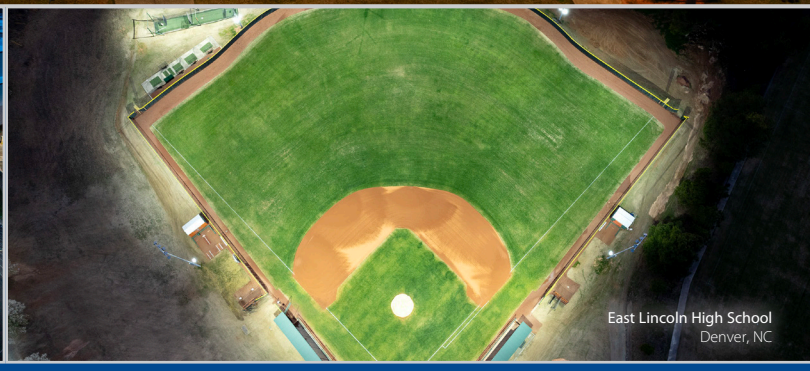
East Lincoln High School
Denver, North Carolina

Owen High School
Black Mountain, NC


East Lincoln High School
Denver, NC

LIGHTING STANDARDS

North Carolina High School Athletic Association

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In partnership with Musco, the NCHSAA is pleased to provide these NIAAA endorsed Lighting Standards to its membership as a valuable resource to enhance safety measures within your respective school and minimize risks.

Introduction

Whether you are an Athletic Director, volunteer coach, or a professional involved with the city or county recreation department, there are a few basics that may help you evaluate and purchase a lighting system that meets the North Carolina High School Athletic Association (NCHSAA) Standards.

The NCHSAA recommended its current lighting standards for two main reasons:

1. To provide safer levels of lighting for the players
2. To comply with current national recommendations and codes for lighting standards

A properly engineered, dependable lighting system is built on three key components: Lighting Design, Electrical Design, and Structural Design. The NCHSAA Standards draw from national codes and recommendations established by the Illuminating Engineering Society of North America (IESNA) in its "Recommended Practice for Sports and Recreational Area Lighting" (RP-6-24), the National Electric Code, the National Fire Protection Association (NFPA), and structural guidelines such as the Uniform Building Code (UBC), the Standard Building Code, and standards developed by the American Society of Civil Engineers (ASCE).

For design professionals and project specifiers, a full specification is also available. This specification follows the standardized structure used in architectural and engineering documentation, making it easy to integrate into project manuals, coordinate with other trades, and ensure consistency across bid and construction documents.

For additional information, contact the NCHSAA office at:

222 Finley Golf Course Road

Chapel Hill, NC 27517

919•240•7401

www.nchsaa.org

Lighting Design & Performance

Light levels on a surface are measured in footcandles. The faster the sport is being played, the more footcandles are needed to perform at the optimal level. Having more light is only the first step, the quality of light over the entire playing surface is also crucial for optimal play. Having consistent light provides an environment without shadows which can result in impaired player performance.

Below are the key factors to consider when it comes to lighting your playable area:

1. LED Technology

LED, or Light Emitting Diode, is the preferred light source technology due to energy efficiency, increased lifespan, reduced maintenance, and minimal light depreciation over the operating life of a typical sports lighting system. Instant on LEDs can be manufactured with a broad range of correlated color temperatures (CCT). Currently, the most efficient LEDs for sports lighting are around 5700K, which is a bright, crisp, daylight-white for clarity and contrast.

2. Quantity of Light

A specified quantity of light for each sport, measured in footcandles, helps ensure visibility for players and spectators. Playing surfaces shall be lit to the criteria in the following chart.

Light levels are set according to the sport, competition level, venue size, and whether the event is broadcast.

3. Sustaining Target Light Levels Over Time

Required light levels should be guaranteed over the life of the system. Additionally, lighting designs should be provided and reviewed to ensure target light levels are achieved throughout the guaranteed period of the system.

4. Quality of Light

Uniformity, or evenness of light over the playing surface, improves visibility and safety for players. An object will appear to change speed when it passes between light and dark spots, much like a strobe light does.

a. Maximum to Minimum Uniformity Ratio: The ratio of highest illuminance value to lowest illuminance value should not exceed the value specified.

b. Uniformity Gradient: The ratio between any two adjacent illuminance values on a field should not exceed the value specified.

To measure uniformity, grid points are put on the field and light readings are taken at each point. It's stated as a ratio, such as 2:1. This means that the brightest point is no more than double any other point. NCHSAA Standards also require no more than 10% change per 10 feet across the field, to further enhance the evenness of lighting.

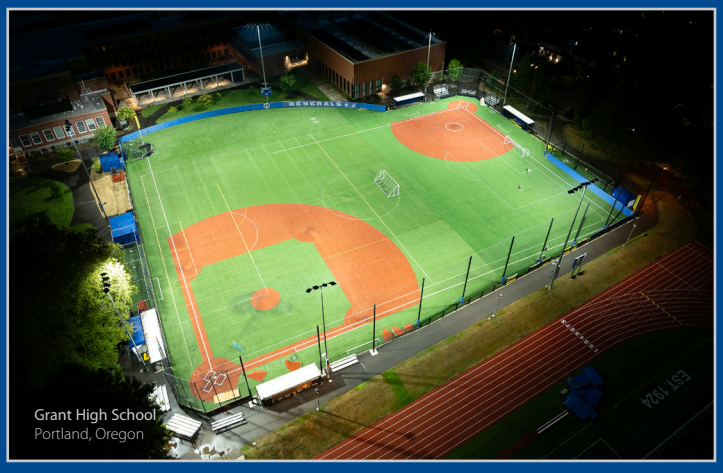
5. Avoiding Glare for Participants

The pole's height and location determine whether the lights are a source of glare for players and spectators. NCHSAA has developed standard layouts that place poles out of the dangerous glare zones which can be found in the appendix.

For areas of concern, a good guideline is to keep glare from the brightest source below 7,500 candela at 150 ft offsite from the edge of the field.

Area of Lighting	Target Light Levels	Maximum to Minimum Uniformity Ratio	Uniformity Gradient	Offsite Candela (150 ft or greater)
Baseball / Softball	50 fc Infield 30 fc Outfield	2:1 Infield 2.5:1 Outfield	1.5	< 7,500 candela
Football / Soccer / Lacrosse Less than 2000 spectators Up to 5000 spectators More than 5000 spectators	 30 fc 50 fc 100 fc	 2.5:1 2:1 1.7:1	1.5	< 7,500 candela
Gymnasium / Basketball No spectators With spectators	 50 fc 80 fc	 3:1 2.5:1	 2.0 1.5	< 7,500 candela
Natatoriums	Consult an experienced lighting manufacturer or lighting specialist.			
Tennis	30 fc 50 fc	2:1	1.5	< 7,500 candela
Track Competitive Use General Use (Walking)	 20 fc 5 fc	 5:1/A	 2.0	 < 7,500 candela
Combination / Multipurpose	Highest minimum for activities played on the field.	Lowest minimum for activities played on the field.	Lowest minimum for activities played on the field.	< 7,500 candela

Choctaw High School
Choctaw, Oklahoma


Grant High School
Portland, Oregon

San Benito High School
Hollister, California


Temple ISD
Temple, Texas

Electrical & Controls Design

Safety issues with electrical systems are two-fold. The electrical supply to the fixtures needs to be adequate from a safety standpoint, and the electrical system itself must help protect spectators and maintenance staff. Technical expertise is essential to assure safety standards are met. Electrical systems vary depending upon facility requirements. A simple design for a lighting system may include the following elements.

1. **Point of Distribution**
   Usually a transformer on-site or very close to the site. Generally provided by the utility company.

2. **Control Panel**
   Usually placed in a concession or maintenance building near the field. The control panel receives power from the point of distribution and delivers it to the circuits leading to each pole. It should have a main disconnect to shut off power, and may have several breakers to shut off power to other electrical devices.

3. **Electrical Distribution**
   The wiring circuits that bring power from the point of distribution through the control panel to each individual pole. The electrical distribution needs to be designed by a qualified individual. Wiring that is too small may be a safety hazard and will cause the light fixtures to operate at less than target levels. If the wiring is sized too large, you are spending money that is not necessary. NCHSAA Standards call for electrical distribution drawings that are approved by the local authority regulating electrical systems. All wiring must be buried underground at depths provided by local codes.

4. **Electrical System**
   The electrical system receives power at the base of the pole and routes it through the electrical components to the light fixture at the top of the pole. NCHSAA Standards call for a separate disconnect on each pole, individual fusing on each fixture, and UL Listed electrical components.

5. **Grounding System**
   All poles, fixtures, and distribution panels must be grounded in compliance with the National Electric Code. In addition, NCHSAA Standards require that lightning grounding be provided for each pole.

Control and Monitoring System

A remote control and monitoring system will provide ease of operation and management for your facility. Manufacturers providing systems with a long-term warranty will utilize this system to ensure your lighting performs as required. Look for a system that provides 24/7 support staffing for any issues that arise.

Structural Design

1. **Foundation**
   Having proper structures and foundation is critical to the safety of participants and spectators. Wind is a constant force that must be resisted in order to keep the fixtures aimed at the proper spots on the field. A typical 60 ft steel pole with four fixtures transfers a heavy load to the ground. For example, in a 35 mph wind, there may be as much as 6,000 lbs of force being transferred. At 70 mph, the load jumps to over 23,000 lbs. It takes a carefully engineered foundation to transfer the load and maintain fixture alignment. Foundations should be engineered based on site conditions and designed to safely transfer loads, commonly utilizing anchor bolt foundations with concrete backfill or pre-stressed concrete bases.

2. **Poles**
   Pole selection is critical to the quality and safety of your lighting system. NCHSAA Standards do not permit the use of wood poles for two basic reasons: they are prone to twisting, which can cause fixtures to become mis-aimed, and they may deteriorate from the interior over time, becoming structurally unsound. Direct-burial steel poles are also not permitted, as prolonged soil contact accelerates corrosion below grade, even with protective coatings, where deterioration is difficult to detect and can compromise structural integrity. Galvanized steel poles are the preferred option for NCHSAA-compliant lighting installations. Poles shall be supported by engineered foundation systems, with the pole connection designed to safely transfer loads and maintain structural alignment.

Assurance of Performance

As you can see, there are many elements to a good lighting system, and many decisions to be made. There are several things you can do to see that they are good decisions for your organization.

1. Ask for detailed proposals — know what is included and what is not.
2. Insist on design documentation that guarantees NCHSAA Standards will be met in lighting, electrical and structural designs.
3. Use only licensed contractors who can furnish references from similar jobs. Ask for written warranties on equipment and installation.
4. Request information on operating and maintenance costs.
5. Consider optional features such as spill and glare control, energy efficiency, and electrical components enclosures located near the base of the pole, for easier maintenance.
6. New generation technology comes with warranty periods of up to 25 years and should include guaranteed light levels, parts, labor, and lift equipment.

We have included the NCHSAA Standards checklist and an example of a request for proposals form for your convenience.

Purpose of the Checklist pages

The pages that follow are intended as practical working tools for evaluating, specifying, installing, and maintaining athletic facility lighting systems. They translate the Lighting Standards into clear, usable criteria that can be consistently applied by owners, athletic directors, facility managers, engineers, and contractors.

These pages are not a substitute for professional engineering judgment or applicable codes. They are provided to support consistent decision-making, documentation, and long-term system accountability.

How These Pages Are Used

1. **Planning and Specification**
   Use the checklists and comparison tables during planning or procurement to define minimum performance, safety, and quality requirements; compare proposed systems on a consistent basis; and confirm alignment with NCHSAA standards, ANSI/IES recommendations, and applicable codes.

2. **Design Review and Submittals**
   During design review, these pages provide a structured method to verify photometric performance, glare control, and compliance with electrical and structural requirements prior to approval, bidding, or construction.

3. **Installation and Project Closeout**
   At installation and closeout, the checklists may be used to confirm that installed equipment matches approved submittals and that required documentation, testing, and warranties are provided before the system is placed into service.

4. **Operation and Maintenance**
   The Annual System Operation & Maintenance Checklist is intended for recurring use throughout the life of the system, including annual inspections and post-event evaluations. Routine completion supports warranty compliance, reliable operation, and long-term asset management.

Documentation

Completed checklists should be retained as part of the facility's permanent records to support warranty claims, service requests, and future planning.

Summary

Used together, these pages provide a consistent, repeatable process for managing sports lighting systems from initial planning through long-term operation, promoting safety, performance, and reliability while protecting the owner's investment.

Salado High School
Salado, Texas

Sports Lighting Specification Checklist

Primary Objective: Establish the performance and installation criteria necessary for a lighting system that is safe for players, enjoyable for spectators, respectful to neighbors, and includes the security of a long-term performance warranty.

Quality Assurance: The manufacturer shall have a minimum of 10 years of experience in the design and fabrication of sports lighting systems that meet the required type and performance criteria. The proposal shall include a list of 10 local LED sports lighting installations located within your state.

Playability: The lighting design shall comply with the latest version of ANSI/IES RP-6 Recommended Illuminance Criteria for Sports and Recreational Areas based on the designated class of play. The following parameters shall be included:

Field / Area of Lighting	Avg Target Illumination Levels	Max Uniformity Ratio	Max Uniformity Gradient	Grid Points	Grid Spacing

1. Color Temperature: The lighting system shall have a color temperature of 5700K and minimum CRI of 75.
2. Vertical Illumination (for aerial sports): Provide adequate illumination above the field to allow visibility of the ball in flight.
3. Pole Heights: Pole heights for your projects should be based on an accurate photometric design that achieves optimal control on and off the playing surface.
4. Beam Type Restriction: To minimize player glare, NEMA beam types 1–3 shall not be used on the field of play.
5. Player glare limits (for diamond sports):
   a. Home plate: Player glare shall not exceed 1,000 cd from any outfield pole fixture.
   b. Outfield positions (LF, CF, RF): Glare shall not exceed 4,500 cd from any A-pole fixture.

Light Pollution & Glare Control:

1. Lighting Ordinances: Lighting design must meet all local lighting ordinance criteria.
2. Offsite Glare: Maximum candela shall not exceed 7,500 cd measured 150 feet from perimeter of field 5 ft above grade.

Warranty: Up to 25-year (new construction) or 10-year (retrofit) parts and labor warranty is required. The warranty shall cover lift equipment rental, shipping, and shall guarantee maintained light levels.

Maintenance Design: Drivers, fuses, and other electronic components shall be housed in an aluminum enclosure no higher than 10 feet above grade, accessible via step ladder.

Control & Monitoring: The system shall provide remote control, monitoring, and scheduling capabilities. The system shall be accessible 24/7 through a website, phone app, or call center. Fields must be monitored to detect luminaire outages. All subscription costs during the warranty period shall be included.

Management Tools: An online dashboard shall be included to report usage metrics and system health.

Structural Design: Manufacturer shall provide steel poles with pre-stressed concrete base or an anchor bolt foundation embedded in concrete backfill. Direct bury steel (including concrete encased), hinged, and wood poles are not permitted. Manufacturer shall design foundation based on Geotechnical report parameters. If there is no Geotechnical report, design shall use Class 5 soil standards per building code. Evaluate the current loading on the poles and perform calculations to determine whether the new system's EPA is equal to or less than the existing loading.

Electrical Design: Electrical control shall use contactor switching rather than dimming drivers. Include ≥50 kA surge protection per pole per ground line. All wiring shall be fully enclosed. The system must be UL listed, or internal wiring shall be enclosed in raceway per NEC.

Installation Requirements: Contractor shall provide all labor, materials, and equipment needed for a complete operational system, including:

1. Permitting and adherence to state and local codes
2. Demolition and removal of existing equipment (as needed)
3. New equipment offloading and storage
4. Installation of new equipment
5. Electrical integration including electrical service panel and wiring (as needed)
6. Debris removal and daily site cleanup
7. Site restoration (as needed)

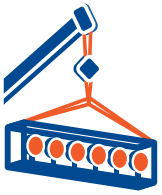
Pre-Bid Site Visit: All bidders must visit the site prior to bid submission. Site familiarity is required.

Submittals: Proposals must include a photometric lighting design reflecting all specified values. The Owner / engineer will review pre-bid submittals from all the manufacturers to ensure compliance with the specification 10 days prior to bid. If the design meets the design requirements of the specifications, a letter and/or addendum will be issued to the manufacturer indicating approval for the specific design submitted.

Waukee Northwest High School
Waukee, Iowa

Mountain Brook Jr. High School
Birmingham, Alabama

Key Values

	Manufacturer 1	Manufacturer 2
 **Experience** • 10 plus years specializing in sports lighting • Expertise in research, application, and control of lighting	☐	☐
 **Precise Light Control** • Light control technology compliant with glare and spill performance limits • Elimination of glare for players, spectators, and broadcast cameras	☐	☐
 **Broadcast Quality Lighting** • Multi-zone aiming reduces harsh shadows and improves uniformity • Superior broadcast results	☐	☐
 **Theatrical Lighting and Video Boards** • Full range of light shows with optional fixture-to-music synchronization • Optional color-changing technology for pole accents, colored light shows, and stadium washes • Preprogrammed or custom shows using industry-standard controls and protocols • Integrates easily with scoreboards, ribbon boards, and DMX equipment	☐	☐
 **Complete System – Lighting, Structural, & Electrical** • Custom designed for retrofit or new application • Factory wired, aimed, and tested • Simple and fast to install - reduces cost and hassle • Single source accountability	☐	☐
 **Service & Reliability Focused Design** • Remote drivers provide easy access and protect sensitive electronics from heat • Passive convection cooling supporting LED performance and service life Fully enclosed wiring and electrical components • Tempered glass lens protects optics from environment	☐	☐
 **Full System Warranty - No Hassle for up to 25 Years** • ALL parts and ALL labor, including lift equipment, provided by the manufacturer • Light levels and uniformity guaranteed • 24/7 full system monitoring and diagnostics • Proactively scheduled maintenance and service • Team members dedicated to monitoring, operation, maintenance, and service	☐	☐

<table>
<tr><th colspan="2">SCOPE COMPARISON</th><th>Manufacturer 1</th><th>Manufacturer 2</th></tr>
<tr><td rowspan="4">PLAYABILITY</td><td>Design meets the guidelines of ANSI/IES RP-6 Recommended Illuminance Criteria for Sports and Recreational Area for Class of Play including:
<table>
<tr><th>Field/Area (ft x ft)</th><th>Avg Light Levels (fc)</th><th>Max Uniformity Ratio</th><th>Grid Spacing</th><th>Grid Points</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
</table></td><td></td><td></td></tr>
<tr><td>The lighting system shall have a color temperature of 5700K and minimum CRI of 75.</td><td></td><td></td></tr>
<tr><td>For Diamond Sports
Player glare shall not exceed the following levels taken at 5 ft above grade:
• 1,000 cd at home plate from any outfield pole fixture
• 4,500 cd at each outfield position (LF, CF, RF) from any A-pole fixture</td><td></td><td></td></tr>
<tr><td>Adequate aerial lighting must be provided to see the ball in flight. If applicable, what is the amount of light (in lumens) on the underside of the ball?</td><td></td><td></td></tr>
<tr><td rowspan="3">WARRANTY</td><td>Warranty length (in years).</td><td></td><td></td></tr>
<tr><td>Warranty includes parts, labor (excluding fuses), shipping, equipment rental, and guarantees light levels.</td><td></td><td></td></tr>
<tr><td>Quantity of in-house service personnel available for monitoring, warranty claims, or service requests.</td><td></td><td></td></tr>
<tr><td rowspan="2">LIGHT POLLUTION & GLARE CONTROL</td><td>What is the maximum glare measured 150 ft from perimeter of field 5 ft above grade?
• The CIE Technical Report Guide on the Limitation of the Effects of Obtrusive Light recommends a maximum value of 7,500 cd for rural areas.
• The Dark Sky International Outdoor Sports Lighting Program requires less than 1,000 cd at 150 ft.
*For reference, low & high beam car headlights are approximately 12,000 and 30,000 cd</td><td></td><td></td></tr>
<tr><td>To provide a comfortable spectator viewing experience, use fixture shielding and adjust aiming angles in order to minimize visibility of the light source.</td><td></td><td></td></tr>
<tr><td rowspan="4">STRUCTURAL DESIGN</td><td>New System
Light structure consists of steel poles with pre-stressed concrete base, or an anchor bolt foundation embedded in concrete backfill. Structure does not consist of wood, direct burial steel or concrete encased steel</td><td></td><td></td></tr>
<tr><td>Retrofit
Existing poles and foundations have been confirmed they are structurally adequate to handle new fixture weights and wind loading. Evaluate the current loading on the poles and perform calculations to determine whether the new system's EPA is equal to or less than the existing loading.</td><td></td><td></td></tr>
<tr><td>Pole & foundation structural parameters comply with applicable IBC codes.</td><td></td><td></td></tr>
<tr><td>Provided stamped foundation design.</td><td></td><td></td></tr>
</table>

SCOPE COMPARISON		Manufacturer 1	Manufacturer 2
Controls & Monitoring	Drivers, control electronics, and fuses can be accessed from a step ladder which provides a safer and inexpensive means to maintain the equipment.		
	Circuits are controlled via contactor switching, not dimming driver output to zero. This minimizes wear on drivers, saves on electricity, and prevents lights from turning on due to communication loss.		
	Lightning grounding with 8 ft grounding rod or integrated grounding.		
	What is the proposed kW energy consumption of the field lighting system?		
Entertainment	Provide remote control and monitoring with scheduling capabilities. The system shall be accessible 24/7 through a website, phone app, or call center. Controls will be a cellular-based system so that lights can be controlled from anywhere in the world.		
	Subscription costs for controls and monitoring covered during warranty period.		
	Cellular costs covered during warranty period.		
	Provide an online reporting dashboard indicating usage and health of the lighting system.		
	Fields are proactively monitored to detect luminaire outages.		
MISC.	Lighting design conforms to state, local codes, and lighting ordinances.		
Installation/Labor	Offload equipment.		
	Demolition / removal of existing foundations, poles, fixtures, and electrical enclosures.		
	Installation of foundations, poles, fixtures, wiring, and control and monitoring cabinets.		

Annual System Operation & Maintenance Checklist

Proper operation and long-term performance of a sports lighting system depend on regular inspection, testing, and preventive maintenance. The Annual System Operation & Maintenance Checklist is a critical tool to ensure that lighting systems continue to operate safely, efficiently, and in compliance with design standards, electrical codes, and warranty requirements throughout their service life.

Safety and Risk Mitigation

Lighting systems involve elevated structures, electrical distribution equipment, and high-output luminaires. Over time, environmental exposure, thermal cycling, vibration, and normal wear can create conditions that pose safety risks if not identified early. The annual checklist addresses these risks by requiring inspection of poles, foundations, grounding systems, wiring, breakers, fuses, and access panels. Verifying proper grounding, insulation integrity, and secure electrical connections reduces the risk of electrical shock, arc flash, fire hazards, and structural failure, protecting athletes, spectators, and maintenance personnel.

Structural Integrity and Pole Performance

Poles and foundations are subjected to wind loading, soil conditions, moisture exposure, and corrosion over their lifespan. The checklist provides a structured method to identify early signs of deterioration such as corrosion at steel pole bases, water intrusion, improper drainage, loose conduits, or visible structural distress. Detecting these issues early allows corrective action before they compromise pole capacity or lead to costly emergency repairs or system downtime.

Lighting Performance and Compliance

Maintaining proper light levels and uniformity is essential for player safety, game quality, and regulatory compliance. Annual verification of maintained footcandles, uniformity ratios, and vertical illumination ensures the system continues to meet the original photometric design intent. The checklist also identifies mis-aimed luminaires, degraded optical components, or failed drivers that can negatively impact visibility, increase glare, or contribute to off-site light spill.

Protection of Warranty Coverage

Most long-term lighting warranties require routine inspection and proper maintenance as a condition of coverage. Completing and documenting the annual checklist demonstrates due diligence and compliance with manufacturer requirements. This documentation helps preserve parts and labor warranty protections, including coverage for replacement components, equipment rental, shipping, and guaranteed maintained light levels.

Cost Control and Asset Longevity

Preventive maintenance is significantly more cost-effective than reactive repair. Identifying minor issues—such as loose connections, deteriorating insulation, or early corrosion—can prevent major failures that require pole replacement, emergency electrical work, or extended field closures. Regular annual inspections extend system life, protect capital investment, and support predictable budgeting for maintenance and upgrades.

Operational Reliability

The checklist ensures that control systems, monitoring functions, and luminaire operation are functioning as intended. Early detection of luminaire outages, driver degradation, or control failures helps maintain consistent field availability and avoids disruptions during scheduled events or athletic seasons.

ANNUAL SYSTEM OPERATION & MAINTENANCE CHECKLIST

School Name_____ Field Name_____

Date of Inspection_____ Voltage/Phase_____ Date Installed_____

Type of Pole_____ Type/# of Luminaires_____

Inspected By_____Title:_____ Contact Number_____

WARNING! Turn off electricity at power source and at safety disconnect on poles

	OK	Needs Repair	N/A	Notes
Lighting Performance Testing				
Check with the AD and Staff to see if there are any concerns regarding field (pole, electrical or lighting).				
Average maintained footcandles meet guidelines.				
Uniformities meet guidelines.				
Service Entrance, Poles, and Distribution Boxes				
Warning Stickers, wiring diagrams, circuit labels should be posted and legible.				
Snap all breakers on and off several times to ensure firm contact. Utilizing breakers for on/off control is not recommended due to reducing the effectiveness of the devices for overcurrent protection. Also, risk of arc flash is increased as breakers age and appropriate precautions should be taken.* See NEC 110.16-A Arc Flash				
Check fuses for continuity*.				
Insulation around wiring should show no signs of deterioration*.				
Wiring should show no heat discoloration*.				
Signs of wear should be replaced on taped connections*.				
Bare wires and exposed connections should be wrapped with insulated covering*.				
Are the panels appropriately locked or access minimized from the public.				
Check all grounding connections at service entrance and at poles. The grounding systems are required to comply with NFPA 70.* 1. Is a ground rod present? 2. Are the bolted connections in good condition? 3. Are the grounding components from acceptable materials and are they sized properly? 4. Is the resistance level satisfactory? This can be verified by measuring resistance to ground. Which for a single rod it should be 25 ohms or less. If it's higher, then a second ground rod shall be added. There is no requirement for minimum resistance value, if two grounds are installed.				
Pole Structures				
Wood poles checked for leaning and resulting misalignment of luminaires.				
Wood poles checked for twisting and resulting misalignment of luminaires.				
Wood poles checked for decay. Just below ground level, woodpecker holes etc.				
Steel anchor bolt poles checked for signs of corrosion.				
Steel anchor bolt poles checked for proper drainage in grout at base.				
Direct burial steel poles checked for proper mastic covering above/below grade at base to ensure no corrosion or pitting of the galvanized protection is evident.				
Direct burial steel poles checked for water/moisture inside pole and corrosion around base of pole.				
Direct burial steel poles checked for proper mastic covering inside the pole.				
Pull on conduits in hand holes to check for looseness*.				
Check for all pole electrical access covers in place.				
Check for all external cable conduit to be in good shape, not cracked or missing*.				
Check for other visible signs of deterioration? Specify.				
Check any pole climbing equipment for proper attachment, alignment and decay or corrosion.				
Check to make sure trees are not encroaching on the pole structures or overhead wires.				
Luminaires				
Check for signs of smoky film on lenses, or water damage to luminaires.				
Check for broken or missing lenses, replace as needed.				
Check for luminaires not operating. Troubleshoot and repair (fuse, lamp, ballast or capacitor for HID)*.				
Visually inspect ballast/drivers for signs of deterioration.				
Do any of the luminaires need realignment (visual and light level testing)? On wooden poles, see if crossarms are still aligned with the field and horizontal.				
Insulation covering on wiring should show no signs of wear or cracking*.				
Ground wire connections must be secure*.				
Check around ballasts for signs of blackening (metal halide).				
Check that capacitors aren't bulging (metal halide).				

*These tests and/or repairs require the services of a qualified electrician.

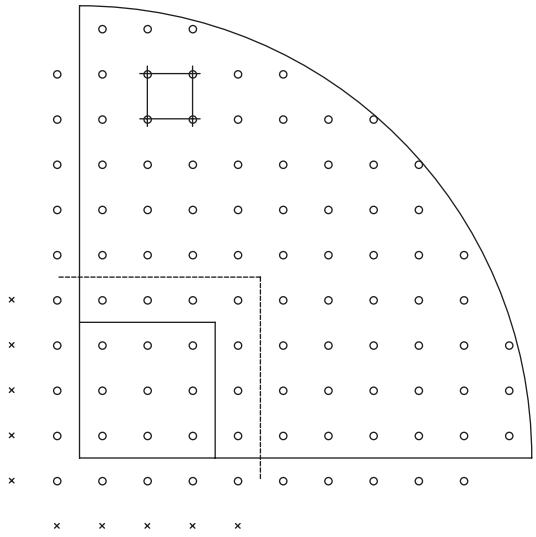
Appendix

Typical Facility Information

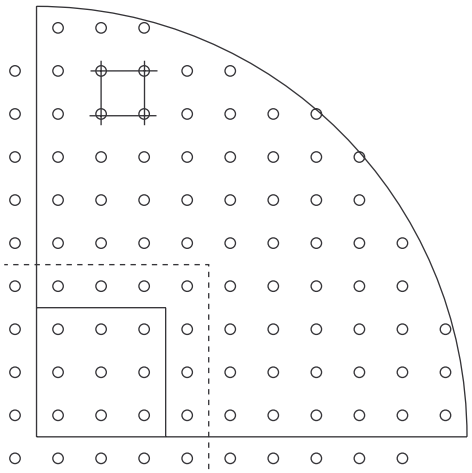
Area of Lighting	Playing Dimensions (ft)	Grid Spacing (ft)	Minimum # of Grids
Baseball, Infield	90 x 90	30 x 30	25
Baseball, Outfield	Dimensions Vary	30 x 30	Varies
Softball, Infield	60 x 60	20 x 20	25
Softball, Outfield	Dimensions Vary	20 x 20	Varies
Football	360 x 160	30 x 30	72
Soccer	360 x 180	30 x 30	72
Lacrosse	330 x 180	30 x 30	66
Tennis	78 x 36	20 x 20	15
Gymnasiums	94 x 50	10 x 10	50
Track and Field	Dimensions Vary	30 x 30	Varies

Light Level Grid Point Layouts

Baseball
300 ft radius field shown

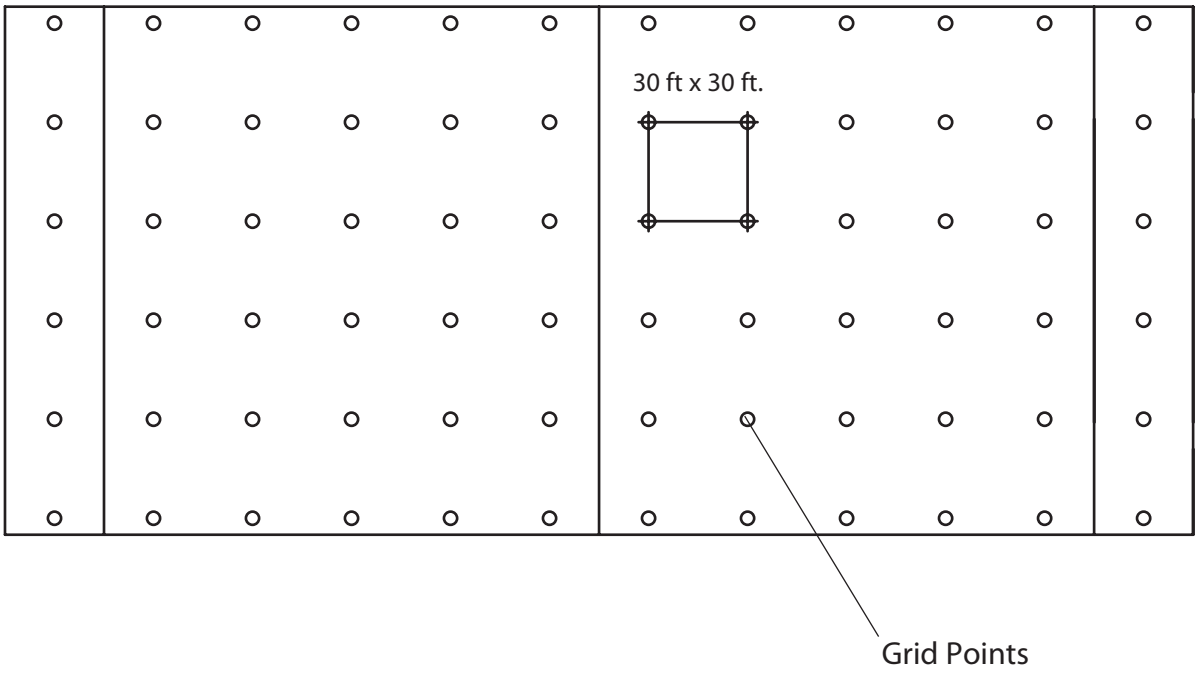


Softball
200 ft radius field shown



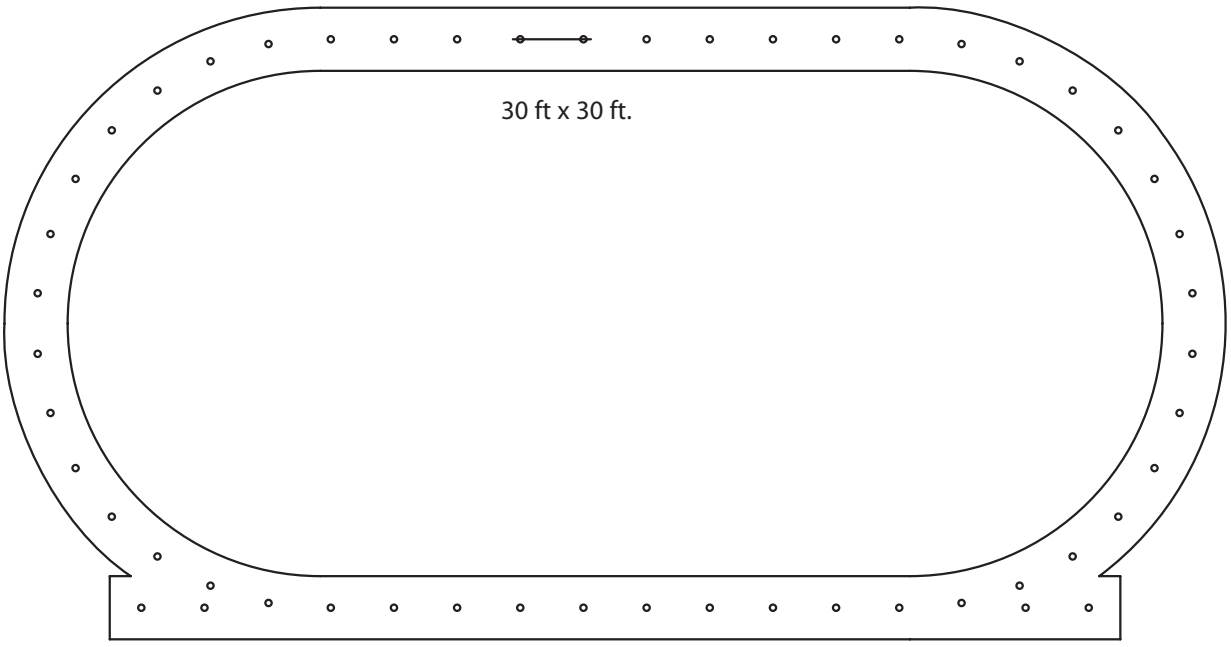
Football

360 ft x 160 ft field shown



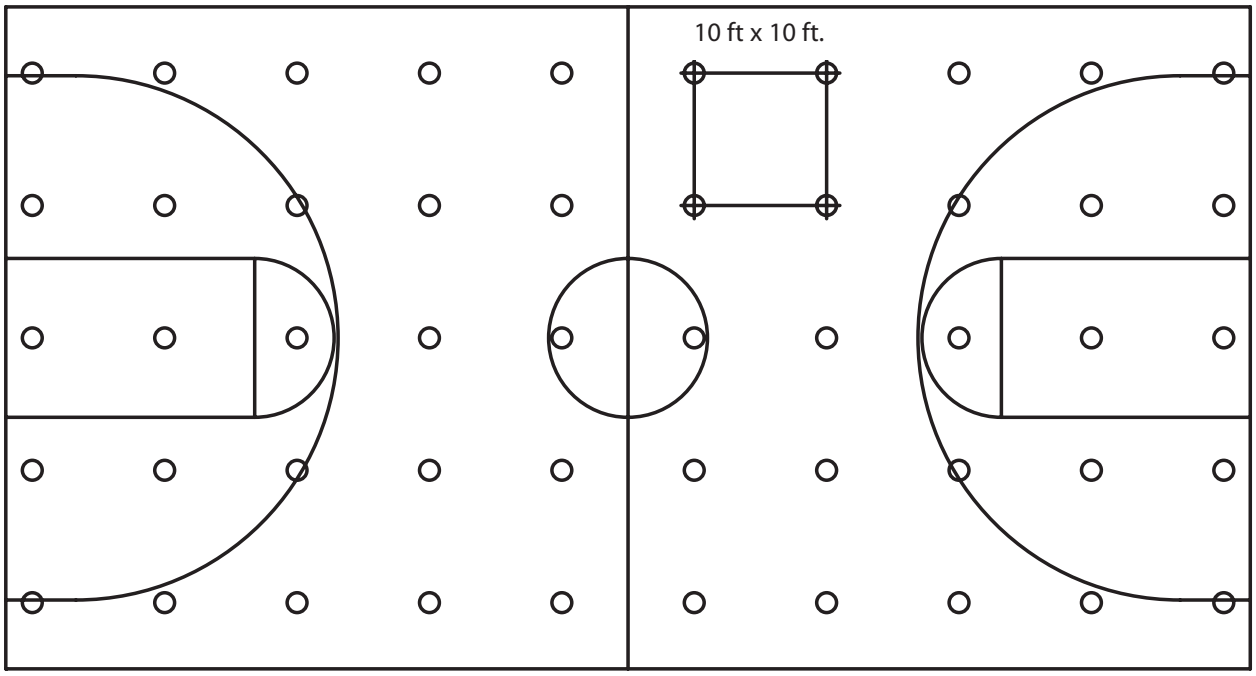
Track

400 m, 8 lane track shown



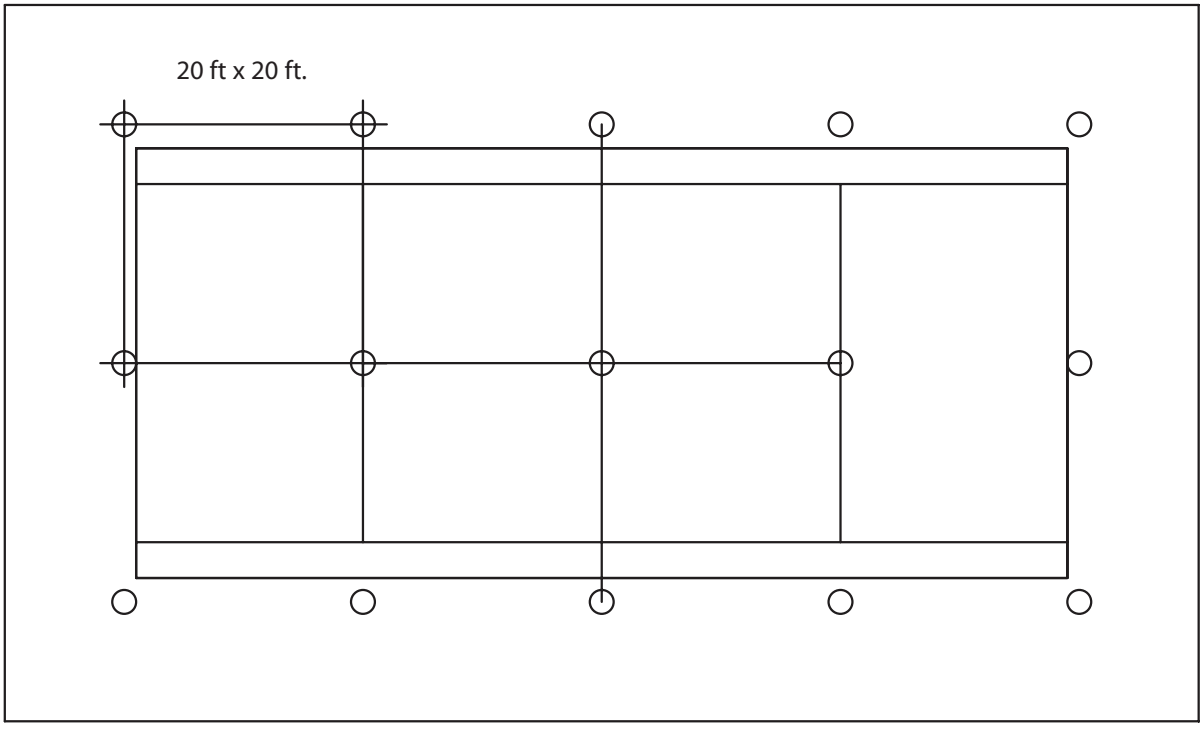
Gymnasium

94 ft x 50 ft court shown



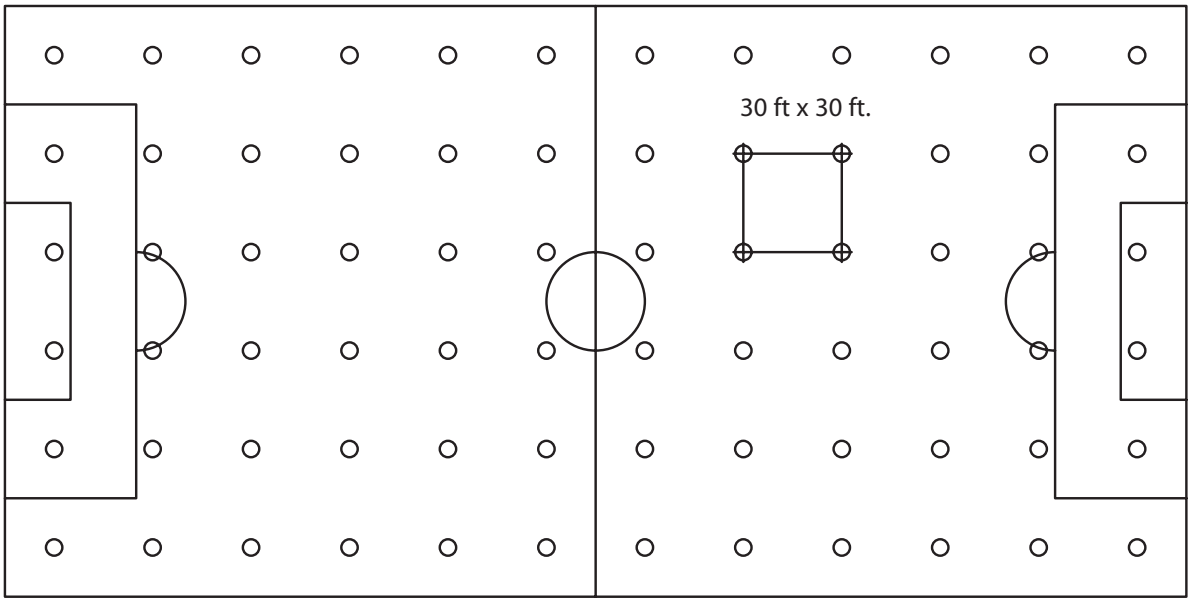
Tennis

78 ft x 36 ft court shown



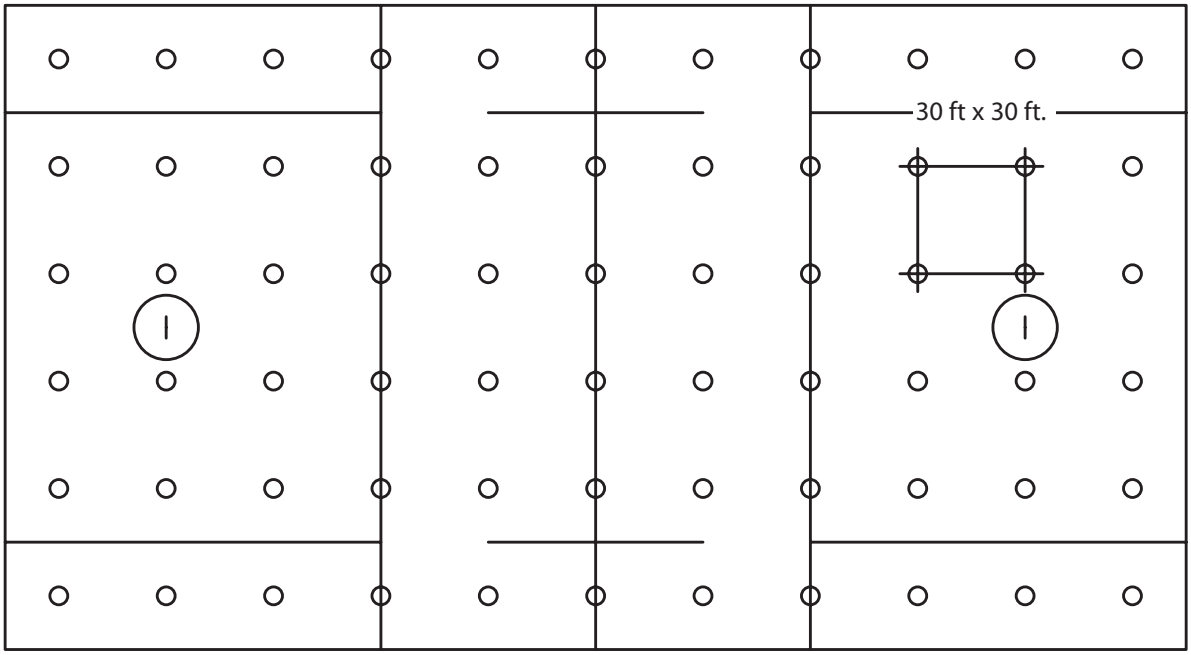
Soccer

360 ft x 180 ft field shown

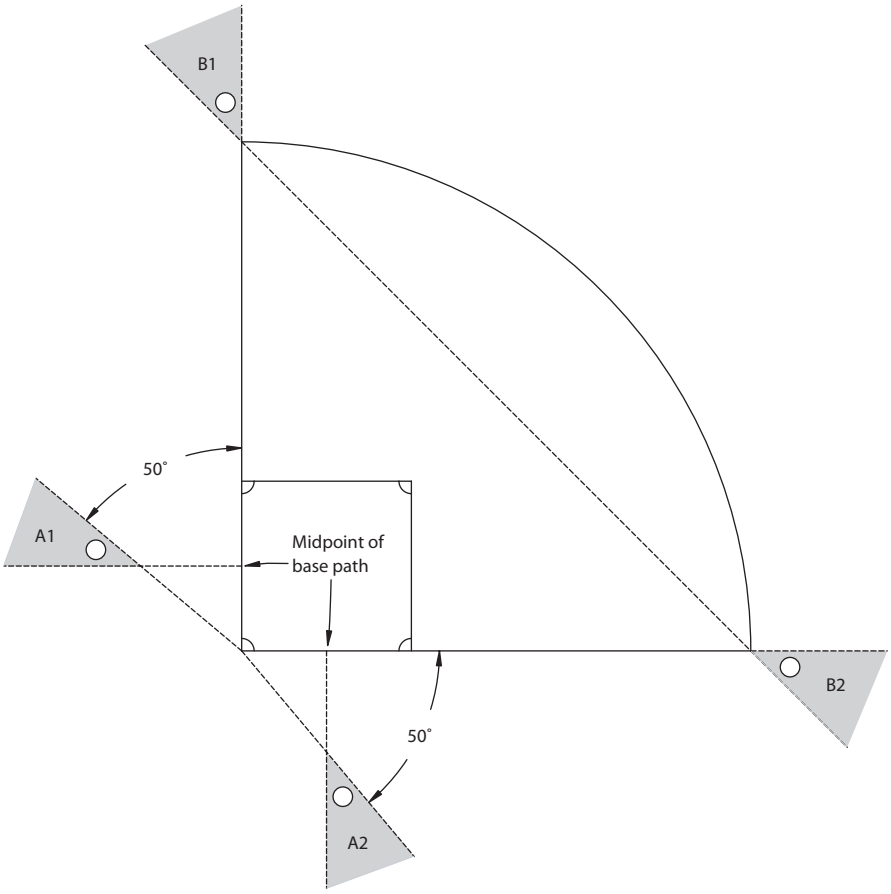


Lacrosse

330 ft x 180 ft field shown



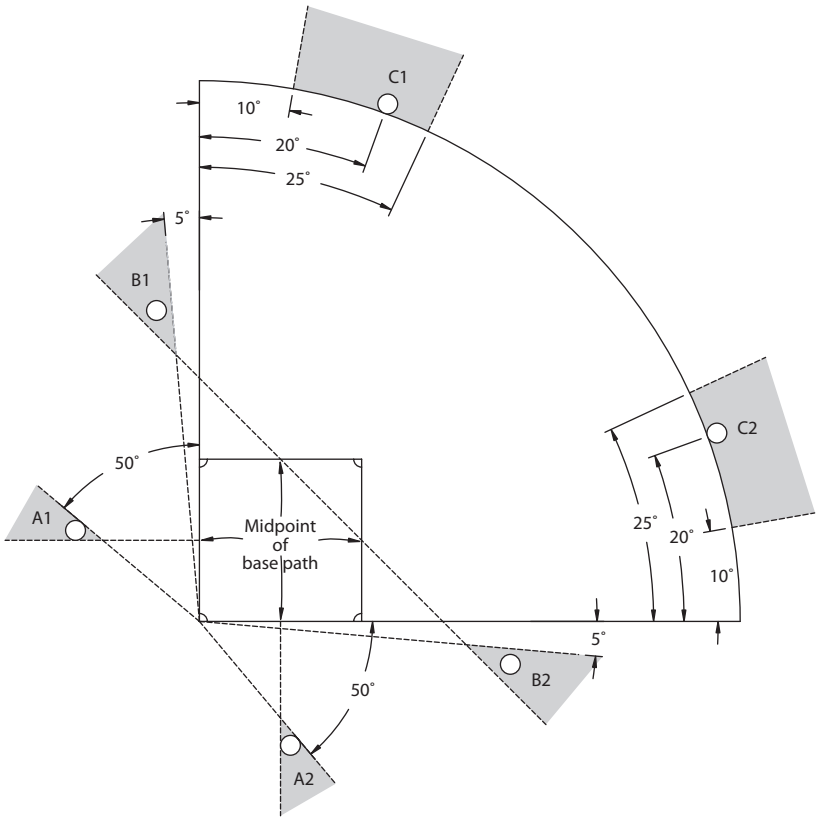
Pole Location Diagrams



4-Pole Softball Field

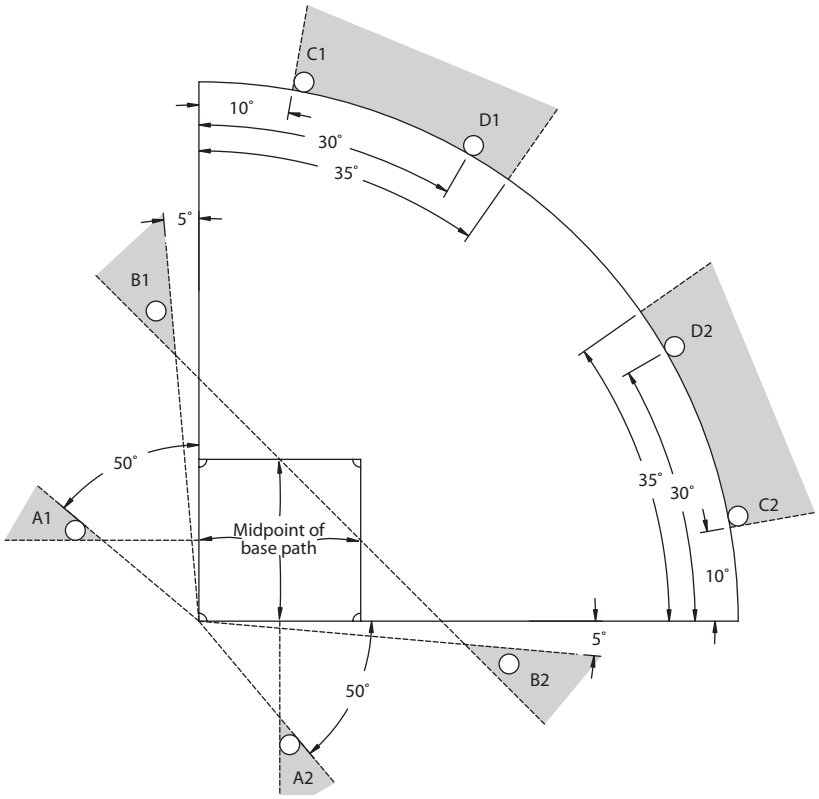
1. Poles are shown in optimal locations. Other permissible pole locations are indicated by the shaded areas.
2. For fields with a radius of 250 ft or greater, a 6-pole design is recommended.
3. Line drawn through the two “A” pole locations should be behind home plate to ensure lighting the portion of the ball the batter sees as it crosses home plate.

Note:
IES standards have not addressed issues for 4-pole design on softball fields. Design criteria are based upon actual practices used on 250 ft and smaller fields and standards adopted by Little League® Baseball and Softball based upon testing done on their facilities.



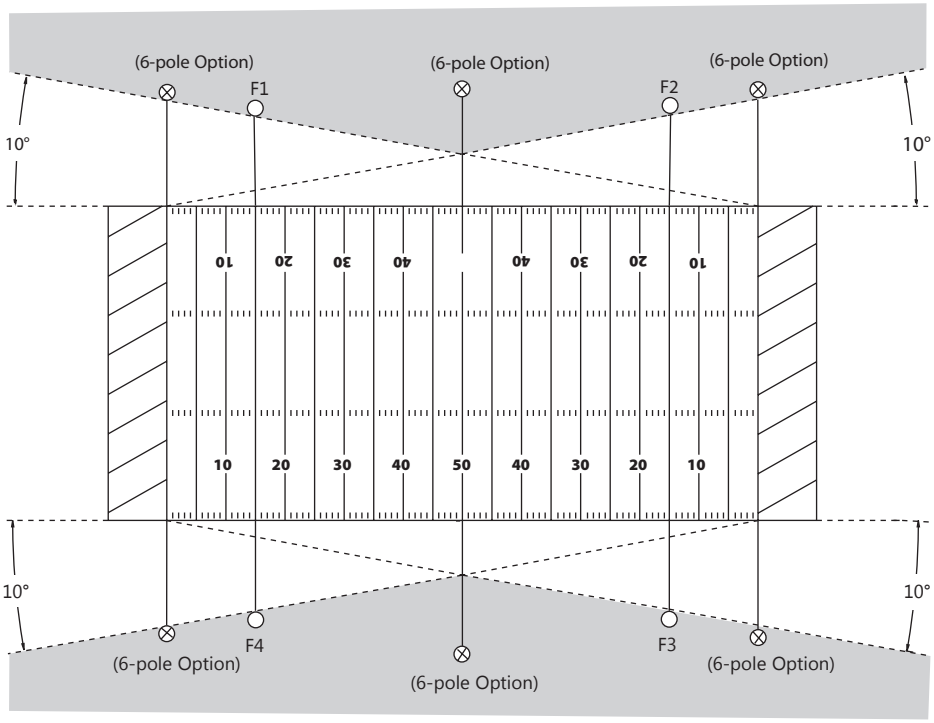
5 or 6-Pole Baseball/Softball Field

1. Poles are shown in optimal locations. Other permissible pole locations are indicated by the shaded areas.
2. For fields with a radius of 320 ft or greater, an 8-pole design is recommended.
3. Line drawn through the two “A” pole locations should be behind home plate to ensure lighting the portion of the ball the batter sees as it crosses home plate.
4. Consideration should be given to locating “B” poles further toward the outfield locations. This positioning towards the outfield foul pole allows the ball to be lighted in a more constant perpendicular illuminance as it travels from the infield to the outfield.



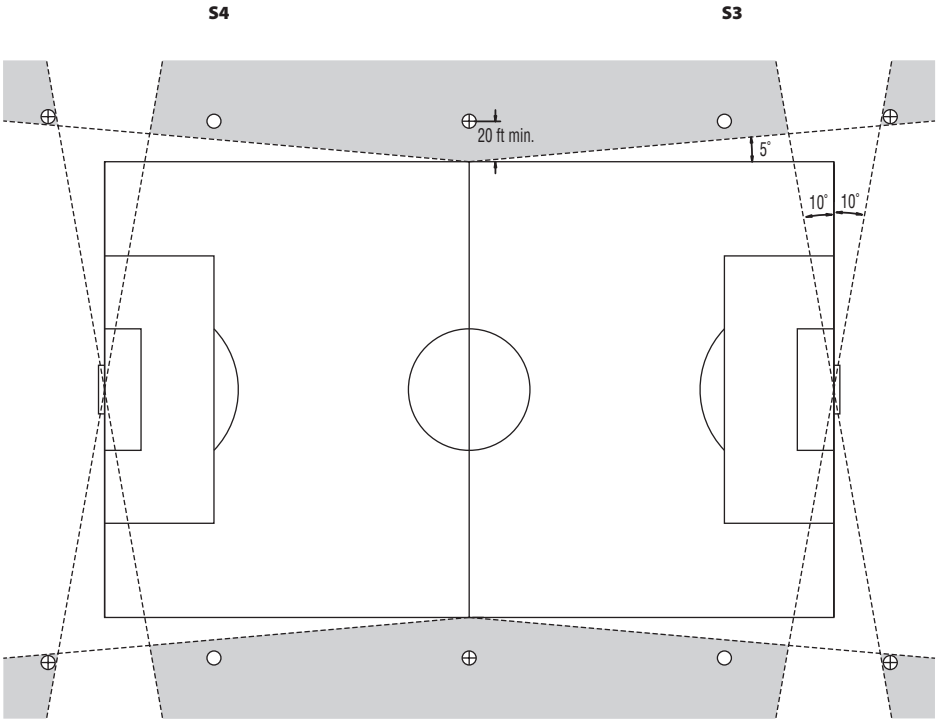
7 or 8-Pole Baseball/Softball Field

1. Shaded areas indicate recommended pole location.
2. Line drawn through each “A” pole location must be behind home plate to ensure lighting the portion of the ball the batter sees as it crosses home plate.
3. Consideration should be given to locating “B” poles further towards outfield locations. This positioning towards the outfield foul pole allows the ball to be lit in a more constant perpendicular illuminance as it travels from the infield to the outfield.
4. “B” poles may be located 10 ft closer to the infield as long as they maintain a position outside the 10° arc. The shaded area is preferable.



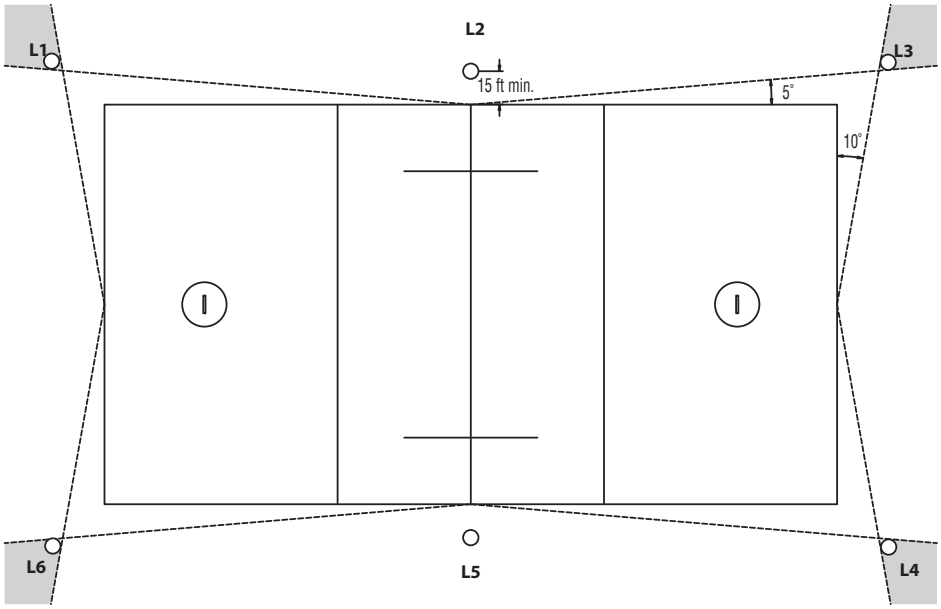
Football Field

1. Shaded areas indicate recommended pole location. All poles should be at least 45 ft from sideline.
2. On a 4-pole design, poles should be located between the 20-yard line and the goal line.
3. For the 6-pole option, setback of middle poles will depend on the presence of bleachers.
4. For TV consideration on a 6-pole design, outside poles should be located toward the end zone line. Optimum placement for TV is 10-15 ft off the end zone line for an end zone camera.



Soccer Field

1. Poles are shown in optimal locations. Other permissible pole locations are indicated by the shaded areas. All poles should be at least 20 ft from the sideline.
2. On a 4-pole design, the optimum pole locations are (0.35 x field length) from center of field.
3. In general, football lighting standards apply to soccer with the following considerations:
   a. A corner kick is a specific visual task and general consideration should be given to facility design specifically for soccer.
   b. The corner grid point shall be lit to no less than 90% of the average light level.
3. For combination football and soccer facilities, soccer should take precedence.
4. Vertical aiming angles should be 2° minimum. The angles are measured from below a horizontal plane at luminaire height.

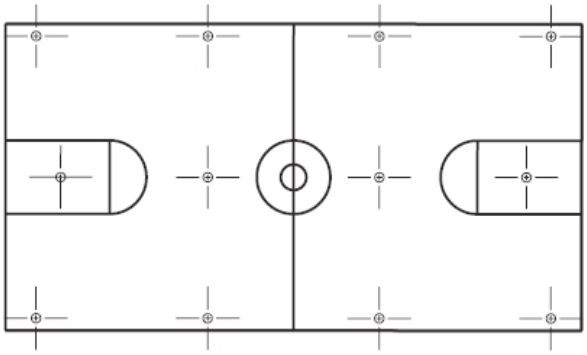


Lacrosse Field

1. Poles are shown in optimal locations. Other permissible pole locations are indicated by the shaded areas. All poles should be at least 15 ft from the sideline.
2. Vertical aiming angle should be 21° minimum. The angles are measured from below a horizontal plane at luminaire height.
3. A 4-pole design utilizing corner location is permissible providing minimum aiming angles can be achieved.

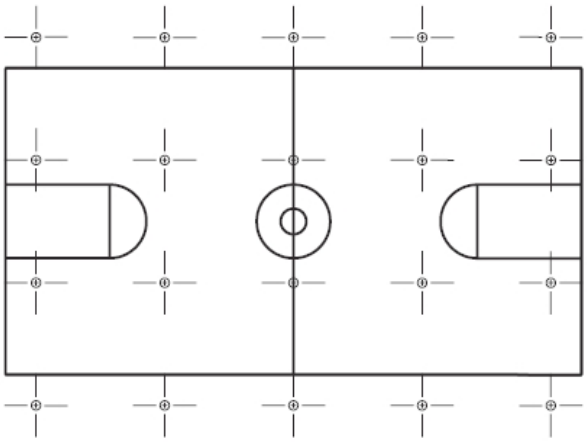
12 Luminaire Design

Designed for lighting in gymnasiums with no special provision for spectators such as smaller high schools or training facilities.



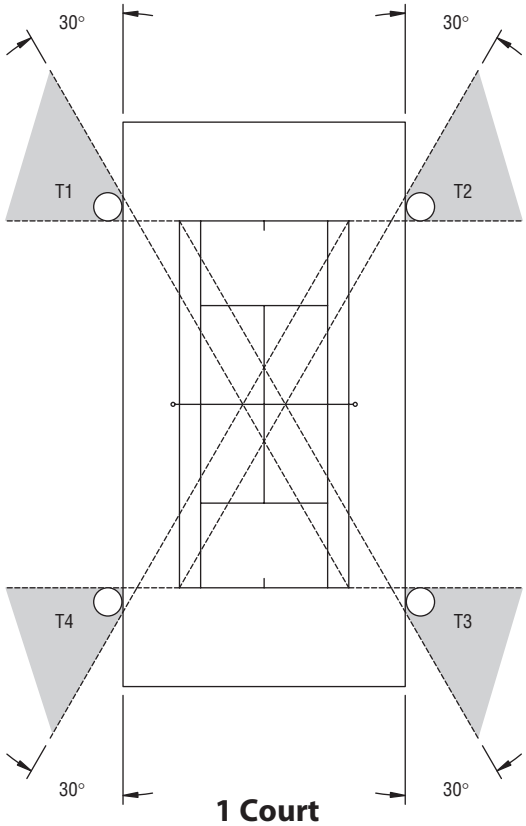
20 Luminaire Design

Ideal for college, semi-professional, or large high schools with facilities for spectators of 5000 or less. Suitable for facilities where lighted surfaces are 50 ft x 94 ft with 22 ft mounting heights.



Gymnasium

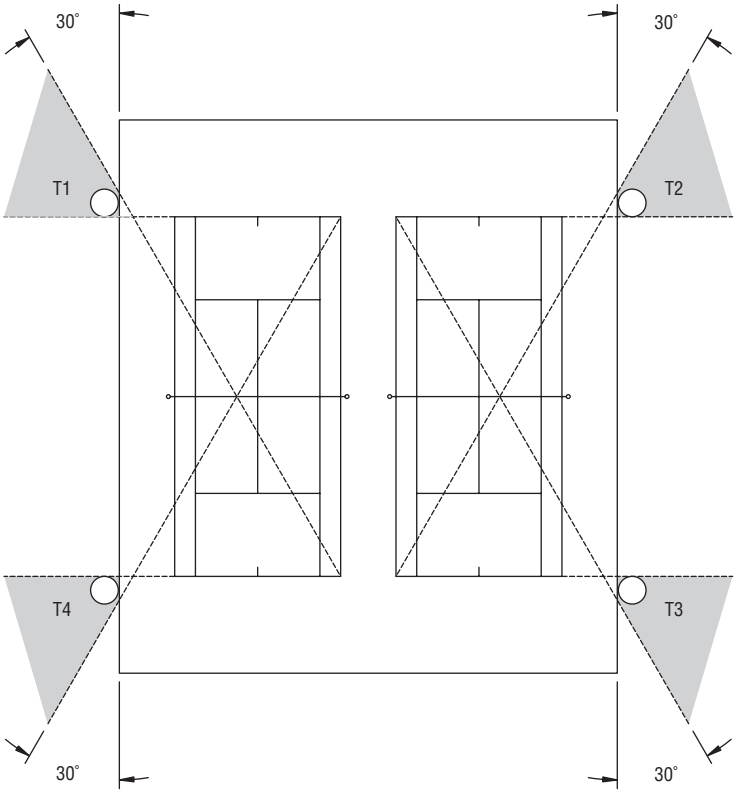
1. For new facilities or upgrades, it is recommended to consult a lighting professional for optimal fixture placement.
2. Optimal fixture placement and mounting heights will impact playability and minimize glare and skip glare.
3. As a general rule, due to mounting heights, lower wattage fixtures are used to achieve recommended light levels.



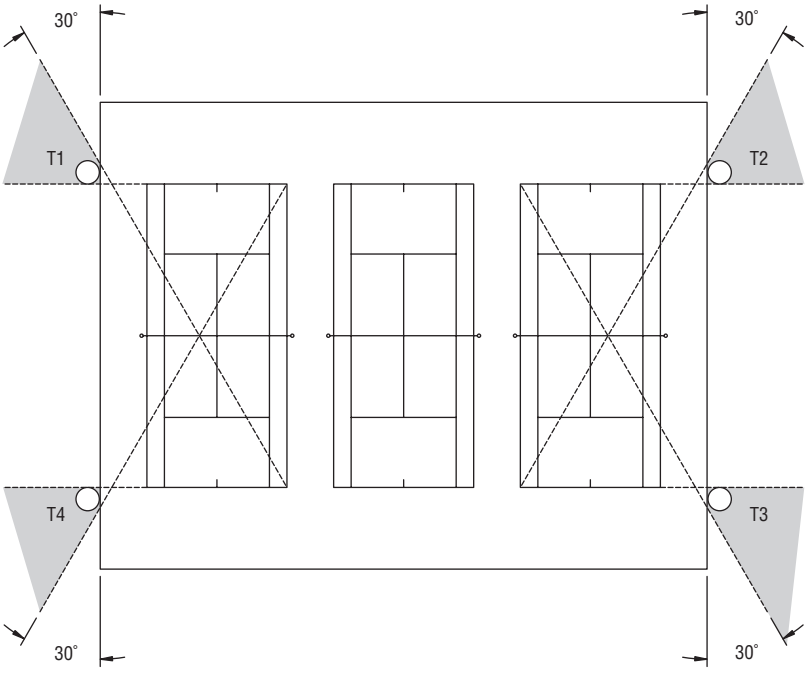
1 Court

Tennis Courts

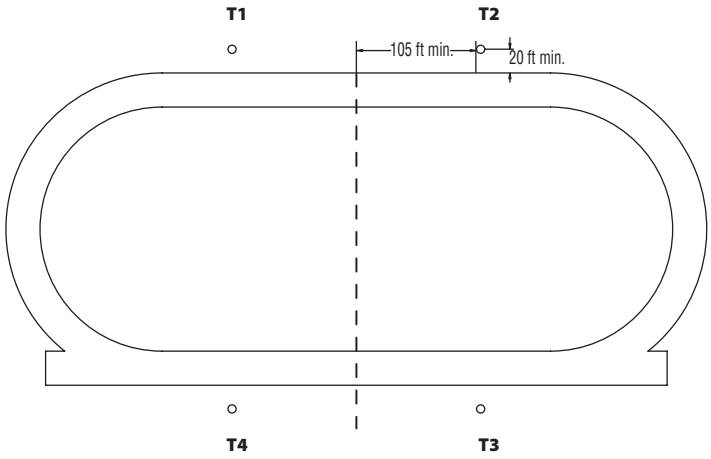
1. Poles are shown in optimal locations. Other permissible pole locations are indicated by the shaded areas.
2. It is not generally recommended to use a 6-pole layout with poles located at net lines. This position may be directly in the server's sight line with toss when the ball is served.
3. Vertical aiming angles should be 25° minimum. The angles are measured from below a horizontal plane at luminaire height.



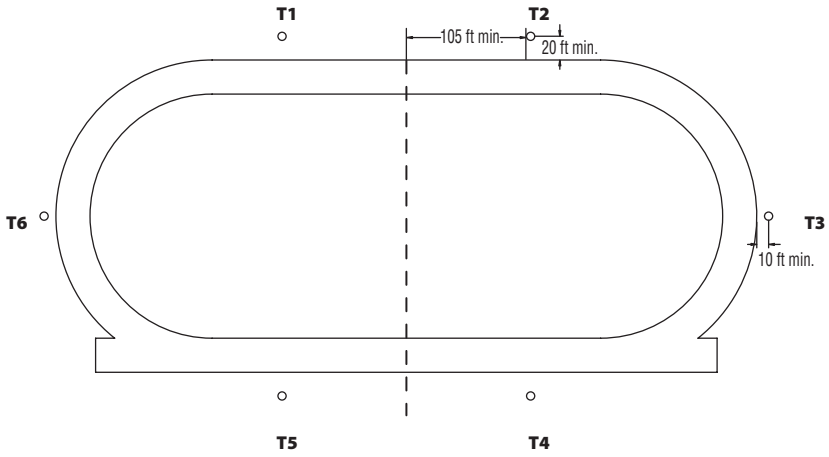
2 Courts



3 Courts



4-Pole Track



6-Pole Track

400 m, 8 Lane Track

1. These pole locations are for typical stand-alone tracks.
2. For tracks built in conjunction with a football or soccer field, use the standard pole locations on the football design (page 22) or soccer design (page 23).

Lighting Performance Testing

To verify that your field meets the NCHSAA recommended standards, complete the performance testing information below. The inspection must be done using a light meter calibrated within the last 12 months. The light meter should be held horizontally 36 in above the middle point of each square in the grid.

Baseball/Softball

To obtain average footcandle value:

Record light readings within each square.

Infield = Total of infield readings ÷ 25

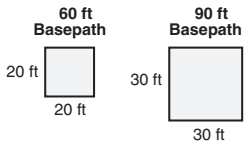
Outfield = Total of outfield readings ÷ number of readings.

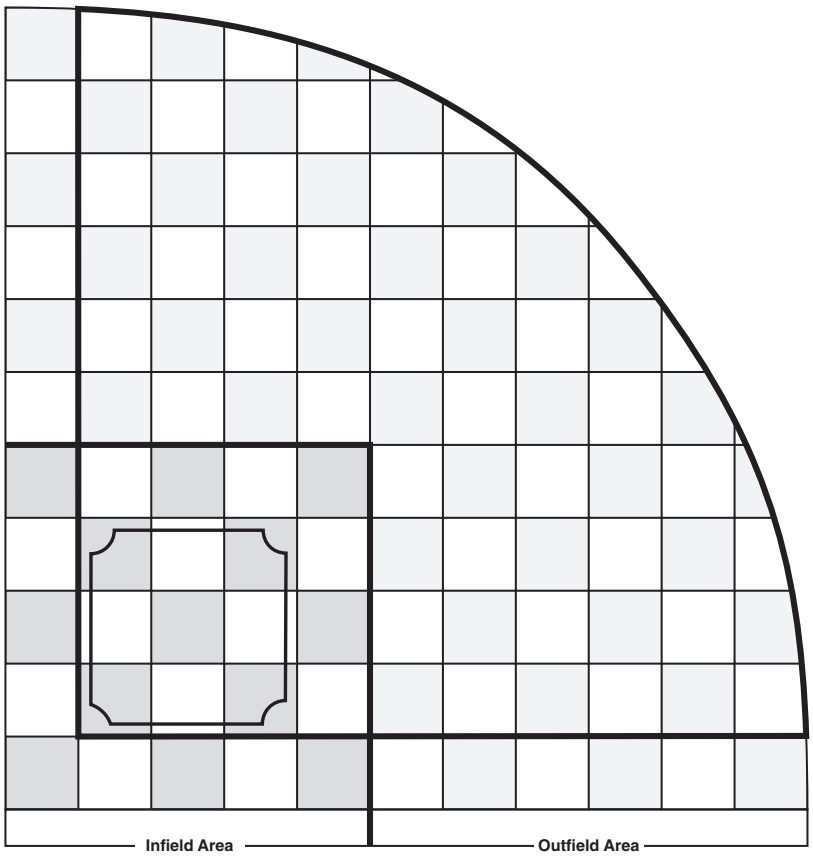
To obtain uniformity ratio for infield or outfield:

Divide highest (maximum) light level reading by the lowest (minimum) light level reading:
Maximum reading _____ ÷ Minimum reading _____ = _____ Uniformity ratio

For example:

61 footcandles ÷ 31 footcandles = 2.1





Football

To obtain average footcandle value:

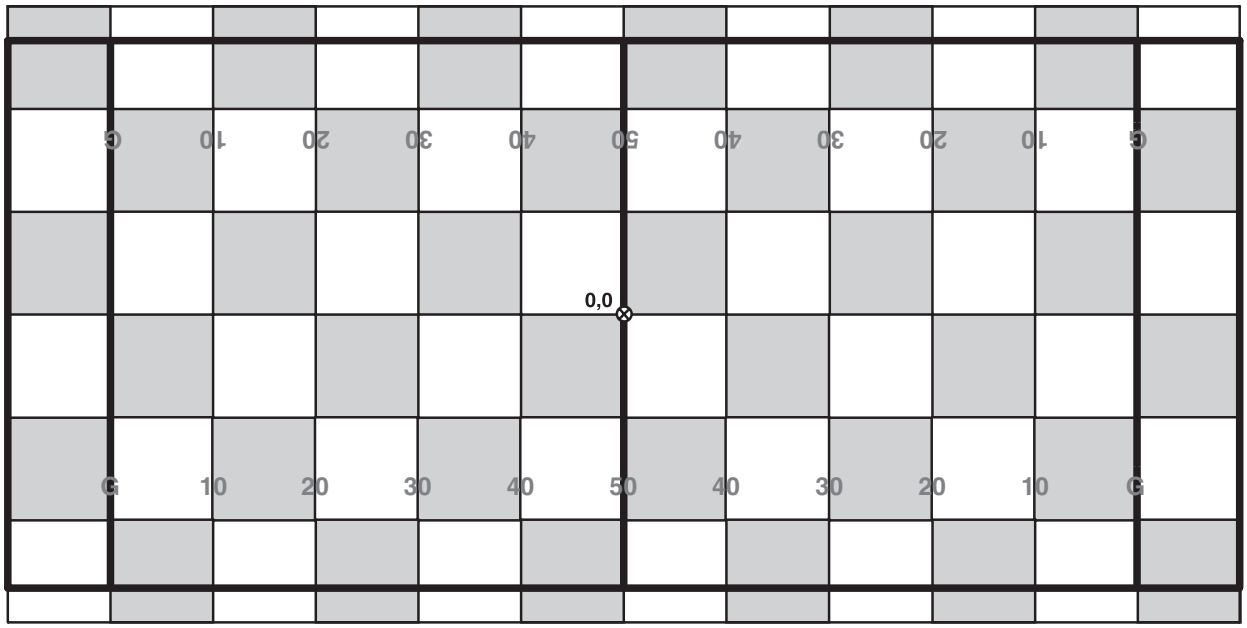
Record light readings within each square.

Total all readings, divide by total number of readings taken.

To obtain uniformity ratio:

Divide highest (maximum) light level reading by the lowest (minimum) light level reading:
Maximum reading _____ ÷ Minimum reading _____ = _____ Uniformity ratio

30 ft x 30 ft grid



Soccer

To obtain average footcandle value:

Record light readings within each square.

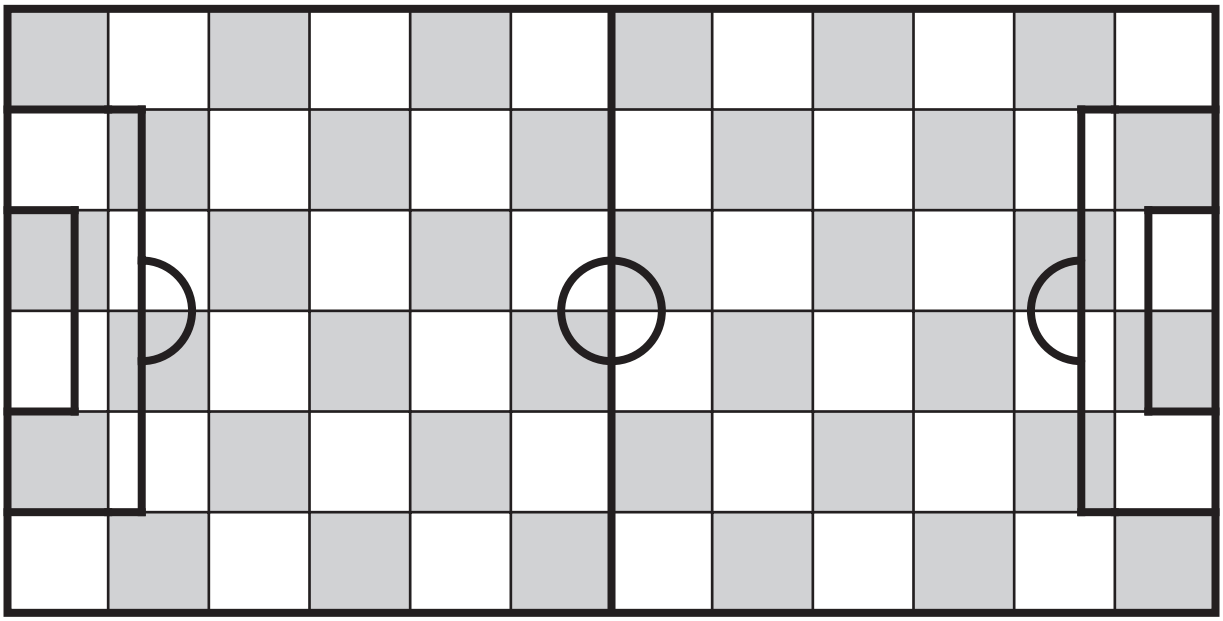
Total all readings, divide by total number of readings taken.

To obtain uniformity ratio:

Divide highest (maximum) light level reading by the lowest (minimum) light level reading:

Maximum reading _____ ÷ Minimum reading _____ = _____ Uniformity ratio

30 ft x 30 ft grid



Lacrosse

To obtain average footcandle value:

Record light readings within each square.

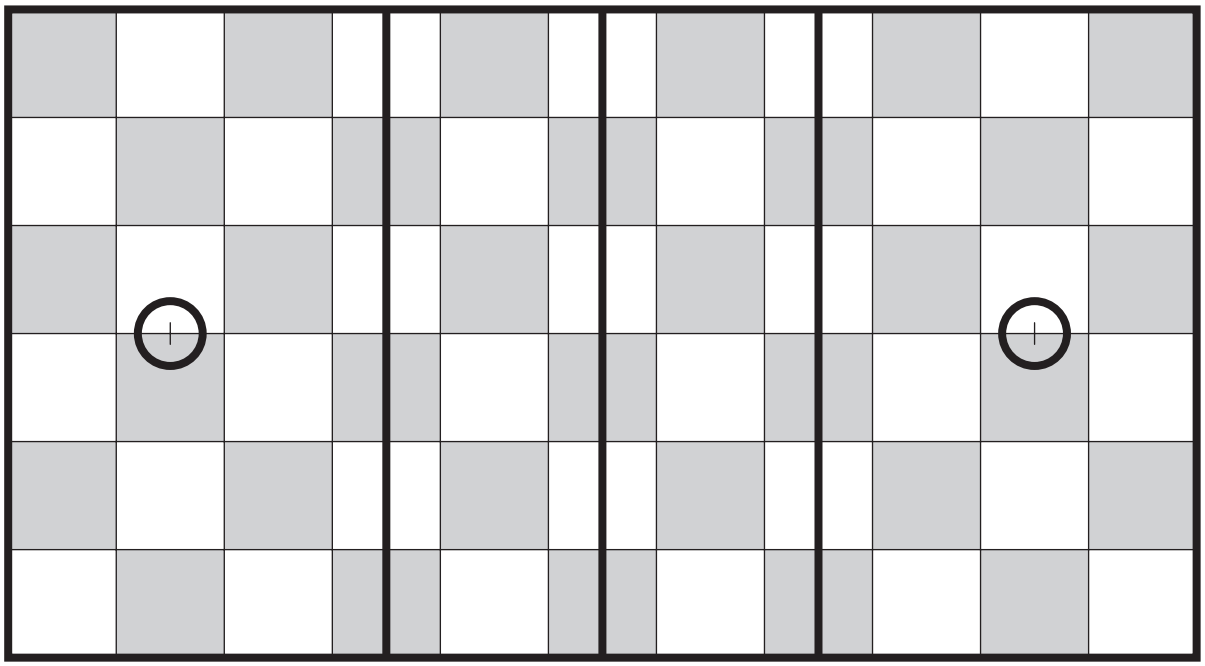
Total all readings, divide by total number of readings taken.

To obtain uniformity ratio:

Divide highest (maximum) light level reading by the lowest (minimum) light level reading:

Maximum reading _____ ÷ Minimum reading _____ = _____ Uniformity ratio

30 ft x 30 ft grid



Gymnasium

To obtain average footcandle value:

Record light readings within each square.

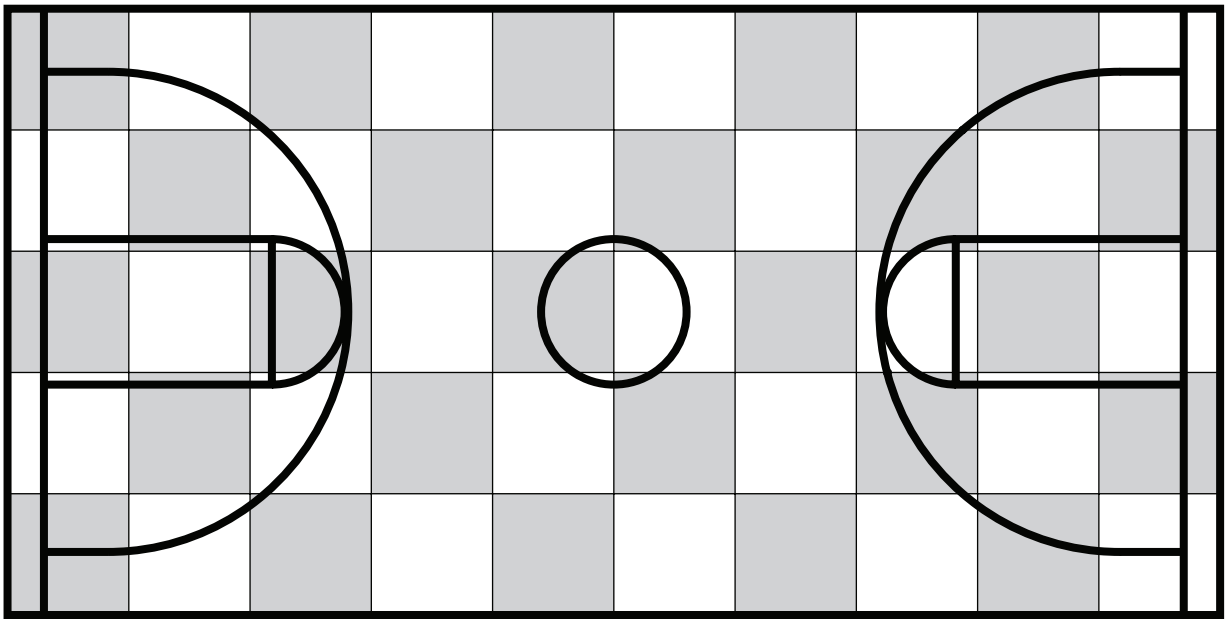
Total all readings, divide by total number of readings taken.

To obtain uniformity ratio:

Divide highest (maximum) light level reading by the lowest (minimum) light level reading:

Maximum reading _____ ÷ Minimum reading _____ = _____ Uniformity ratio

10 ft x 10 ft grid



Tennis

To obtain average footcandle value:

Record light readings within each square.

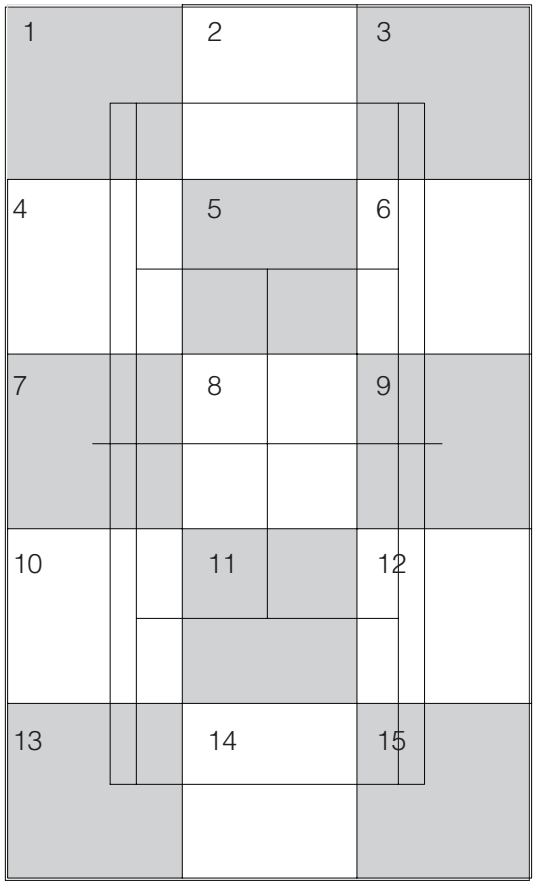
Total all readings, divide by total number of readings taken.

To obtain uniformity ratio:

Divide highest (maximum) light level reading by the lowest (minimum) light level reading:

Maximum reading _____ ÷ Minimum reading _____ = _____ Uniformity ratio

20 ft x 20 ft grid



Track

To obtain average footcandle value:

Record light readings within each square.

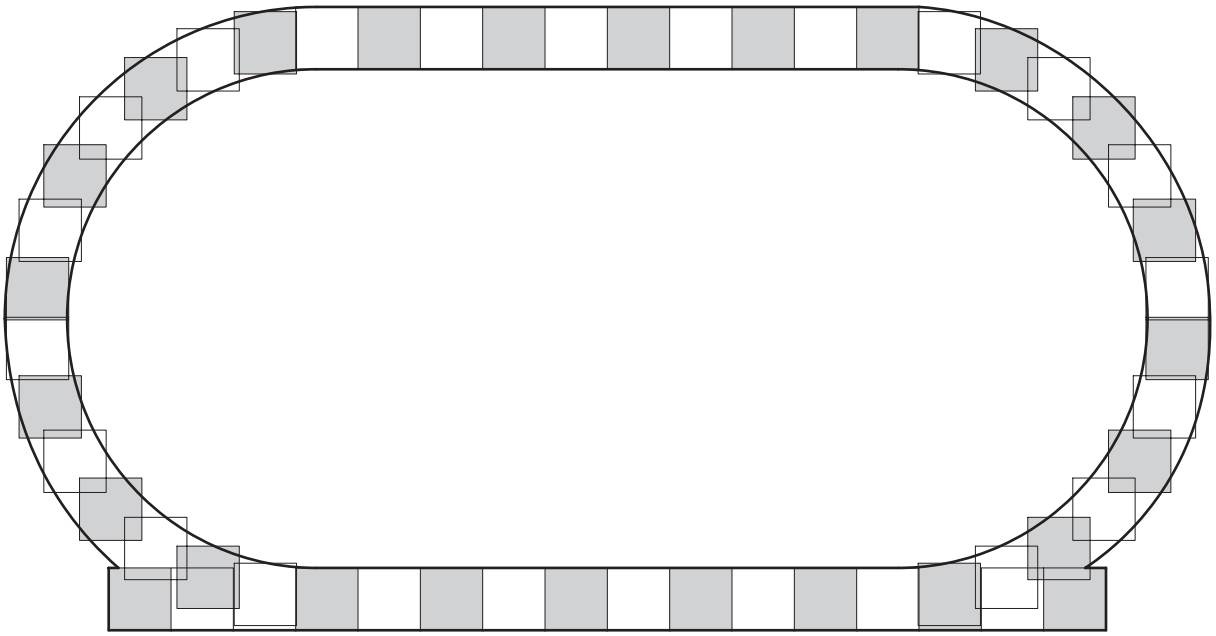
Total all readings, divide by total number of readings taken.

To obtain uniformity ratio:

Divide highest (maximum) light level reading by the lowest (minimum) light level reading:

Maximum reading _____ ÷ Minimum reading _____ = _____ Uniformity ratio

30 ft x 30 ft grid



GLOSSARY

Aiming Angles (vertical) – The degrees below horizontal that luminaires are aimed at the field. Angles are measured from a horizontal plane at luminaire height. Critical in safe, playable lighting design.

Candela – A unit that represents the intensity of light the eye experiences, from a specific viewing angle of a source.

Coefficient of Variation – The ratio of the standard deviation for all of the footcandle values to the average. A maximum ratio is specified.

Color Rendering Index – The ability of a light source to reproduce colors accurately, compared to the same colors under daylight conditions.

Correlated Color Temperature (CCT) – The color appearance of a light source, measured in Kelvin. Lower temperatures will appear yellow, whereas higher temperatures are a crisper white

Controller – A device that regulates the output of an LED driver to control LED luminaire lumen output.

Driver – A power source that delivers the proper operating current to LED luminaires.

Footcandle (fc) – The measurement of light on a surface. One footcandle equals one lumen spread over one square foot.

Glare – Light that interferes with the ability to see. Luminaire design, proper aiming angles, and pole locations are key to limiting glare for participants and spectators.

IESNA – Illuminating Engineering Society of North America. An organization that develops recommendations for sports lighting.

Lockout/Tagout – A safety procedure to ensure that equipment is properly shutoff and not able to be used.

Lumen – A quantity measurement of light, used mostly in measuring the amount of light an LED creates.

Luminaire NEMA Type – A classification of luminaires. For example, a NEMA 2 luminaire gathers light in a narrow, focused beam, allowing it to be projected a long distance. A NEMA 5 project lights a relatively short distance in a very wide beam. Most lighting designs use various combinations of NEMA types to get the desired results.

NEC – National Electric Code. A national safety code for electrical systems that is the basis for most local codes.

NFPA – National Fire Protection Association. An organization that establishes and publishes various codes such as the Lightning Protection Code and the National Electric Code.

Overcurrent Protection – The method of implementing hardware and other electrical components to limit or disable current flow.

Overturning Moment – The amount of force applied to a lighting structure, mostly from wind. Pole foundations must be designed to withstand this force.

Remote Electrical Components Enclosure – A weatherproof enclosure that allows the electrical gear to be moved from the top of lighting structures to a lower point where it can be serviced from a step ladder.

Spill Light – Wasted light that falls off the field or is projected into the sky. Systems that can re-direct spill light back onto the field save dollars and keep neighbors content.

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

Underwriters Laboratories (UL) – Independent, non-profit, product safety testing and certification organization. Visit www.ul.org for additional information.

Uniformity – The smoothness of light on the field. Also called uniformity ratio. A design criteria to assure that light is distributed evenly across the entire field. A max/min ratio of 2:1 means that the brightest point is no more than double any other point.

Uniformity Gradient – The ratio between any two adjacent illuminance values on the field. A maximum ratio is specified.

For additional information, contact the NCHSAA office at:

222 Finley Golf Course Road

Chapel Hill, NC 27517

919•240•7401

www.nchsaa.org