

Sports Lighting

7 Answers to Common Questions

Bonus Information:
Funding Options
Inside back cover



We Make It Happen.®

Decisions ... decisions ... decisions.

There are more decisions than you may realize in planning a sports-field lighting project. As the decision maker, the standards you set will affect recreation or athletic programs in your community for 20 to 30 years.

Obviously, you want your decisions to result in a trouble-free lighting system that will be a safe, energy-efficient source of pride rather than a disappointing source of continuing high-maintenance headaches and neighbors' complaints.

Lighting an outdoor sports facility is a big investment. You and your design consultant need to ask many questions about initial and long-term benefits to ensure you get the most value from the dollars you spend. The more you know about sports lighting, the better chance you have of getting the results you want.

To help get you started with your project, we've put together this guide to answer the most common questions people have about lighting a sports field.

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1. What affects the cost of lighting my ball field?

Many people don't realize the cost of light fixtures is only a small part of the overall project cost. When comparing proposals, it is important to look at both the initial and operating (or life-cycle) costs. (See pages 6 and 7 for more information on operating costs.)

Initial costs for a complete project will include three components:

- Lighting
- Structural
- Electrical

For each of these three components you will need to select someone to:

- Design
- Supply
- Install

Decisions you make on one component affect the others. For example, due to variances in fixture efficiency, some manufacturers may require more light fixtures, which means you may need larger poles to support the additional wind load and additional electrical components to operate the system.

9 Important Sports-Lighting Decisions

	Lighting	Structural	Electrical
Design	?	?	?
Supply	?	?	?
Install	?	?	?

This matrix is an easy way to see at a glance if you've covered all areas of your project in developing cost estimates.

Musco provides

- Free project planning assistance and budget estimates
- Complete systems engineered for fast, cost-saving installation
- Energy efficient systems that save 50% in operating costs over the life of the system
- Ways to reduce your total project costs by up to 1/3 with volunteer-assisted installation
- Fundraising and financing programs

In addition to the nine important sports-lighting decisions, several variables affect the design and final cost of your project. The following is a checklist of the major items that will need to be reviewed with your local sports-lighting representative and incorporated into your lighting system design.

Quantity and quality of light

- Facility type
- Players' skill level
- Facility size
- Spectator capacity
- Television/video requirements
- Required or recommended lighting standards (for organizations such as Little League Baseball® and Softball or Amateur Softball Association)

Geographical issues

- Location — affects structural codes and local/state building codes
- Soil conditions
- Existing structures
- Pole setback requirements

Environmental light control issues

- Proximity of neighbors
- Community light ordinances
- Nearby airport or observatory ordinances
- Multifield complexes

2. How many lights do I need?

It is a common practice to specify a number of fixtures, rather than the amount of light produced on the field. However, this is like buying a car based on the size of its gas tank rather than its fuel efficiency. The efficiency of reflector systems currently available varies significantly. What you are buying is the quantity and quality of light on the field.

Quantity of light

Light on a playing surface is measured in footcandles. There are several factors that determine the number of footcandles required to light your field:

- 1. Sport type** — More light is required to light smaller, faster moving objects. For example, baseball uses a small ball traveling at high speeds and, therefore, requires a higher light level than soccer.
- 2. Players' skill level** — Higher light levels are needed for increased skill and accuracy.
- 3. Field size** — Defines the number of square feet to be lighted.
- 4. Spectator capacity** — More light is needed to see action that is farther away.
- 5. Television/video requirements (if any)** — A camera interprets images more slowly than the human eye and requires more light to be able to follow the action.

Generally Accepted Lighting Standards

	LIGHT LEVELS			
	FOOTCANDLES		LUX	
	Target ¹ / Constant	Initial	Target ¹ / Constant	Initial
Baseball/Softball				
Recreational	30/20	43/29	323/215	462/308
Schools/Amateur Leagues	50/30	71/43	538/323	768/462
Little League Baseball®	50/30	71/43	538/323	768/462
Amateur Softball Association (ASA)	50/30	71/43	538/323	768/462
College ²	100/70	143/100	1076/753	1538/1076
Basketball (indoor)				
Elementary	30	43	323	462
High School	50	71	538	768
College ²	80	114	861	1230
Football				
Schools/Amateur Leagues	30	43	323	462
College ²	50	71	538	768
Soccer				
Schools/Amateur Leagues	30	43	323	462
College/Municipal ²	50	71	538	768
Tennis - 2 court (side by side)				
Recreational	30	43	323	462
Schools/Amateur Leagues	50	71	538	768
College ²	75	107	807	1152

¹ .7 light loss factor used to determine target light levels on field for extended life of lighting system.

² May vary due to seating capacity and television requirements.

Light levels naturally depreciate over time as lamps age. New technology offsets this, but it is important to make sure your system is designed to provide maintained, or target, footcandles to ensure you have enough light over the life of your lighting system.

Lighting terms you'll hear

Lumen — A measure of light, much like a mile is a measure of distance.

Footcandle — One lumen of light spread over one square-foot of surface. In other words, a light level of 30 footcandles means that 30 lumens of light are being projected onto each square foot of playing surface.

Initial footcandles — The amount of light on the field when the lighting system is first put into use.

Target footcandles — The lowest average amount of light for which a lighting system should operate over its extended life to ensure performance requirements.

Constant light levels — The amount of light you can expect on the field at any given time over the extended life of the system.

Uniformity — The smoothness of light on the field.

Photometrics — The reflector is the photometric unit of a lighting system. It provides a mechanical redirection of light.

High intensity discharge lamp (HID) — A group of lamps consisting of metal halide, mercury, and high pressure sodium.

Light loss factor — A factor used to calculate the level of light after a given period of time. Accounts for lamp depreciation, dirt accumulation, temperature and voltage variations, and maintenance procedures.

Point-by-point — A computer-generated model of your proposed lighting system showing footcandle readings at given points on your field.

Quality of light

When talking about quality of light on the field, you'll hear the term uniformity, or evenness, of light on the field. It is stated as a ratio, like 3:1, the minimum standard for most sports.

What it means: the brightest point on the field should be no more than three times the darkest point. Why is that important? Balls appear to change speeds if they pass from dark to light areas, making it difficult to follow the flight and gauge the speed of the ball.

Each manufacturer should provide specific information on initial and maintained light levels as well as a uniformity ratio, so when you compare proposals you can be sure they're all designed to the same criteria.

It's also a good idea to get written guarantees for both the quantity and quality of light your system will provide.

Musco provides

- Free lighting design services to you or your consultant
- Guaranteed constant light levels

3. What will it cost to operate my lighting system?

Several issues affect the operating cost of a lighting system. In addition to the electrical cost of lighting your field, you should consider management and staff time for operating the on/off schedules and tracking facility usage. Routine maintenance and unexpected repair costs can rack up if your system is not well designed from an electrical and structural standpoint.

Electrical consumption

Differences in reflector system efficiencies and aiming design can vary, meaning one manufacturer may require fewer fixtures to achieve the same amount of light on the field. Over the life of the system you'll save money on electrical costs with fewer fixtures, and you'll save on lamp replacement and other maintenance costs.

In the example, Manufacturer A saves \$41,500 in energy cost over the life of the system.

300-foot Radius Baseball Field (1500-watt metal halide lamps)		
Manufacturer A – 32 fixtures		Manufacturer B – 52 fixtures
	32 fixtures	Number of fixtures required
x	\$.14*	Hourly cost per fixture
	<u>\$4.48</u>	Hourly energy cost
x	500 hours	Hours operated per year
	<u>\$2,240</u>	Annual energy cost
x	25 years	Life of system
	<u>\$56,000</u>	Life-cycle energy cost
		52 fixtures
x	\$.15*	Hourly cost per fixture
	<u>\$7.80</u>	Hourly energy cost
x	500 hours	Hours operated per year
	<u>\$3,900</u>	Annual energy cost
x	25 years	Life of system
	<u>\$97,500</u>	Life-cycle energy cost

* Assuming a 9¢ kWh electrical rate, Manufacturer A uses an average of 1.564 kW per fixture, and Manufacturer B uses an average of 1.62 kW per fixture.

Efficient management and scheduling

As public concern over energy conservation grows, many cities and organizations are implementing automated lighting control systems to turn their lights on and off. The automated systems are more reliable than timers and better at accommodating last minute changes or rainouts. Also, operating lights only when needed will save substantial energy dollars over time, especially for multiple fields.

In addition to the energy savings, automated control systems can save your staff traveling to and from the ballparks every night to turn lights on and off. Some systems provide advance weekly planning and management reports that track hours by user, helping you set user fees that offset your operating expenses.

Musco's Control-Link® automated control system

- Saves energy and staff costs
- Allows flexible control
- Improves management tools
- Increases security
- Provides reliable operation

Routine maintenance

Relamping — It's more efficient to “group” relamp rather than replace lamps as they burn out. We recommend group relamping prior to the end of the rated lamp life.

Costs include:

- Lamps (\$60 – \$70/lamp average)
- Equipment rental to get to top of pole (\$60 – \$125/hour)
- Labor (Approximately \$40 / hour average)

Fuses — Replace as needed (average cost \$1 – \$5 / fuse). Unless fuses are accessible at ground level, you may also need to rent equipment to get to the top of the pole (see above).

Repair and unexpected costs — how to avoid them

These costs may be overlooked during the initial purchase of a lighting system, but can take significant time and money to correct later. A well-designed system will be durable enough to withstand the elements and have features designed to reduce labor costs.

Re-aiming — Make sure your manufacturer guarantees fixture alignment. Over time, several factors, including the weather, can cause misalignment resulting in less light on the field. Labor and equipment costs to correct this can be significant.

Multiple fixture outages — Each fixture should be individually fused. This lessens the chance of a multiple or “gang” failure and also the need for emergency repairs.

Troubleshooting — Easy-to-access systems are designed so the major electrical components — ballasts, capacitors, and fuses — are located close to the ground, saving time and money.



Misalignment of as little as 10 degrees shifts light off the playing field into the stands.



Having major electrical components accessible at ground level avoids hiring a \$100 crane to replace a \$1 fuse.

Musco Constant 25™, a comprehensive foundation-to-pole-top warranty and maintenance program, covers 100% of your maintenance costs, including parts and labor, for the next 25 years.

Musco Constant 25 includes

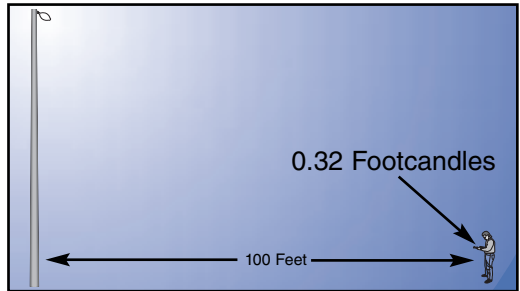
- Guaranteed constant light levels
- Group lamp replacements
- System monitoring
- Routine maintenance and on/off control services

4. If they use the same wattage bulb, aren't all fixtures the same?

All 1500-watt metal halide bulbs produce about the same amount of light (155,000 lumens). However, without a reflector, a 1500-watt metal halide bulb produces less than one footcandle of light on an area 100 feet away.

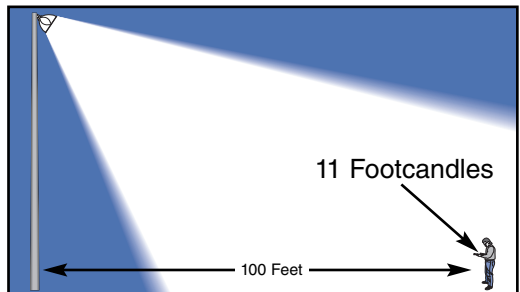
The manufacturer's reflector design is the critical factor in how effectively the lamp's light energy is projected onto the playing surface. New technology allows previously wasted spill light to be redirected back onto the playing surface, increasing the light on the field.

1500-watt metal halide bulb with no reflector



1500-watt metal halide bulb with reflector

A reflector concentrates and projects the light energy onto the playing surface.

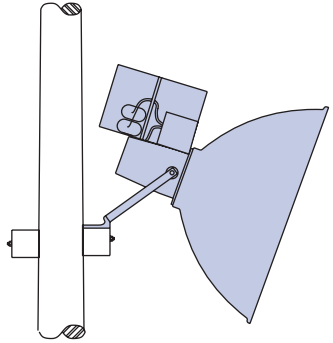
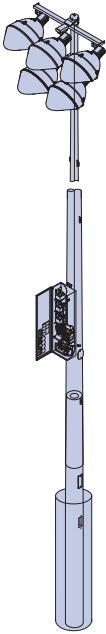


It is a common mistake to specify a number of fixtures, rather than the quantity of light produced on the field. Specifying a set number of fixtures simply spells out the amount of light that is going to be generated by the lamp at the top of the pole, rather than the light on the field.

Musco's Technology

- Provides more light per fixture on the playing surface — fewer fixtures to buy, install, operate, and maintain
- Reduces spill light and glare off-field by 50%; reduces fixture glare for players
- Ensures guaranteed Constant Light™ for the safety and performance of players without wasting energy
- Offers complete foundation-to-poletop lighting system

Fixtures may be purchased as a system or as single fixtures. Here's an analysis:



Shaded areas indicate engineered components

System	Single Fixture
<p>Engineered as a total system</p> <ul style="list-style-type: none">▪ Parts selected by trained engineers for system compatibility▪ Critical components assembled in controlled environment▪ Tested prior to shipment▪ Single source accountability with warranty on entire system	<p>Parts and pieces of unknown strengths put together by the installer</p> <ul style="list-style-type: none">▪ Inconsistent warranties from several sources
<p>Factory aimed</p> <ul style="list-style-type: none">▪ Reduced installation cost▪ Known results	<p>Individual fixture-by-fixture aiming from the top of the pole</p> <ul style="list-style-type: none">▪ Adds installation cost▪ Unknown results
<p>40+ pound ballast mounted at base of pole</p> <ul style="list-style-type: none">▪ Easier maintenance▪ Weight reduction assures fixture alignment	<p>40+ pound ballast mounted on fixture</p> <ul style="list-style-type: none">▪ Troubleshooting must be done from top of pole▪ Increases chance of misalignment

5. Our local utility company has offered to donate wood poles. How will these work on my field?

While it's tempting to use wood poles, you'll find any initial savings are quickly eaten up in repairs and re-aiming fixtures. Here are some of the problems we've observed on facilities that used wood poles.

Improper mounting heights

In general, wood poles that are donated are not tall enough to allow for proper mounting heights required for sports lighting. Poles that are too short cause glare for players and spotty lighting on the field.

Fixture misalignment

Twisting poles — As wood poles dry in the sun, they naturally twist. Today's lighting systems are aimed to $\frac{1}{2}^\circ$ accuracy, but wood poles commonly twist $15^\circ - 20^\circ$ in either direction. Re-aiming fixtures is a costly maintenance chore that can be avoided.

Leaning poles — Wind load created by the fixtures at the top of the pole make a standard utility embedment (10% plus 2 feet) inappropriate for a sports-lighting application. As a result, your poles may begin to lean, misaligning your fixtures.

Safety hazards

Twisting poles — Because electrical conduit must be run on the outside of the pole, twisting of a wood pole can result in exposed wiring.

Rotting wood — The center of treated wood poles are the most susceptible to deterioration, which means you may unknowingly have a pole that is in danger of failing.

Woodpeckers — Woodpeckers can create large holes in wood poles, making them structurally unsafe. (It sounds funny, but it does happen!)

Toxic preservatives — Effective wood preservatives are made from a variety of materials inappropriate for use in areas of high activity.



Twisting of this pole caused electrical conduit to separate, exposing wiring.

Other common pole types are concrete and steel

Pole Type	Benefits	Drawbacks
Concrete	<ul style="list-style-type: none"> ▪ Can be direct buried eliminating the cost of elaborate footings ▪ Corrosion and moisture resistant ▪ Pleasing appearance 	<ul style="list-style-type: none"> ▪ Poles are heavier and more expensive to set ▪ High freight costs often limit their use to areas near concrete pole manufacturing plants
Base-plate Galvanized Steel	<ul style="list-style-type: none"> ▪ Pleasing appearance ▪ Lightweight, easy to handle 	<ul style="list-style-type: none"> ▪ Higher initial cost ▪ Require construction of concrete foundations with anchor bolts on which poles are mounted ▪ Curing time of concrete base ▪ Corrosion at ground level ▪ Difficulty with pole orientation
Direct Burial Galvanized Steel Pole	<ul style="list-style-type: none"> ▪ Pleasing appearance ▪ Lightweight 	<ul style="list-style-type: none"> ▪ Underground corrosion accelerated due to moisture and soil chemicals — often undetectable prior to pole failure ▪ Increased installation time and cost depending on structural engineer's criteria

Combination concrete and steel pole

This pole option combines the advantages of steel and concrete, while reducing or eliminating many of the problems. Steel pole shafts are slip-fit onto precast concrete bases that are set directly into the ground and backfilled with concrete.

Benefits

- **Installation ease** — Poles can normally be set onto pre-stressed, direct-buried bases within 24 hours, eliminating the up to 28-day cure time and extra expense for designing and fabricating on-site built foundations.
- **Cost savings** — Poles and bases are shipped in sections, lightweight and easier to handle for lower freight costs and faster installation.
- **Corrosion resistance** — Concrete bases provide maximum corrosion and moisture resistance at ground level and below grade; galvanized steel poles kept above accelerated corrosion zone (two feet above and below ground).



Musco's Light-Structure Green™

Combines the benefits of both concrete and steel poles — reduces installation costs and time

6. There are no houses near my field, so why should I be concerned about spill light and glare?

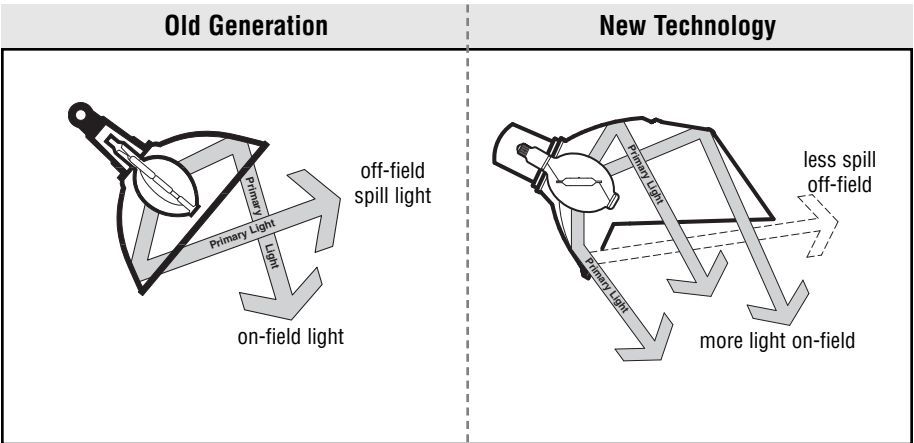
Even if there aren't any houses there now, controlling spill light and glare is important for several reasons:

- Spill light is wasted energy
- Spill light and glare control technology will improve the quality of light on the field for players and spectators
- Communities often “grow-up” around recreational facilities
- Communities are becoming increasingly concerned about environmental light control and energy consumption

Spill light = wasted energy

Prior generation, standard symmetrical reflectors actually waste light. Light control technology redirects wasted spill light back onto the playing surface, increasing light on the field.

By better controlling the light from each fixture, you reduce the number of fixtures needed to get the required amount of light on the field. This, in turn, reduces the electrical cost to operate and maintain the lighting system.



Standard Symmetrical Reflector

Redirections Off-Field Spill Light

Glare problems

Glare control is not only important for off-site locations, it is also critical to player safety and spectator enjoyment. Glare from fixtures can make it difficult for players to follow the ball, creating the possibility for injury.

Players competing on multifield complexes can also be affected by glare from adjacent fields.



Old Generation Standard Symmetrical Reflector



New Technology — gets the glare out of players' eyes

Community growth

Often communities “grow up” around sports facilities. The fact that the facilities and the lights were there first doesn't stop the new neighbors' complaints when lights are shining into their living rooms. Your lighting system should last over 20 years, plenty of time for growth to become an issue in many communities.

Growing concern

We're all aware of the growing public concern for wasting the valuable energy resources it takes to produce light. Many communities are also enacting environmental light pollution ordinances to regulate bothersome light that shines on private property, through windows, onto roadways, and around astronomical research facilities.



Musco's Technology
Musco has developed advanced spill light and glare control systems to solve serious environmental concerns.

7. How can I make sure I get the results I want?

We've reviewed some of the issues involved in choosing the sports-lighting system that will meet your needs. Once you've made your decision, there are ways to ensure you get the results you want:

Define standards

It is important to have written specifications that establish the performance that you want from your system.

When defining specifications, remember to incorporate the three components of a lighting system: lighting, structural, and electrical. Take into account the costs involved for the design, supply, installation, and operation of the entire system. Specify the values you want for playability, environmental light control, life-cycle cost savings, and warranty.

Clear cut standards avoid two problems on bid date:

- Insufficient, cheap equipment substitutions to lower bid price
- High bids to cover the uncertain costs of an under-defined project

Seek accountability

Having a manufacturer that stands behind their product and provides good service will make a huge difference in long-term satisfaction with your lighting system:

Get a written guarantee — Manufacturers can provide written performance guarantees that your entire system — from the foundation to the light fixtures — will meet the specifications you established. Getting this guarantee from a single source that provides your entire system can save you the headache of sorting out responsibility among multiple manufacturers should a problem arise.

Compare warranties — The warranty reflects a manufacturer's confidence in their product. Some manufacturer warranties include routine maintenance and provide longer coverage based on their confidence in their product's performance.

Evaluate their reputation for service — Ask for project references and review the manufacturer's track record for service. Find out if there will be an on-site field performance evaluation after the installation.

Musco Lighting

- Provides local representatives to assist you in developing written specifications to ensure the performance of your sports-lighting system
- Offers an industry-leading 25-year product assurance warranty and maintenance program
- Provides dedicated warranty and field services personnel

We'll help get you started.

Whatever the size of your project, Musco provides the same quality equipment and expert engineering. Our technology provides unequalled performance:

- Reduces energy and life-cycle costs by 50%
- Eliminates 100% of maintenance for 25 years
- Cuts wasted spill light by 50%
- Provides constant light levels
- Control-Link® provides system monitoring, management tools, and on/off control

For free planning assistance for
your sports-lighting project contact



We Make It Happen.®

800/825-6030

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e-mail: lighting@musco.com

Funding options to help make your project happen

Finding available funds is often the most challenging part of the buying process. There are options available that can make your lighting project doable.

Utility grants/rebates

Many utility companies offer incentives to promote the use of energy efficient products including athletic field lighting. Incentives vary and come in the form of rebates, grants, low-interest loans, or reduced kilowatt rates. Once the utility company completes an energy savings audit, they can help fund new lights or upgrade your existing lighting equipment with an energy-efficient system.

Financing Programs

Financing programs for municipalities and public school systems provide a “budget stretcher” to help with facility improvements such as sports lighting and other equipment. The added revenue from expanded use of your facility can help make the annual payments, allowing you to enjoy the benefits of lighted facilities sooner. Plus, a set payment can be built into your annual budget, freeing you from budget uncertainties and lowering the cash flow impact of a large purchase.

Unique Fundraising

Musco’s unique Pennant Program™ provides corporate advertising opportunities using pennants displayed on Musco’s Light-Structure Green™ systems. Many organizations have used this program to totally finance their project or to complement other fundraising efforts. Others have continued the program after the initial purchase to help with annual operating costs.

Volunteer Installation

Reducing installation time can save significant total project costs. Buying the components from one manufacturer as a complete, compatible system makes installation simpler, saving time and money. Plus, systems suitable for volunteer installation can save up to one-third of the total project costs.

Musco Lighting

- Has a resource database to help identify recreation, utility, and community foundation incentive programs available in your area
- Meets utility companies’ eligibility requirements with its Light-Structure Green™ and Control-Link® energy and life-cycle cost savings
- Offers flexible, affordable financing programs for qualified applicants
- Provides Pennant Program™ material and other fundraising tips
- Offers a lighting system that makes volunteer installation possible

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We Make It Happen[®]

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