreational athletic fields are recommended to be lighted a minimum of 30 foot-candles maintained horizontal over the playing surface.

**D. On-Field Measurement Criteria**

1. Horizontal Foot Candles

Determining the method of measuring the horizontal foot-candles shall be the maximum footcandle light value which would occur on a light meter held in the horizontal position with the light sensitive surface of the meter located between 3 and 5 feet above the surface to be measured.

2. Maintaining Light Definition

Planning or maintained light levels for the purposes of this policy shall allow for IES light loss factors by using .80 of the rated lumens as the assumed maintained light output of the 1500 or 1000 watt metal halide lamps (see Annotation B).

**E. Quality of Lighting**

Facilities shall be planned with lighting uniformity not to exceed deviation of 3 to 1 when comparing the brightest to the darkest spot on the designated playing area, except that baseball and softball fields shall have a 3 to 1 measurement for the outfield portion, but shall have a measurement of 2 to 1 of uniformity on the infield.

Additionally, smoothness of lighting shall be evaluated to meet a standard not exceeding a 15% deviation in a 10 foot distance, except as the light values reduce at the end of the field (see Annotation C).

**F. Spectator Facilities**

Specialized applications with large spectator facilities may be granted permission to operate at specially-approved light levels greater than those provided for herein after proper public hearing to determine the appropriate light levels necessary for spectators.

## II. ENVIRONMENTAL CONTROL

The luminaries used to provide light on the recreational athletic fields shall include reflectors and application technology designed to protect the environment surrounding the facility and the Palomar Observatory from the impact of glare and spill lights.

### A. Glare and Spill Criteria

#### 1. Spill Light

The optimum foot-candle level five (5) feet from the property line of the facility upon which the planned lighted recreational athletic fields are located should not exceed twenty-five one-hundredths (.25) foot-candles. Due to geographic difficulties or areas that require higher lighting levels for security, a maximum output of five-tenths (0.5) foot-candles of light at ground level at property line may be utilized. Where the adjacent property line is another City facility, the foot-candles may exceed the maximum requirements.

The maximum foot-candle level for the purpose of measuring spill light is defined as the maximum foot-candle light value that would occur on a light meter located between 3 and 5 feet above the surface. The light-sensitive surface of the meter should be aimed at the light sources of greater intensity as viewed from that location.

This policy assumes that no playing surface area is closer than 50 feet to the property line of residential units. In the event any playing surface is closer than 50 feet to the property line of residential units. Ambient light shall not be included (see Annotation D).

#### 2. Glare Light

When viewed from any location outside the property line of the property on which the fields are to be lighted under the proposed plan, the maximum acceptable glare shall be determined by the following candlepower limitations at the light source:

- Individual Fixtures. For any single fixture, the maximum candlepower shall not exceed 12,000 candlepower.
- Total Fixtures on Pole. When the cumulative total of the candlepower of all the luminaries on any single pole for the luminaries aimed at any one field exceeds 30,000 candlepower, then the average of all the fixtures aimed at measurement point, on the single pole, shall not exceed 4,000 candlepower per fixture.

At any location where the property line of residential units is less than 50 feet from the playing surface.

The single value candlepower curve shall be calculated with all the fixtures on the individual field simultaneously illuminated and with all fixtures aligned as they are proposed to be aligned for the final installation.

3. Extended Spill Light Scan

The manufacturer of the lighting equipment shall also submit a numeric simulation of the maximum foot-candles as determined for spill light measurement for a distance of 500 feet each direction from home base for softball and baseball fields, or from the approximate center of other types of fields with light values shown on 50-foot increments. This light scan shall be run with all the lights operating on the applicable field.

Where applicable, the City of Moreno Valley may request the extended maximum foot-candle scans to be provided for purposes of determining spill light, in which all fields are assumed to be simultaneously illuminated to determine the cumulative effect of the spill light of the fields.

4. Extended Glare Light Scan

The manufacturer shall also, upon request, submit with the plan an extended numeric model for each to determine the sufficiency of the equipment to achieve the designed performance of the plan.

**B. Equipment Criteria**

To assure that the proposed recreation and athletic field lighting is capable of meeting the criteria set out in this policy; the luminaries to be used must meet the following minimum performance criteria:

1. Arc Tube Brightness

No portion of any arc tube shall be visible beyond 12 degrees vertical and 35 degrees horizontal measured from the maximum candlepower point of any fixture.

2. Output of Light Beam

The candlepower from the fixture above the maximum candlepower axis of the fixture shall not exceed the candlepower quantity at the specified degree measured in a vertical plane above the maximum candlepower axis as follows:

<b>Nema Type Reflector for Vertical</b>	<b>Candlepower</b>	<b>Degrees above Maximum Candlepower In Vertical Plan</b>
Nema 2	12,000	18 degrees
Nema 3	12,000	20 degrees
Nema 4	12,000	22 degrees
Nema 5	12,000	28 degrees
Nema 6	12,000	34 degrees

All new construction or retrofitted fields shall have glare and spill controls in the construction of the lighting. Glare control shall include a requirement that no light rays may emanate from the luminaries above horizontal in a direct manner.

**C. Application Criteria**

The maximum candlepower aiming point of each luminary used in lighting recreational athletic fields shall, as a minimum requirement, be aimed at least 25 degrees down from horizontal. Furthermore, as additional criteria for the aiming of fixtures, it shall be a requirement that any axis line from the fixture where the output of the fixture is 12,000 candlepower or more, that line shall be aligned down from horizontal a sufficient number of degrees to strike the surface so as to meet the glare criteria of this standard.

**D. Submittal Documents**

Plans for lighting recreational athletic fields shall include with their submittal for approval a numerical model that shows compliance with these guidelines and shall describe their compliance in the following manner, and shall each be presented on documents using 1 inch equals 200 feet.

1. Glare and Spill Documents

- a. Isocandela Curve of Total Candlepower–To establish a numerical model from which glare and spill control can be evaluated, there shall be provided with the lighting plan the plot of a line showing the total candlepower around the field at a uniform quantity of candlepower determined by multiplying the number of fixtures illuminating the field times the quantity of 2,000 (see Annotation E).

The single value candlepower curve shall be calculated with all the fixtures on the individual field simultaneously illuminated and with all fixtures aligned as they are proposed to be aligned for the final installation.

- b. Extended Spill Light Scans—There shall also be submitted a numeric simulation of the maximum foot-candles as determined for spill light measurement for a distance of 500 feet each direction, from home base for softball and baseball fields or from the appropriate center of other types of increments. This light scan shall be run with all the lights operating on the applicable field.

Where applicable, the City of Moreno Valley may request the extended maximum foot-candle scans to be provided for purposes of determining spill light in which all fields are assumed to be simultaneously illuminated to determine the cumulative effect of the spill light of the fields.

## 2. Equipment Criteria

There shall be submitted with each proposed recreation and athletic field lighting project a written statement signed by the manufacturer, which provides the information as to degrees above vertical from a MAXIMUM candlepower, at which the candlepower output ceases to exceed 12,000 candlepower from the vertical plane above the maximum candlepower and in a vertical plane 15 degrees to the right or left of the maximum candlepower, which documentation shall establish that the equipment meets or exceeds the criteria set out above the equipment. The City of Irvine may, at its discretion, require a demonstration of the proposed lighting equipment to confirm the submittal documents.

## 3. Application Criteria

For proposed recreation and athletic field lighting projects, there shall be submitted a scale drawing showing the following information:

- a. The location and height of each pole.
- b. The number of light fixtures to be located on each pole.
- c. The point on the ground where the max candlepower of each fixture is to be aimed.
- d. The horizontal and vertical aiming angles for each fixture to that max candlepower aiming point.
- e. The point on the ground where each fixture reaches 12,000 candlepower at the greatest angle in which that occurs above the max candlepower aiming point.
- f. The vertical and horizontal degrees from each fixture to that 12,000 candlepower point.

### **III. EVALUATING GLARE AND SPILL CRITERIA RESULTS**

The science of lighting is such that there is a direct fixed relationship between candlepower, glare, and foot-candles at any specifically defined point.

The most clearly determined measurement and the most convenient measurement is the foot-candle reading at a given point. Accordingly, the primary method of evaluating the glare and spill performance criteria shall be to test the foot-candle numbers provided on the extended spill lighting scan against actual readings at the designated location.

To confirm the correlation between the isocandela curve of the candlepower and the extended light scan of foot-candle readings, the City may require the specific candlepower calculations and foot-candle calculation for a sampling of the locations around the facility so that it may be determined that the various points are mathematically and scientifically consistent.

The City may additionally, at its discretion, further require additional candlepower information to permit direct testing of candlepower at specific off-site locations through the use of a candlepower measuring device.

### **IV. LONG-TERM PERFORMANCE**

The performance guidelines established herein for the lighting of recreational athletic fields need to be adhered to, not only in the planning stage and the initial installation stage, but also during the life of the equipment on the facility. Accordingly, the following standards must be provided for in plans for the lighting of the facility and adhered to upon installation.

#### **A. Reflector Surfaces**

Details of the design of the luminaries and the luminary assembly shall be sufficient to show the nature of the materials to be used in the construction of the luminary and that the materials are properly selected and applied that the effect they achieve on glare and spill control on the surfaces of the reflector can be sustained in the environment of wind, heat, air, and ultraviolet sunlight to which the equipment will be subjected.

#### **B. Mechanical Alignment**

Sufficient design details of the luminary assembly shall be provided to show that the mechanical alignment of the luminary assembly has sufficient structural strength of materials and connecting methods to provide that the system will remain accurately aligned in winds of 125 miles per hour with a gust factor of 1.3, such that the glare and spill control standards will be maintained over the life of the equipment.

## **V. PROCEDURES**

The following steps shall be followed to ensure that new construction or retrofitted lighting complies with these standards for recreation and athletic uses in City parks:

### **A. ARCHITECTS**

These standards shall be provided to architectural firms who are proposing to provide design for new lighting systems.

The following should be carefully considered in the design of parks with lighted recreation athletic fields:

1. Pole heights shall be maximized to ease or improve upon the environmental control parameters of these standards.
2. Pole placement shall be such that each field is illuminated from adjacent poles surrounding that field.
3. Lights shall be placed on crossarms at the top of poles, rather than spaced vertically along poles. Multiple crossarms, placed immediately below the top arm may be used where warranted by the number of lights.
4. Park or field boundaries shall have berms and/or landscaping to minimize the visibility of the illuminated playing field from adjacent streets and residential property lines.

### **B. LIGHTING CONSULTANT**

A lighting consultant with experience in spill and glare control compliance may be required to provide documentation of compliance assurance in the master plan approval process, as well as to ensure proper construction to meet the specifications.

### **C. EXCEPTIONS TO STANDARDS**

In order that the provisions of this policy may be reasonably applied in instances where difficulties exist and unnecessary hardship would result to recreational athletic fields due to an inability to light a facility in an otherwise reasonable location, then an appeal may be made to the Parks and Recreation Commission for recommendations to the City Council. Only the City Council shall waive provisions of this policy.

### **D. ANNOTATION**

1. The annotations included with this policy are intended to describe the technology that is to be utilized in achieving the standards established in this policy.



## **ANNOTATION A - MAXIMUM HORIZONTAL FOOT-CANDLES**

The maximum glare and spill light levels have been set, based upon the combination of the available glare and spill technology and the desired light requirements for the facility, as stated in horizontal foot-candles. However, since maximum light values are established for environmental protection and since, for purposes of environmental protection, the light values as viewed from the off premise locations are not directly affected by the horizontal foot-candles, therefore, only the glare, which is measured in candlepower, and the spill light, which is measured in foot-candles at or outside the property line, shall be ultimately determinative of the impact of maximum light values. Accordingly, the maximum horizontal foot-candle guidelines for the playing field are advisory only as to glare and spill control. The candlepower limitations for glare and the foot-candle limitations for spill light, established elsewhere in this policy are the governing guidelines for environmental control of light.

## **ANNOTATION B - MAINTAINED LIGHT VALUES**

Current manufacturers' lamp catalogue publications list the initial lumen output as 155,000 lumens to 162,000 lumens for the various manufacturers. Test results available, and published manufacturers' charts for depreciation of lamps offer somewhat varying allowances for the amount and rate of depreciation of the lamps.

The dirt factor which will affect light output can only be estimated, as it will vary depending upon weather conditions and the environment in which the lighting is installed. For purposes of testing new installations, the IES (Illuminating Engineering Society) and manufacturers' guideline of 100 hours of burning time shall be used. Accordingly, tests to determine initial light values for purposes of pro-rating to maintained light values shall be conducted after the lamps in the lighting system have been operated for 100 hours.

Accordingly, the policy established herein has set .80 of the rated initial lumens as the guideline for the IES standards of light loss factor to be used so that a consistent standard for lighting design can be applied to all new installations.

To assist in determining whether or not the field exceeds the maximum allowable lighting levels, the manufacturer shall supply a numerical computer simulation of the anticipated initial light value after the 100 hours of operations as a

guideline for measurement.

### **ANNOTATION C - LIGHTING SMOOTHNESS**

As of the time of the adopting of this policy, no IES guidelines exist for a smoothness of lighting on athletic facilities. It is anticipated that the IES will publish standards at some time as to this issue and at such time as the IES guidelines are established, those guidelines shall govern the issue of smoothness for purposes of this policy. Until such time as the IES establishes such guidelines, these standards, as provided, shall be the applicable standards.

### **ANNOTATION D - AMBIENT LIGHT**

Ambient light from sources other than the planned playing field lighting shall be excluded in determining the foot-candles of spill light. To test the quantity of spill light from the field lighting, there shall first be taken light meter readings at the designated location without the design field light shown in the plan to determine the ambient light. These quantities of light shall be deducted from the light values measured with the field lights operating.

### **ANNOTATION E - ISOCANDELA CURVE**

The purpose of the isocandela curve of total candlepower is to establish a mathematical benchmark against which spill and glare calculations can be confirmed in the event questions arise during the testing process after installation, or for purposes of determining whether or not equipment proposed to be used has the technical capability, at the proposed aiming angle, of achieving the designed glare and spill standards.

The use of 2,000 times the number of fixtures is based upon the maximum average candlepower of 4,000 per fixture from a pole, and then reduced by one-half on the assumption that one-half of the fixtures will be facing away from any given surrounding point.

## **2. SECURITY LIGHTING**

### **Recreational Spaces Provisions**

The provisions of this section shall apply to community buildings, parks, open spaces, trails, community swimming pools/splash pads, and associated sidewalks and parking lots.

- A. All exterior lighting shall have horizontal shields to reduce vertical light above the fixture. Lighting for the areas described above should be a

maximum of twenty-five one-hundredths (.25) foot-candles at five (5) feet from property line. Due to geographic difficulties or areas that require higher lighting levels for security, a maximum output of five-tenths (0.5) foot-candles of light at ground level at property line may be utilized, during the hours of darkness. Where the adjacent property line is another City facility, the foot-candles may exceed the maximum requirements. Exterior lighting shall conform to the following standards:

1. All types of exterior doors shall be illuminated during the hours of darkness with a minimum maintained one (1) foot-candle of light at ground level, measured within a five (5) foot radius from the center of the door.
2. Lighted picnic shelters shall be lighted at dusk and a minimum of one hour after the facility is closed.
3. Recessed areas of buildings or fences, which have a minimum depth of two (2) feet, a minimum height of five (5) feet, and do not exceed six (6) feet in width and are capable of human concealment, shall be illuminated with a minimum maintained twenty-five one-hundredths (0.25) foot-candles of light at ground level during the hours of darkness. This requirement applies to defined recessed areas which are within six (6) feet of the edge of a designated walking surface with an unobstructed pathway to it, not hindered by walls or hedge row landscaping a minimum of two (2) feet in height.
4. Stairways shall be illuminated with a minimum one (1) foot-candle of light on all landings and stair treads, during the hours of operation and a minimum of one hour thereafter.
5. Parking lots and walkways accessing buildings and parking areas shall be illuminated with a minimum maintained one (1) foot-candle (maximum eight (8) foot-candles) of light on the driving or walking surface during the hours of operation and a minimum of one hour thereafter. After hours illumination may be reduced 50%. Therefore, lighting of these areas shall be designed utilizing two circuits or more, alternating power to fixtures.
6. Lighted bike and multi-use trails not incorporated in the roadway shall be illuminated with a minimum maintained twenty-five one-hundredths (0.25) foot-candles of light at ground level during the hours of darkness.
7. Paved walkways in open space areas, not directly serving buildings or parking areas, shall be illuminated with a minimum maintained five-tenth (0.5) foot-candles of light on the walking surface during the hours of operation and a minimum one hour thereafter. After hours illumination may be reduced 50%. Therefore, lighting of these areas shall be designed utilizing two circuits or more, alternating power to fixtures.

8. Swimming pool decks, splash pads and other hard surface recreation activity areas shall be illuminated with a minimum maintained one (1) foot-candle of light on the walking surface during the hours of operation and a minimum of one hour thereafter.
9. Lighted monument signs shall be lighted during the hours of darkness.
10. The light source utilized to comply with this section to meet parking and drive surface lighting shall have a rated average bulb life of not less than 10,000 hours.
11. Luminaires utilized to meet the requirements of this section shall have vandal resistant light fixtures, if accessible, and be not less than eight (8) feet in height from ground level. A luminaire not less than forty-two (42) inches may be utilized to illuminate a walkway if adjacent landscaping is of a variety which does not mature higher than two feet, and it does not interfere with the required light distribution for a distance of sixteen (16) feet along the walkway. Light fixtures shall be deemed accessible if mounted within fifteen (15) feet vertically or six (6) feet horizontally from any accessible surface or any adjoining roof, balcony, landing, stair treads, platform or similar structure.
12. Activation of the required exterior lighting shall be either by a photocell device or a time clock with an astronomic clock feature and/or photocell.
13. A site plan shall be provided showing buildings, parking area, walkways, detailed landscaping and a point-by-point photometric calculation of the required light levels. Foot-candles shall be measured on a horizontal plane and conform to a uniformity ratio of four to one (4:1 average/minimum). Landscaping shall not be planted so as to obscure required light levels.
14. Public recreation facilities and spaces shall utilize light poles and fixtures listed in the Moreno Valley Parks and Community Services Department approved products list.

B. Park restroom interior lighting shall conform to the following standards:

New park restroom designs shall be naturally lighted during the day and artificially illuminated no later than dusk and turned off no later than two hours after securing the site.