Community Sporting Facility Lighting Guide

for Australian Rules football, Football (Soccer) and Netball

State Government Victoria
Department of Planning and Community Development

Index

Minister's Foreword

Local sporting facilities create a place where people gather with family and friends to keep active and socialise.

Across Victoria, we are now experiencing increased demand for our sporting facilities due to large participation numbers in several sports including football (soccer), Australian Rules and Netball. In recent years the demand on playing facilities for these sports has meant developing innovative solutions to cater for participation needs.

The provision of more uniform, higher quality and practical sports lighting is helping meet this demand. However, as many of us know the provision of sports lighting can be a complex and technical task without the correct information.

That's why I'm pleased to present the *Community Sporting Facility Lighting Guide.*

This Guide is designed to answer key questions local clubs, organisations and councils may have when undertaking lighting projects for Australian Rules football, football (soccer) and netball. It offers recommendations for planning, design, maintenance and operation of a variety of lighting systems.

This Guide will assist local sporting clubs, organisations and councils develop facilities for communities to enjoy well into the future.

HUGH DELAHUNTY MP
Minister for Sport and Recreation

Introduction

The *Community Sporting Facility Lighting Guide* for Australian Rules football, football (soccer) and netball has been developed to assist clubs and councils to install effective sports lighting for their facilities.

Some components in this Guide are technical in nature and are therefore predominantly provided to inform clubs and councils in their discussions with qualified lighting experts.

This Guide covers key topics that councils and clubs will need to consider when planning a sports lighting project. These include:

- Planning process
- Planning the power supply
- Maintenance and operation
- Environmentally sustainable design
- Types of lighting
- Pole height and location
- Design standards for training and competition
- Where to get further assistance

This Guide is divided into four sections. Section One covers general information to plan a lighting project which is suitable for all sports lighting projects. The remaining three sections contain sport specific information relating to Australian Rules, football (soccer) and netball.

A range of useful tips have been provided throughout the Guide to highlight a number of planning considerations for local clubs and councils.

Glossary

The following table defines key lighting terms.

Term	Meaning
Colour Rendering Index (CRI)	Measure of the degree to which the colours of objects illuminated by a given lamp conform to those of the same objects under an ideal light source of similar colour appearance. CRI range from 0-100. The higher the CRI, the better the colour rendition appears. An inappropriate colour rendition can deceive the eye and supply it with wrong information.
Floodlight	A lamp designed specifically for floodlighting or sports lighting (usually weatherproof).
Glare rating	A numerical value on a scale of 0 to 100, determined in a specified manner, representing the degree of glare from a lighting system for given observer positions and viewing directions. Higher values correspond to greater glare from the lighting system.
Illuminance (Lux)	The total amount of visible light illuminating a point on a surface from all directions above the surface. The standard unit for illuminance is Lux (lx). For a lamp it normally refers to the total light emitted irrespective of the directions in which it is distributed.
Kilowatt (kW)	The total power requirements for a series of lamps – a lighting system – are usually defined in terms of kilowatts. One kilowatt equals 1000 watts.
Light loss factor	The ratio of the illuminance provided by an installation in the average condition of dirtiness and with a lamp of average age expected in service, to the initial illuminance provided by the same installation.
Metal halide lamp	A high intensity discharge lamp with high efficiency and good colour rendition. These lamps are used in stadiums, warehouses and industrial settings.
Principal Playing Area	All portions of all surfaces which the ball or participants may touch and be considered in play in accordance with the rules.
Uniformity ratios	Describes the uniformity of light levels across an area. This may be expressed as a ratio of minimum to average or it may be expressed as a ratio of maximum to minimum level of illumination for a given area.
Watt (W)	The watt is a unit for measuring electrical power. It defines the rate of energy consumption by an electric device. The power input to a lamp is usually measured in watts.

Source: Standards Australia, Sports Lighting Part 1: General Principles, Volume 2560.1 - 2007

The Planning Process

This section assumes the appropriate pre-planning has been undertaken to ascertain that a sports lighting project is needed.

New or amended sports lighting installations will need to consider obtaining statutory planning consent and other appropriate approvals.

Planning Permits

A planning permit is a statement that a particular use or development (subdivision, buildings, and works) may proceed on a specified parcel of land. Sometimes a permit is specific to a nominated person or operator. It is always subject to a time limit and will expire under specified circumstances. The responsible authority (usually local council) is entitled to impose conditions when granting a permit.

If you propose to use or develop land, first discuss the proposal in detail with your local council planning and recreation departments. Early discussion will confirm whether a planning permit is necessary and highlight likely conditions. Typically, sports lighting upgrades do not require a permit.

The planning permit process may require consultation with surrounding residents and other stakeholders. Organisations should consider undertaking community consultation prior to seeking a planning permit to help address any community concerns.

It is important not to confuse planning permits with building permits. Building permits relate to the method of construction of a building or development to ensure it complies with relevant standards. A planning permit does not remove the need to obtain a building permit.

When applying for a planning permit, applicants should use their local council's *Planning Permit Application* form and include the prescribed permit application fee (refer to the *Planning and Environment (Fees) Regulations 2000*), and all necessary supporting information, such as accurate plans, reports and photographs.

Spill Light

As residential properties are often in close proximity to sporting fields, spill light issues (i.e. light that falls outside the area intended to be lit) need to be considered in the planning process. Planning permits often require verification of obtrusive lighting provisions (i.e. calculation of spill light to nearby residences). There may also be special traffic and aviation spill lighting requirements that apply to your area.

Building Permits

Many light pole installations will require a building permit, irrespective of whether a planning permit is also required. In many instances local council is the landowner and needs to grant permission for any works to be carried out on its land. The *Building Regulations 2006* indicate that for poles not attached to a building, a permit is required when they are over eight metres in height. Further information about the building permit process can be obtained from the building department of your local council.

Tips & Suggestions

- If planning permits require verification of Obtrusive Lighting Provisions (i.e. calculation of spill light to nearby residences or other sensitive locations), include this into your project design brief and be aware that additional design time may be required.
- Establish the proximity and orientation of any nearby residential areas at the time of planning the site design layout. Simple matters like field/court orientation and set out can help limit spill light to residential areas. Typically greater than 20m distance from a property boundary will likely see less light spill.
- Identify any particularly sensitive locations that may be impacted by proposed sports lighting e.g. main roads and/or intersections.
- Consider proximity to airports and ensure civil aviation requirements for screening of sports lights are addressed. Restrictions typically exist up to 6kms away from airport runways.

Budget

The budget tables included in this guide provide a breakdown of indicative costs for a new sports lighting installation consistent with the sample layouts highlighted. This is current at the time of writing (2011) and annual cost escalations should be taken into account.

There are a number of factors that will have a bearing on probable costs to establish new or upgraded sports lighting. It is recommended that the budget be used as a guide only as site specific factors and implementation aspects will vary between projects (e.g. power supply requirements).

Existing installations give rise to different cost considerations. Questions regarding suitability of the existing equipment to be used as part of an upgraded design need to be carefully considered to ensure they comply with the current Australian Standards (AS). Be particularly mindful of the pole height as many older poles do not meet current Australian Standards.

For new sports lighting, soil conditions should be considered as this may impact on the placement of poles and overall costs. For example many recreational reserves are constructed over landfill sites with poor soil conditions. Alternatively, facilities may be constructed on sites where rock is commonly encountered.

Therefore, it is critical to obtain a geotechnical report of soil conditions at the proposed pole locations in conjunction with a structural engineer advising on the pole foundation designs. A geotechnical report typically costs $2,000 and should be included in your budget.

Equipment

Sports lighting should be designed and installed so that the sport being conducted can be comfortably performed by the participants and officials and viewed by spectators.

Before installation, consideration should be given to determine what the intended purpose of play is; training, club-competition or semi-professional play. Making provision for upgrades (e.g. pole size and cabling) can significantly reduce the cost of upgrades in the future.

The decision to install sports lighting should be made following consultation between the user groups, council and peak sporting bodies. Visiting sites with different levels of lighting also provides project proponents with a practical understanding of what various lux levels actually mean.

Project Insight

In 1991 the Learmonth Football and Netball Club upgraded their Australian Rules football lighting to an average of 100 lux with infrastructure in place to accommodate additional lighting upgrades into the future. In 2008 the Club was able to upgrade their lighting to over 150 lux whilst still maintaining Australian Standards without the need to replace poles or upgrade power supply.

(See page 57 for more details.)

The sports lighting installations can also serve to intentionally illuminate the areas where spectators gather. Poles can be used to mount other lights to illuminate perimeter areas. This needs to be considered when specifying poles and allowing the provision to mount such lighting (usually at lower levels on the poles), using separate electrical cabling infrastructure. This will allow operation of the lights for different times and requirements, such as public lighting.

Planning Power and Electrical Supply

Contact your local electricity company early in the process to organise power to the facility. Consider who is paying for the power use. Options include providing a separate metered account, installing a check meter which logs hours of use or payments based on typical usage patterns.

Power supply requirements should be discussed early in the planning process to ensure supply requirements can be met for both immediate and future lux levels.

A field of play will vary in its power demand requirements depending on the illumination level. Competition level lighting power demands are often greater than the rest of the facility's demand combined.

In addition, many sports lights have a higher demand during start up and this demand needs to be carefully considered when selecting the electrical supply and cable reticulation.

Power supply to each pole can come from either the clubroom main switchboard (for training level) or a dedicated floodlighting switchboard and submain supply system for each pole (for competitive level). Ensure existing switchboards have the capacity to cope with additional requirements.

Health and Safety tip

The power supply to each pole can come from the clubroom main switchboard. While not mandatory, control via a suitable Residual Current Device is recommended. The Residual Current Device is designed to disconnect the power supply to prevent an 'electrical leak' which can cause fatal injury through an 'electric shock'.

Tips & Suggestions

- Establish what method will be used to meter/record lighting use, particularly for the purposes of attributing power bill payments and maintenance.
- Determine the power supply required to meet immediate and future levels of play. Ascertain whether the supply required is readily available and any potential costs.

Control Supply – How should lights be controlled?

Training level lighting is often controlled directly through manual switches.

Club competition level lighting can also be controlled in a similar way on a pole-by-pole basis. Pole switches can be located at a central location or at the base of each pole.

Switches should be either operated by key, in a lockable enclosure or locked in a controlled area accessible to authorized persons only. Accessibility should be considered when locating lighting controls.

A useful and inexpensive additional measure is to fit an hours-run indicator to log operating hours. This allows clubs to keep track of energy use (= hours x total rated wattage of lights) and provides a log for repair and maintenance purposes.

Diagram 1 – The pole is permanently wired from the club switchboard. A key switch at the base of the pole provides lighting control of a playing surface.

Environmental tip

The configuration of competition lighting in set groups (banks) enables the provision of lower lighting levels to suit training use. This will save energy, reduce running costs and increase the life cycle of the lamps.

Project Insight

Lighting at the Fawkner Secondary College Synthetic Pitch is controlled through a key lockable switch to restrict the operation of floodlights to authorised persons.

(See page 58 for more details.)

Operation and Maintenance

Sports lights are usually operated manually. Curfew timers can, however, offer a simple inexpensive energy saving measure to ensure sports lights do not burn excessively if they are accidentally left on. Curfew timers can also ensure that sports lights are not run past a set 'curfew' time that have been set in agreement with local residents or council policy. N.B. Curfew timers are not appropriate if the lighting could be used by emergency services.

Operation and Maintenance Manuals

Operation and maintenance manuals provide guidance on the correct operation and maintenance of floodlights. Developing an operation and maintenance manual at the time of the sports lighting installation will assist with the longevity and performance of lights.

Section 4 in AS 2560.1-2002 contains useful details concerning 'Maintenance of Outdoor Lighting Equipment' which should be used when developing a maintenance manual.

The operation and maintenance manual should identify a policy for lamp replacement and should specify how regularly lights are cleaned. Manufacturer's advice should be sought regarding cleaning procedures and any other maintenance recommendations.

Labelling each light with a unique reference and cross referencing this in the operation and maintenance manual assists with future maintenance and record keeping. Information from hours-run indicators and curfew timers (devices that automatically record the hours of lighting usage) should be recorded in the operation and maintenance manual to assist with further maintenance scheduling.

Usage Patterns

Lamp manufacturers determine the average life of lamps according to expected usage patterns. Therefore, more frequent 'switching on' of the lights will shorten their life and reduce performance.

Manufacturers typically base the average life of lamps on a three hour 'on' operation. Discuss potential implications with manufacturers if your lighting's usage patterns are expected to differ from this. Be aware that some manufacturers base average life of lamps on a ten hour 'on' operation which is not consistent with practical use in a club setting.

There are number of factors that affect the life of a lamp. These include:

- Lamp lumen depreciation (light output drops off with age).
- Lamp dirt depreciation (light output will reduce as dirt accumulates on the lamps).

Aiming has a major impact on performance. A common factor in poor light performance is lamps which are not aimed correctly at installation.

Sports Light Aiming and Commissioning

It is important that sports light aiming is completed by a professional under the supervision of the lighting designer or floodlight supplier. The aiming should be undertaken using specifically designed equipment and not 'by eye'. The set aiming positions should be recorded in case it is necessary to re-aim errant lights in the future.

Make provision for a commissioning lighting measurement test, preferably by an independent party, to verify that the aiming has indeed achieved the design outcome. Generally, this involves taking lighting measurements on a 10m grid of points and should be directly compared with the lighting design. It is important to allow reasonable tolerances which the lighting design usually states (10% is commonly used).

The test should also form a necessary component of proof that the contractor has delivered the project properly and evidence of this may be required by funding partners. It is worth noting that the test may also be a requirement of the competition/league administrator if night matches intend to be held.

Light Loss Factor (previously known as Maintenance Factor)

To compensate for the progressive deterioration of a lighting system as it ages, an overall compensating factor referred to as 'Light Loss Factor' must be included in the design. For average outdoor conditions, a light loss factor of 0.8 to 0.7 should be included in the design calculation. If air pollution is heavy (e.g. in a heavy industrial area) or regular maintenance is not planned, factors of 0.65 or even 0.55 should be used to offset the increased light loss.

Tips & Suggestions

- Have the contractor develop an operation and maintenance manual at the time of commissioning the new or upgraded sports lighting. The manual should include lamp replacement and cleaning intervals to assist sports light performance being maintained throughout their life.
- Aiming is a relatively small component of many installations but has a major impact on performance. Have it done professionally.
- Record the final aiming position of floodlights in the operation and maintenance manual along with any on site adjustments made during commissioning.
- Install hours-run indicators to automatically record hours of use to assist with maintenance scheduling.
- Consider including curfew timers as an energy saving device or to comply with planning restrictions.

Environmentally Sustainable Design

Several facets of design require consideration to optimise environmental sustainability.

Sports Light Quantity

More floodlights equals more power. Designs which minimise sports light quantity will therefore also help minimise power use. Lighting installations should seek to use the most efficient floodlights possible with the highest practical light loss factor (e.g. 0.8).

Control Gear Wattage

Control gear is required to operate sports lights which itself consumes energy. The amount of energy depends on the make and model of lamp but typically 50-150W is consumed on top of the lamp power. Therefore a 2000W lamp may actually consume 2000 + 150 = 2150 Watts or close to 10% more power.

Control gear systems are available to optimise the energy consumption of lamps throughout their life. This reduces energy consumption and lowers maintenance costs as lamps need less frequent replacement. Sometimes called ‘lumen maintenance’ strategies, the control gear systems operate the lamps to obtain a more consistent light output, rather than having high light output at the beginning and diminished output as lamps age.

Duration – Hours of Use

Energy is power (watts) multiplied by time. Measures to limit the time lights are in use (e.g. curfew timers or key switch controls permitting access to authorised persons only) are relatively inexpensive to install. Costs are typically $300-500 to supply or retrofit. Such measures return the expense quite quickly (typically 3-5 years).

Tips & Suggestions

- Consider energy and maintenance costs over the life of the installation (not just the initial capital outlay) and budget accordingly.
- Have an appropriately qualified professional review lighting quotes prior to acceptance to provide advice on efficiency and performance.

Australian Rules Football Lighting

Key Standards

AS 2560.1 – 2002 Sports lighting Part 1: General Principles

AS 2560.2.3 – 2007 Specific Applications – Lighting for football (all codes)

AS 4282 – 1997 Control of the obtrusive effects of outdoor lighting

A basic requirement for illumination of a football field is that the ball is adequately illuminated at all times while in play.

The Australian Standards (series 2560.2.3) contains recommendations and requirements specific to the lighting of Australian Rules football. The standard deals with training and competition, and takes into consideration spectator viewing requirements.

The Standard contains information highlighting the maintained horizontal illuminance (lux) required for training and club competition at a recreational, amateur, semi-professional and professional level for Australian Rules football.

The table on page 15 uses information from the Australian Standards and requirements from the AFL to articulate the minimum average lux required for various levels of play.

Illuminance Requirements

The information outlined in this section regarding illuminance is technical in nature. The information is provided to make the reader aware of the standards and to be passed on to qualified lighting designers/ contractors who will then be able to plan your project.

Uniformity ratios are an important part of a complete set of lighting criteria and can have a positive effect on the quality of lighting installations. An adequate level of uniformity is required to create balanced lighting conditions so that people's eyes do not have to continually adapt to a different light level. The Minimum Horizontal Uniformities are given in two ratios, each providing a numerical representation of the uniformity of illuminance over a given area.

This may be expressed as a ratio of minimum to average (U1) or it may be expressed as a ratio of minimum to maximum (U2) level of illumination for a given area. For example, (U1) Club competition and match play minimum uniformity equals 0.5. The lowest level of illumination should not be less than 50% of average (U1) or 30% (U2) of the maximum level of illumination.

The above values are identified to provide for the safety of the participants and level of visual tasks anticipated. Factors such as large crowds (e.g. more than 10,000) with consequent longer viewing distances, might require higher values to be chosen than indicated above.

Australian Rules Football Lighting

Level of play	Typical Activity	Maintained average horizontal illuminance (lux)	Minimum horizontal uniformities		Maximum glare rating
			(U_1)	(U_2)	
Recreational level					
Touch and tag	Touch and tag football.	50	0.3	N/A	N/A
Amateur level					
Ball and physical training	May be suitable for training a local club level.^	50	0.3	N/A	N/A
Club competition and match practice	Minimum requirement suitable for competition at local club level. Provides minimal viewing distances for spectators. *(NB: below)	100	0.5	0.3	50
Semi-professional level					
Match practice	Suitable for training at a semi-professional (VFL) level.	100	0.5	0.3	50
Semi-professional competition	Minimum suitable for competition at a semi-professional level.	200	0.6	0.4	50
Professional level					
Match practice		200	0.6	0.4	50
Professional competition	Minimum suitable for professional (AFL) match.	500	0.7	0.5	50

Source: *Lighting Criteria (source Standards Australia, Sports lighting Part 2.3: Specific applications – Lighting for football (all codes))*

^ According to AS2560.2.3 footnote e), Ball and Physical Training is considered to differ from match practice in that ball and physical training is more controlled, involves fewer participants (typically two to four) and the paths of the participants and that of any ball used are more predictable than in a match-practice environment.

**NB:* *If a club, league or council is looking to develop a club night football venue, a minimum of 150 lux should be considered if it wishes to take contemporary viewing expectations of spectators into account. Where possible, it is recommended that clubs/councils inspect sites detailed in the guide and other recent installations to increase their understanding of the impact of different lighting levels.*

Recent installations include:

- *Woori Yallock Reserve*
- *East Point, Ballarat*
- *West Oval, North Geelong*
- *Carisbrook Recreation Reserve*

Types of Floodlights

The 2kW Metal Halide Luminaire is a standard floodlight for football sports lighting. It provides a versatile, robust design solution with good colour rendering properties and averagelamp life of 3-5,000 hours.

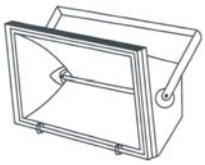
Lighting constructed with an International Protection rating of 'IP6x' classification leads to improved maintenance benefits and helps reduce costs.

The beam characteristics of floodlights to illuminate a particular playing field will depend on the size of the playing field and the number and location of lighting poles available.

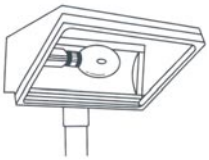
Major lighting suppliers have standard designs for various levels of play which can prove quite helpful. Caution should be exercised before adopting an indicative layout as site specific issues such as spill light and glare-to-light sensitive locations are not usually considered with such designs.

For competition play it may be necessary to use a combination of the full range of beam types described in Australian Standards (series 2560.1), in order to achieve the required illuminance and uniformity over the playing area. For training, floodlighting types A, B or C (see pictures below) will generally be suitable to achieve the required illuminance and uniformity.

Type A floodlight giving a symmetrical beam



Type B floodlight giving a fan-shaped beam



Type C floodlight giving a fan-shaped beam with asymmetric distribution in the vertical plane

The pictured floodlights are commonly used in four-pole arrangements for lighting playing surfaces.

In the design of Australian Rules football ground lighting installations, careful consideration should be given to visual requirements relating to the comfort of the participants and spectators. The selection of suitable floodlights should be the responsibility of the lighting designer who will have access to detailed photometric information and the means to apply it.

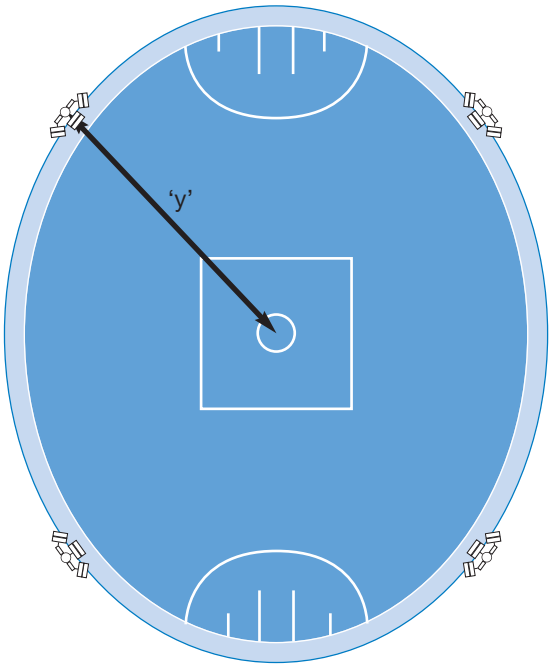
Tips & Suggestions

- Do not rely on nominal designs without seeking advice from qualified persons concerning the site specific installation issues (for example glare, light spill and identifying the need for any special measures).
- Gain an understanding about the underlying assumptions. For instance, what 'light loss factor' allowance has been made for light depreciation with age and dirt accumulation on light fittings?
- Consider whether the lighting performance depends on use of special lamps with high light output and what restrictions this will impose.
- Use a consistent make and model of floodlight for ease of design, routine maintenance and re-aiming in the future. Consider designs having an 'IP6x' classification to improve 'light loss factor' i.e. permit use of a higher factor.

Height and Type of Poles

Guidelines for pole height are given in the Australian Standard (series 2560.2.3).

Minimum pole height depends on the distance from the centre of the ground to the base of the pole location. For non-professional competition, the distance can be calculated by 0.36 x 'y' (the distance to proposed pole location from the centre of the ground) – see diagram below. For most grounds this will result in pole heights of 25-30 metres.



Poles required for Australian Rules are often a fixed design due to increased costs associated in obtaining poles which have inbuilt climbing structures or facilities to lower poles or headframes. In most cases, this requires crane access to reach the lights for maintenance. The crane access and clearances for safe working environments should be considered from the outset.

It is important to consider the highest standard of play proposed at a venue prior to the installation. Higher levels of play require more floodlights, higher poles, which require a larger headframe to support the floodlights. This may result in an increase in foundation costs.

The budget table on page 23 provides indicative pole supply costings.

Tips & Suggestions

- Refer to Australian Standards (series 2560.2.3) for recommended pole heights and locations. Pages 19-21 also provide an overview of requirements.
- Manage the risk. Check relevant 'conditions of use' and insurance matters before proceeding to install poles of inadequate height which may not to comply with the Australian Standard.
- Identify the highest level of play that the facility should be designed for and select poles to accommodate this higher play level incorporating the required structural capacity, electrical supply configuration and headframe facilities to mount future floodlights.
- Consider that efficient well designed floodlights can help reduce pole costs through lower quantities, less surface area, lower headframe mass and reduced foundation requirements.
- Consider how the light fittings will be maintained and ensure safe access can be obtained for routine lamp maintenance.
- Typically allow 3-4 months for pole supply and delivery.

Layout and Pole Locations

The recommended zones for the location of poles are available in AS 2560.2.3. The standard identifies placements for four and six pole designs.

As a general rule, it is recommended that when standing at the centre of the ground no poles are located within 20 degrees either side of the goal to goal line i.e. to avoid lights in the vicinity of the goals.

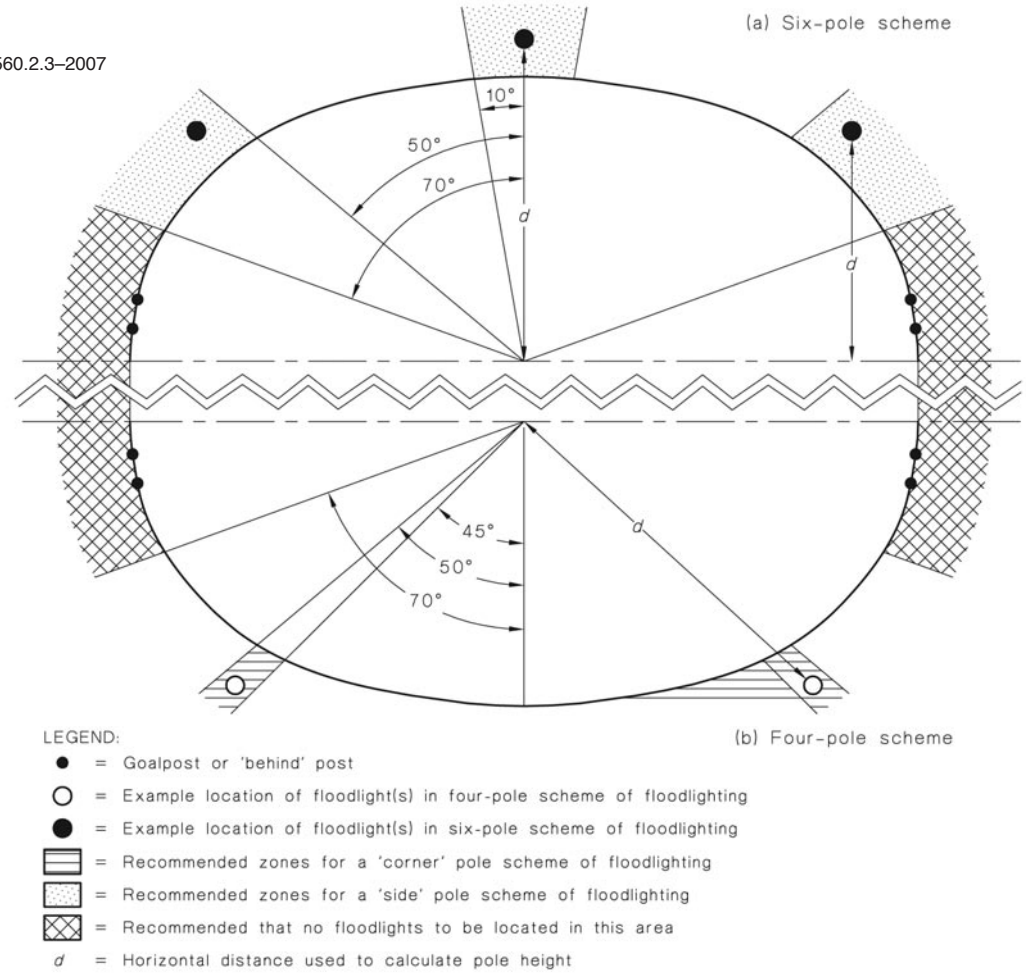
To minimise the risk of injury to players, poles should be located behind the boundary fence, if any, or set back at least five metres outside the limits of the playing area. The following Football Light Pole Arrangement diagram shows the recommended luminaire location zones for Australian Rules football.

Tips & Suggestions

- Consult the Australian Standard (series 2560.2.3) to locate poles in the correct zones for play. Pages 19-21 also provide an overview of requirements.
- Be aware of the minimum five metre obstruction clearances set out in the Standard from the edge of the principal playing area i.e. line marked boundary when planning the Ground Lighting Layout and pole positions.
- Consider the need for Geotechnical advice at light pole locations to establish proper foundation requirements. This will identify the true foundation costs at an early stage.

Diagram 2 – Football light pole arrangement

AS 2560.2.3–2007

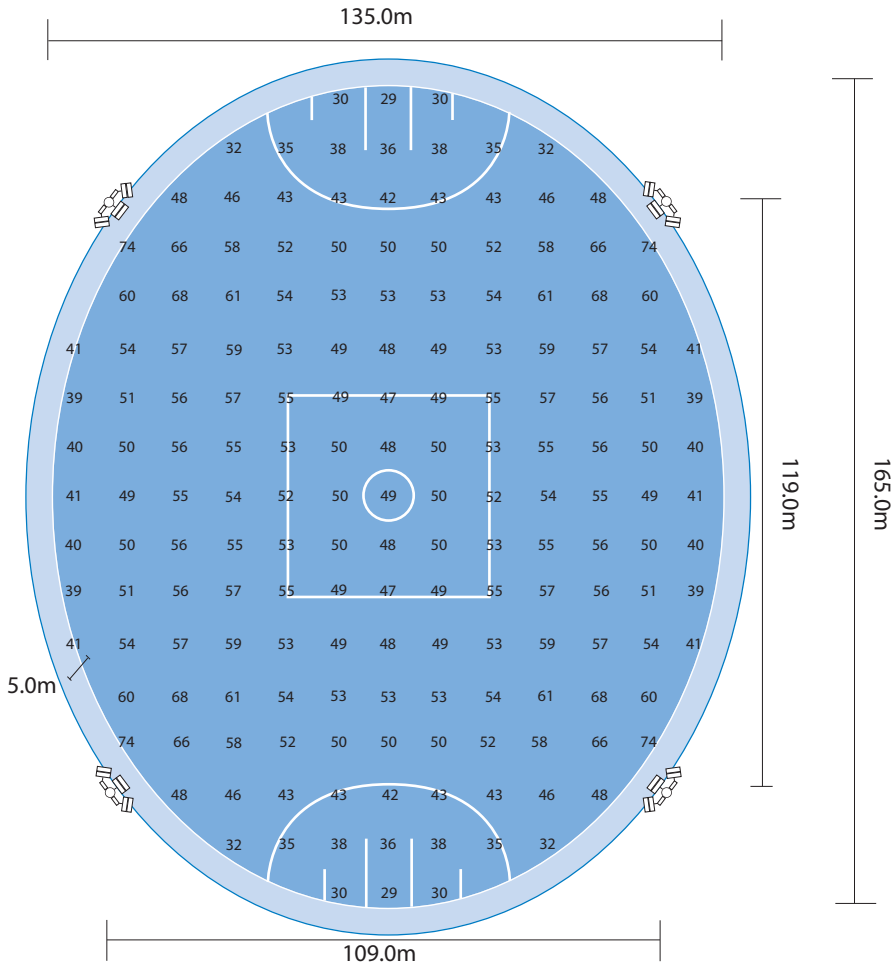


Sourced from Australian Standards AS 2560.2.3 – 2007

Football Lighting Plan Example 1

Ball and physical training level – 50 lux

Diagram 3 below represents the site design layout for ball and physical training at an amateur level of 50 lux.



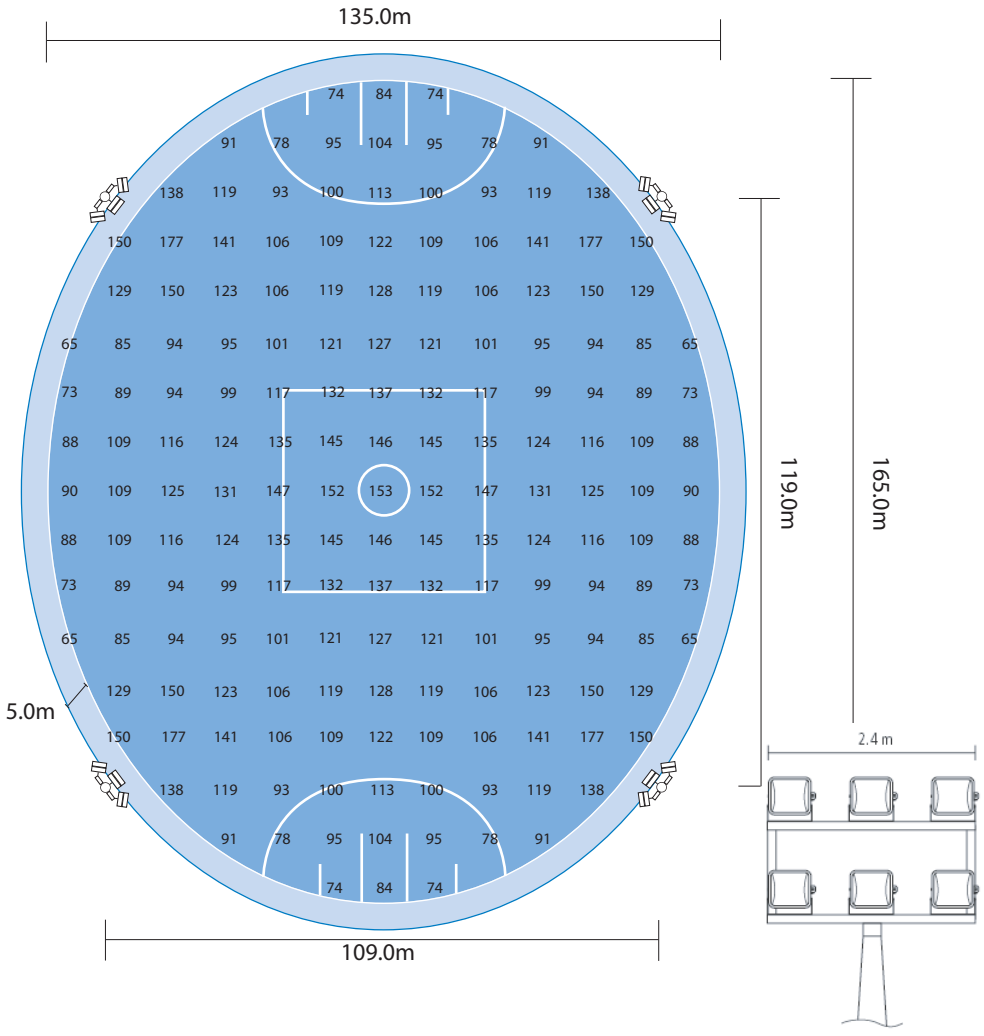
Design summary

Level of play	Training amateur level
Average lux	50
Number of lamps	12
Number of poles	4
Pole height	30m
Type of floodlight used	2kW fan-shaped beam

Football Lighting Plan Example 2

Competition and match practice – 100 lux

Diagram 4 below represents the site design layout for club competition level and match practice of 100 lux.



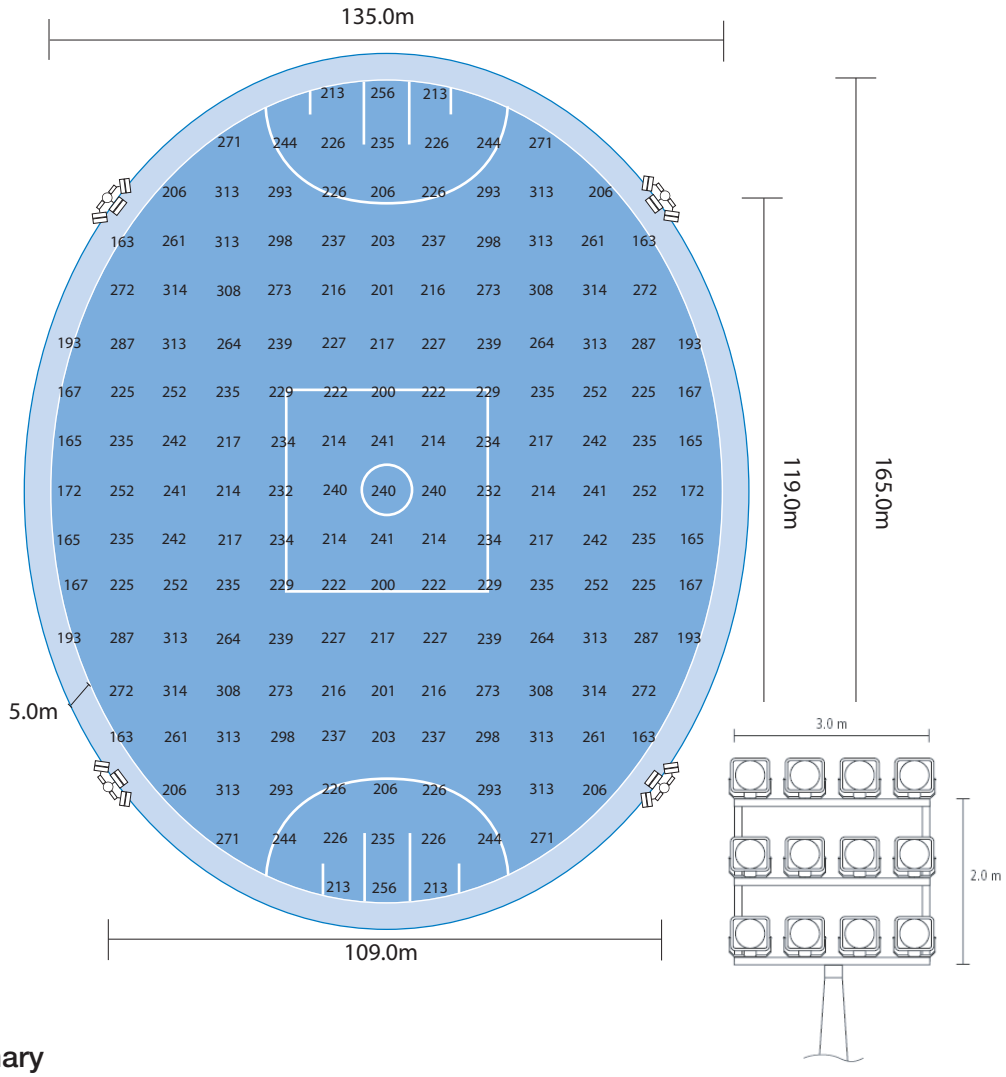
Design summary

Level of play	Club competition
Average lux	113
Number of lamps	24
Number of poles	4
Pole height	30m
Type of floodlight used	2kW fan-shaped beam

Football Lighting Plan Example 3

Semi-professional – 200 lux

Diagram 5 below represents the site design layout for semi-professional competition level of 200 lux.



Design summary

Level of play	Semi professional
Average lux	240
Number of lamps	48
Number of poles	4
Pole height	30m
Type of floodlight used	2kW fan-shaped beam

Australian Rules Football Lighting

Budget

The budget table below should be used as a **guide only**. Costs will vary between suppliers/manufacturers and will also depend on quantity and quality of floodlights proposed for use. Current as at June 2011.

INDICATIVE COSTS	Football Ball and Physical Training (50 Lux)	Football Match Practice and Club Competition (100 Lux)	Football Semi-Professional Competition (200 Lux)
Capital – Initial Cost			
Geotech (Soil) Report	$2,750	$2,750	$2,750
Floodlights Supply	$22,800	$45,600	$91,200
Floodlights Install	$3,000	$6,000	$12,000
Poles Supply	$32,000	$43,200	$43,200
Poles Install	$9,800	$11,000	$11,000
Foundations	$11,000	$16,000	$16,000
Lifting/Cranage	$2,500	$5,000	$7,500
Power Supply	$10,000	$35,000	$55,000
Floodlighting Distribution Boards	$5,000	$21,000	$31,000
Lighting Controls	$1,000	$2,500	$5,000
Cabling	$12,000	$22,100	$34,700
Underground Works eg Pits & Conduits	$20,000	$23,800	$23,800
Test, Aim & Commission	$1,900	$3,800	$4,800
Maintenance Records	$750	$1,000	$1,500
Design & Project Management (15%)	$18,950	$35,800	$48,600
TOTAL CAPITAL COST	**$153,450**	**$274,550**	**$388,050**
Energy Avg pa	$625	$1,250	$2,500
Maintenance Avg pa	$1,570	$3,140	$5,850
TOTAL 10 YEAR COST	**$175,400**	**$318,450**	**$471,550**

*Note: **Energy costs** have been estimated using a 'typical pattern' for football clubs; 6 hours per week x 24 weeks = 144 hours per annum. Energy costs on average have been estimated at $0.12 /kWhr.*

Estimates have been provided assuming works are for a new project on a green field site. The figures have not taken into account cost estimates to upgrade lighting infrastructure.

Australian Rules Football Lighting

Pole Supply Costings (Typical)

Pole Height (Fixed Galv Steel)	Pole Supply Indicative Cost / Pole (*)
27m (Physical Training/ Club Competition Level)	$8,000 + GST
27m (Club Competition–Dual Crossarm)	$10,200 + GST
30m (Club Competition–Single Crossarm)	$8,400 + GST
30m (Club Competition–Dual Crossarm)	$10,800 + GST
30m (Semi-Professional-Tri-Crossarm)	$21,000 + GST
+ Include Total Freight to Country location (if required)	Approx. $ 1,000

**Indicative Costs – Courtesy of Vicpole Pty Ltd for Typical Fixed Galv Steel Poles. Add Installation, Foundation and Floodlight costs separately. Note costs will vary between manufacturers and will also depend on the weight and number of floodlights proposed for use. These can vary between suppliers and depends on their light output performance for a given size and weight of floodlight design. Current as at June 2011.*

Football (Soccer) Lighting

Key Standards

AS 2560.1 – 2002 Sports lighting Part 1: General Principles

AS 2560.2.3 – 2007 Specific Applications – Lighting for football (all codes)

AS 4282 – 1997 Control of the obtrusive effects of outdoor lighting

The Australian Standard (series 2560.2.3) contains lighting recommendations and requirements specific to football (soccer) to ensure that the ball is adequately illuminated at all times while in play.

The standard deals with training and competition and takes into consideration spectator viewing requirements.

The standards contain information about maintained horizontal luminance (lux), minimum horizontal uniformities (U1 & U2) and maximum glare rating. These properties vary depending on whether the level of play is recreational, amateur or semi – professional. The following table uses information from the Australian Standards and competition types that have been specified by Football Federation Victoria (FFV).

Competition	Typical Activity	Maintained horizontal illuminance (lux)	Minimum horizontal uniformities		Maximum glare rating
			U1	U2	
Recreation					
Touch and Tag	Touch and tag soccer	50	0.3	N/A	N/A
Amateur					
All other competitions	Ball and physical training^	50	0.3	N/A	N/A
	Competition/ match practice	100#	0.5	0.3	50
Semi-professional					
Victorian Premier League (Seniors)*	Ball and physical training^	100	0.5	0.3	50
Men's State League 1 (Seniors)*	Competition/ match practice	200	0.6	0.4	50

Source: *Lighting Criteria (source Standards Australia, Sports lighting Part 2.3: Specific applications – Lighting for football (all codes))*

* Leagues defined by FFV as semi-professional are those that employ players.

FFV suggests that a majority of football (soccer) training is game based, match practice and therefore recommends that 100 lux lighting is installed.

^ According to AS2560.2.3 footnote e), *Ball and Physical Training is considered to differ from match practice in that ball and physical training is more controlled, involves fewer participants (typically two to four) and the paths of the participants and that of any ball used are more predictable than in a match-practice environment.*

Football (Soccer) Lighting

Football Federation Victoria has adopted the Australian Standard (series 2560.2.3) as the basis for match lighting requirements by football (soccer) for affiliated competitions.

Illuminance Requirements

The information outlined in this section is technical in nature. It is provided to make the reader aware of the standards and qualified lighting designers/contractors will then be able to plan your project.

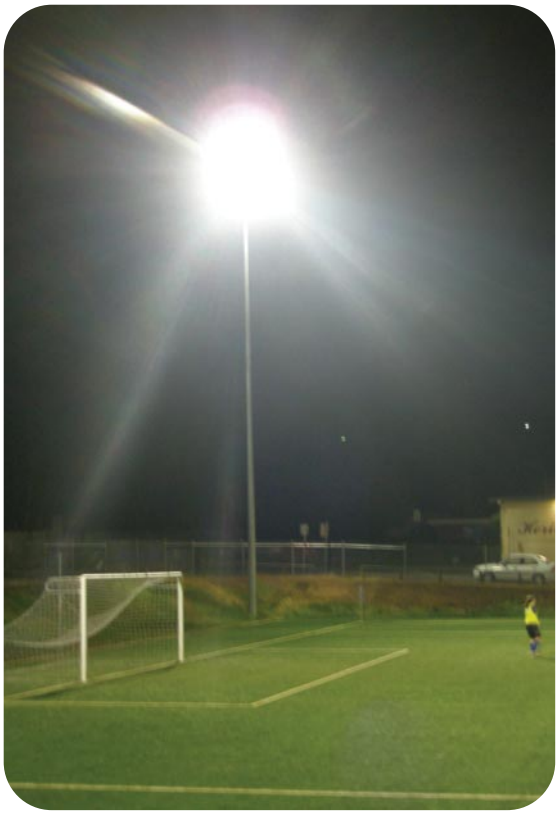
Uniformity ratios are an important part of a complete set of lighting criteria and can have a positive effect on the quality of lighting installations. Adequate uniformity is required to create balanced lighting conditions so that people's eyes do not have to continually adapt to a different light level. The Minimum Horizontal Uniformities are given in two ratios, each providing a numerical representation of the uniformity of illuminance over a given area.

This may be expressed as a ratio of minimum to average (U1) or it may be expressed as a ratio of minimum to maximum (U2) level of illumination for a given area. For example, (U1) club competition and match play minimum uniformity equals 0.5. The lowest level of illumination should not be less than 50% of average (U1) or 30% (U2) of the maximum level of illumination.

The above values are identified to provide for the safety of participants and level of visual tasks anticipated. Factors such as large crowds (e.g. more than 10,000) with consequent longer viewing distances will require higher values to be chosen than indicated above.

Tips & Suggestions

- Making provisions for future upgrades (e.g. pole size and cabling) can significantly reduce the cost in the long term. Plan for the ultimate design.
- Consider design flexibility to allow running of fewer floodlights for training purposes. Use of all floodlights in a system may only be required during competition.
- Where it is intended that a pitch be used for night competition the lighting needs to be planned and delivered to meet FFV requirements. FFV's match lighting requirements and process for approving night match venues can be found on their website: **www.footballfedvic.com.au**



Football (Soccer) Lighting

Types of Floodlights

The 2kW (2000W) Metal Halide lamp is a standard floodlight for football sports lighting. It provides a versatile, robust design solution with good colour rendering properties and average lamp life of 3-5,000 hours.

Many existing grounds where there are no issues with light spillage use standard 2kW Metal Halide lamps with an ‘open face’ design. Use of floodlights with an ‘open face’ design is limited as they do not have any screening mechanisms and therefore are more likely to produce spill light.

Major lighting suppliers have standard designs for various levels of play which can prove quite helpful. Caution should be exercised before adopting an indicative layout as site specific issues such as spill light and glare-to-light sensitive locations are not usually considered with such designs.

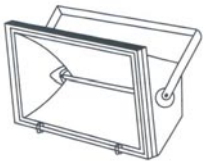
Be aware that all lights lose brightness over time due to the gradual reduction in lamp efficiency and the accumulation of dirt and dust on fittings. A ‘light loss factor’ should be incorporated into designs to compensate for this.

Lighting constructed with an Ingress Protection rating of ‘IP6x’ results in improved maintenance benefits and helps reduce costs through the ability to apply higher ‘light loss factor’ allowances.

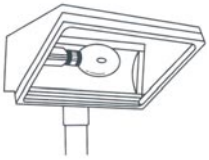
Increased performance is also sometimes claimed through the use of special lamps or lamps with higher light output. It is important that factors such as cost and potential lamp availability limitations are carefully weighed against other claimed benefits of the lamps. It is best that a consistent make and model of lamp is chosen for ease of maintenance and re-aiming at a later date.

The pictured floodlights are commonly used in four pole arrangements for lighting playing surfaces.

Type A floodlight giving a symmetrical beam



Type B floodlight giving a fan-shaped beam



Type C floodlight giving a fan-shaped beam with asymmetric distribution in the vertical plane

Football (Soccer) Lighting

Project Insight

- Fawkner Secondary College's synthetic pitch is not close to any residential properties or any other light sensitive areas. Here an 'open face floodlight' system was used due to the very low potential for light to become obtrusive.
- By contrast Quay Reserve, Torquay is set within a new residential subdivision. Here a 'flat glass' style floodlight was used which limits upward spill light and brightness at higher angles which may have become a nuisance.

(See page 58 for more details.)

Tips & Suggestions

- Avoid relying on standard designs without seeking advice from qualified persons concerning site specific issues such as spill light and glare to light sensitive locations.
- Ensure a 'light loss factor' is incorporated into designs to compensate for a loss of lamp brightness over time.
- Use a consistent lamp make and model for ease of maintenance and re-aiming at a later date. Consider designs having an IP6x classification to improve 'light loss factor' i.e. permit use of a higher factor.

Football (Soccer) Lighting

Pole Height

Guidelines for Pole Height and Location are given in the Australian Standard (AS2560.2.3).

Minimum pole heights depend on whether a side pole or corner pole design is being used. The height depends on the distance from centre of the pitch to the base of the pole location. For amateur competition, required pole height can be estimated by multiplying 0.36 by the distance from centre of ground to the base of the pole location.

Layout and Pole Locations

The recommended zones for the location of floodlight poles are available in the standards (AS 2560.2.3). The standard identifies placements for corner and side pole designs with four and six pole designs.

The standard recommends a side pole system with a minimum of two poles per side. The standard also recommends that for side pole systems no poles be located behind the goals or within the arc 10 degrees front and back of the goal line i.e. to avoid lights in the vicinity of the corners of the play area.

Similar considerations apply to corner pole designs. Refer to the Australian Standards for further information and diagrams. The standard requires poles to be located behind the boundary fence, where one exists, or at least 5m outside the Principal Playing Area.

Pole location and height is also affected if multiple adjoining pitches require lighting and where pitches will be multi-use (i.e. sharing with cricket or Australian Rules). Layouts for these types of facilities are discussed on page 33.

Access and clearances to reach the lights for maintenance purposes (e.g. by crane) should also be considered when planning the pole locations. Start with an accurate survey plan. This will ensure pole locations can be accurately positioned.

Tips & Suggestions

- Consult the Australian Lighting Standard AS 2560.2.3 for recommended zones for the location of poles.
- Be aware of the minimum 5m clearances set out in the Australian Standards from the edge of the principal playing area (i.e. line marked boundary) when planning the ground lighting layout and pole positions.
- Geotechnical advice should be sought at light pole locations to establish correct foundation requirements. This will help flag increased foundation costs at the planning stage of the project.

Side Pole Design

Consider a soccer pitch 105m long x 68m wide with a 5m run-off zone.

The closest position for poles at the side of the pitch to ground centre (goal to goal centre line) allowing for foundations (say 1m minimum) = 68/2 (half the pitch width) + 5m (Runoff) + Foundation (1m) = 40m. 40m x 0.36 = 14.4m.

Therefore a 15m pole could be used in theory, but in practice Poles at 18m are encouraged for side pole designs as a general minimum to address other technical criteria such as the uniformity and glare rating requirements of the standard.

Football (Soccer) Lighting

Corner Pole Design

Consider the same soccer pitch 105m long x 68m wide with a 5m minimum run-off zone. With the corner poles located as per the Australian Standard, the nearest location a pole can be situated is 15 degrees back from the goal line (angle from centre goal) and 5 degrees back from the sideline (angle back from halfway line). Calculation indicates this distance to be a minimum of 77.6m. At this distance the pole would be well clear of the run off clearances and so could be a minimum practical distance.

Pole height then becomes 77.6m x 0.36 = 27.9m.

Therefore a 28m pole would be the minimum for this size ground.

Many clubs funding new floodlighting installations are tempted to install lower height poles than those recommended in the Australian Standard to reduce cost. Often side poles can be seen in the range of 12-15m instead of the 18m+ height recommended.

This approach may not comply with the Australian Standard (AS 2560) as the uniformity and illuminance standards are not met with the lower pole heights.

It is important to consider the highest level of play proposed at a venue prior to the installation. Higher levels of play require more floodlights and higher poles which require a larger headframe to support the floodlights. This may result in increased foundation costs.

The budget on page 45 provides indicative pole supply costings.

Tips & Suggestions

- Refer to AS 2560.2.3 for recommended pole heights.
- Manage the Risk. Check relevant ‘conditions of use’ and insurance matters before proceeding to install poles of inadequate height which may not to comply with the Australian Standard.
- Establish the highest level of play that the facility will be used for and select poles to accommodate this higher play level incorporating the required structural capacity, electrical supply configuration and headframe facilities to mount future floodlights.
- Consider how the light fittings will be maintained. Be aware that a higher pole height may result in a higher cost of hiring equipment to undertake cleaning and maintenance. Ensure safe access can be obtained for routine lamp maintenance.
- Typically, allow 3-4 months for pole supply and delivery.

Multiple Pitches

New venues often seek to establish more than one soccer pitch on a site. The Australian Standard does not consider this aspect specifically and so the following considerations are highlighted.

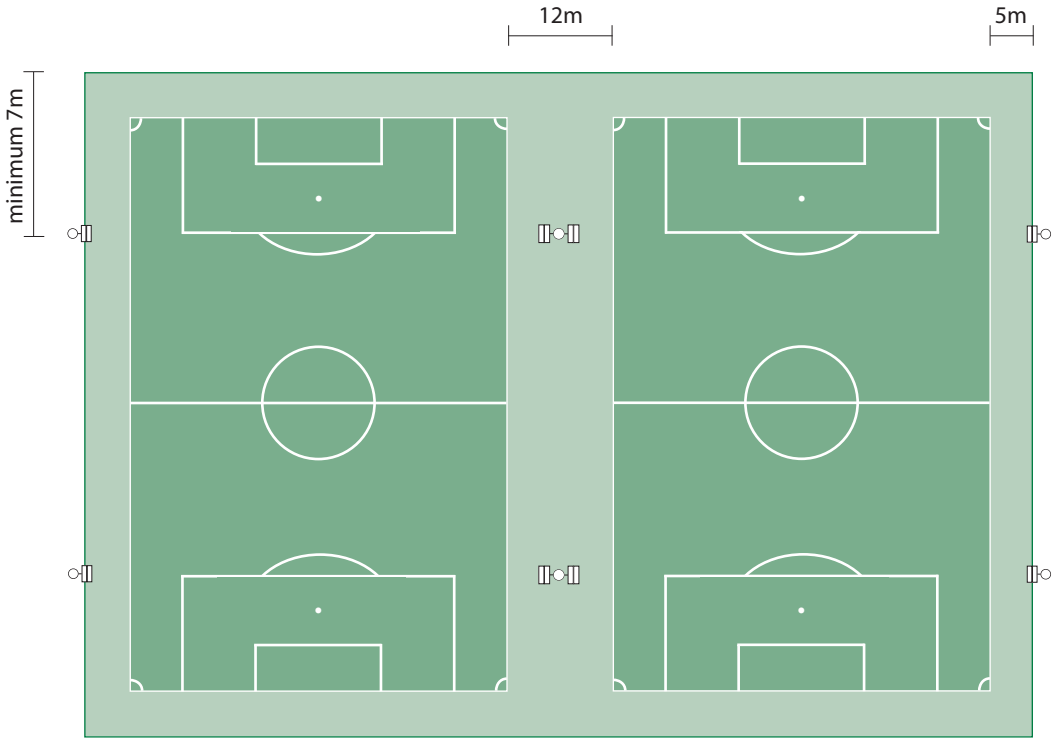
Pole infrastructure is a major component of lighting costs. Consideration of lighting implications when planning for multiple pitches may minimise the number of poles required and therefore the costs. Diagram 6 shows a side by side pitch arrangement.

This example shows a 5m run off from each pitch's Principle Playing Area and an additional 2m between pitches for placement of light poles.

Aligning the pitches side by side allows optimal placement of four poles in a side lighting design. The two centre poles are common to both pitches given they are correctly placed to light front and back to each pitch.

If a second pitch will be installed sometime in the future, infrastructure capacity (i.e. additional floodlights and cabling) and placement of poles to serve a second pitch should be considered when lighting the first pitch. At semi-professional competition levels this may also result in additional electrical control gear cabinets needing installation next to the centre poles.

Diagram 6: Side by side pitches – no offset



Football (Soccer) Lighting

Offsetting of Pitches

In order to gain the best use of land on a site, pitches are sometimes offset along their side line as per Figure 2 & 3.

For floodlighting efficiency, offsetting of pitches is optimal where the offset is no more than 7m. This is because a four pole side light design will generally look to position poles between 35-42m either side of the halfway line.

Offsetting pitches by more than 7m means an alternative layout for one of the pitches resulting in additional poles. Depending on the offset between pitches solutions could include:

a) Pitch one - A four pole side lighting design and
Pitch two – A four pole corner design

This is shown in Diagram 7. Pole three is the only pole utilised to light both pitches.

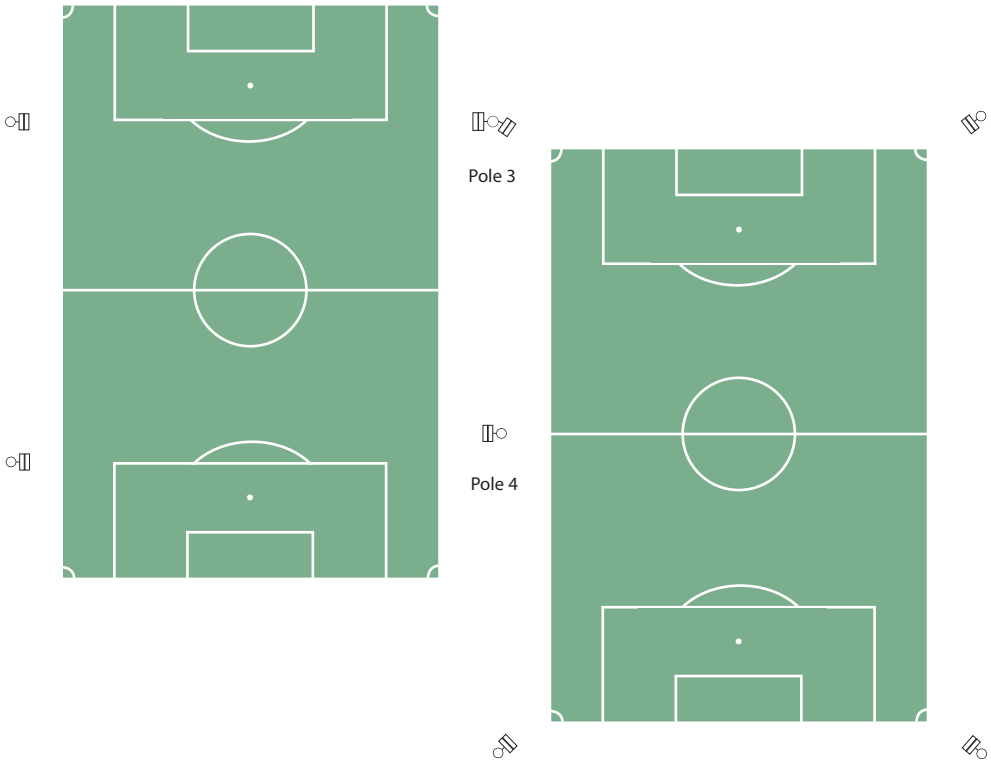
b) Pitch one – A four pole side lighting design and
Pitch two – A six pole side lighting design

This is shown in Diagram 8. Poles three and four are utilised to light both pitches.

Other viable arrangements tailored to the site may be possible, particularly where existing poles are integrated into the layout. Expert advice should always be sought to determine the best approach.

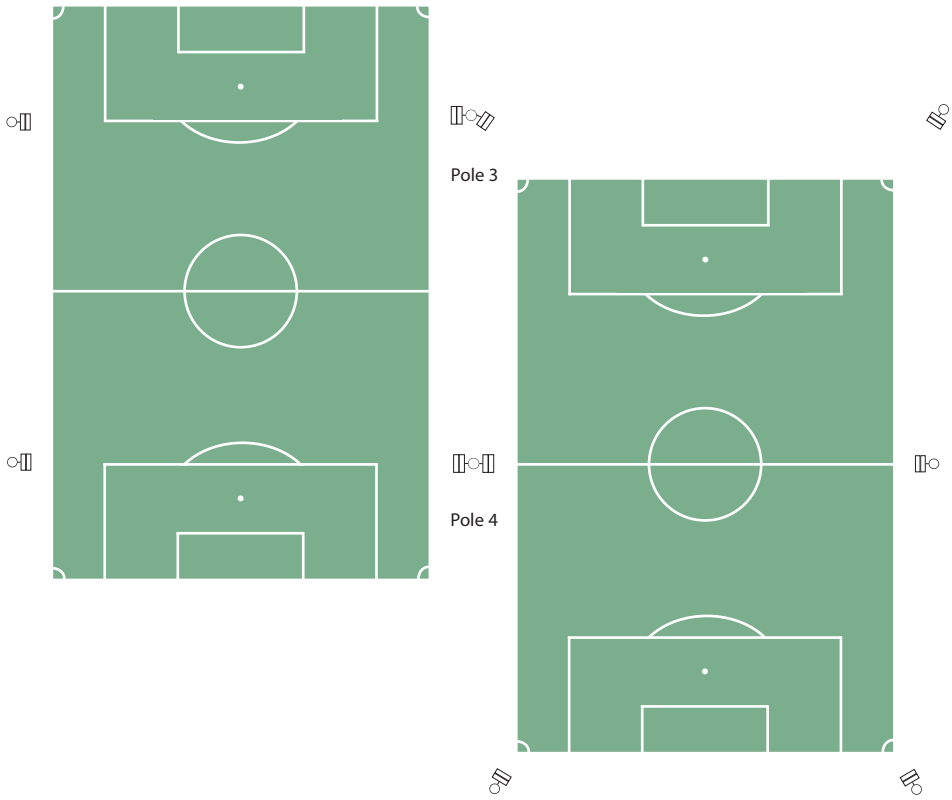
Diagram 7 only requires one extra pole. Care is required to ensure pole three is not placed too close to the corner of pitch two. It should be noted that where pitch one and pitch two are the same size the corner poles for pitch two will need to be higher than the side poles for pitch one.

Figure 2: Pitches offset 4 pole side (Pitch 1) + 4 pole corner (Pitch 2)



Football (Soccer) Lighting

Diagram 8: Pitches offset 4 pole side (Pitch 1) + 6 pole corner (Pitch 2)



The design in Diagram 8 appears to have no advantage over Diagram 7 as it requires two extra poles. However, its main advantage is that all poles in this design could be kept to the same, and lower, height for both pitches. This may be preferred for design appearance.

Tips & Suggestions

- Keep multiple pitches aligned where possible.
- Allow space between pitches additional to the run off zones for pole placement and ensure sufficient room for maintenance access.
- If a second pitch is likely to be developed in the future, ensure the poles placed closest to the future pitch are suitable for the floodlights and electrical supply for the current and future pitch.
- If offsetting pitches, try to minimize the offset. Less than 7m is best.
- Consider the relative merits of four pole corner and six pole side lighting designs. (N.B. Guidance regarding typical costs is provided on pages 44-45).

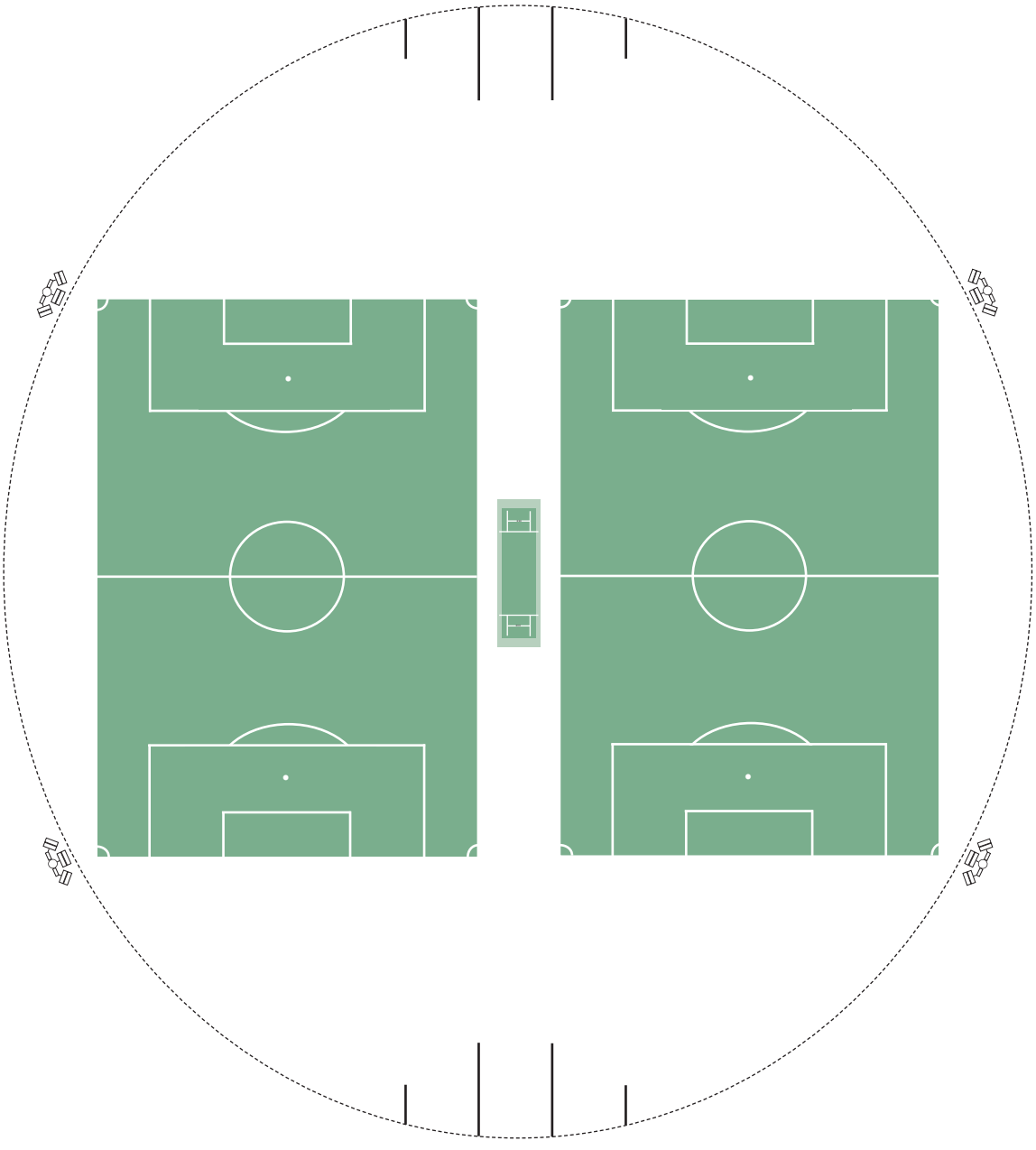
Football (Soccer) Lighting

Multi-use Sports Fields

Multi-use sports fields are becoming more common when there is limited opportunity to build new pitches due to available open space and/or budget restrictions. They provide an opportunity to maximise use of the facility along with associated infrastructure such as lighting.

Designing to accommodate multi-use is therefore expected to factor increasingly into future designs. Common examples include soccer pitches being overlayed onto ovals used for other sports, most commonly Australian Rules and cricket. An increasingly common application is the location of two side by side pitches onto an Australian Rules or cricket oval. This layout is shown in Diagram 9.

Diagram 9:Multi-use sports fields and lighting locations – football (soccer), Australian Rules football and cricket



Football (Soccer) Lighting

The following issues should be considered during the design process:

a) Reconciling the pole locations to suit both codes. Field sizes vary so there are no uniform rules. Often pole locations for Australian Rules can be reconciled at or near the corresponding locations required for soccer using a standard four pole Australian Rules lighting design as shown in Diagram 9.

b) Due to the multi-use nature of the field, poles cannot be located in between pitches. Therefore, a corner pole design will more commonly be used and poles will typically be the same height as those used for Australian Rules (i.e. typically 25 - 30m).

c) The increased pole height and greater floodlight quantities associated with lighting an Australian Rules oval compared to a football (soccer) pitch should be considered. This is due to the larger Principle Playing Area for Australian Rules.

d) It is not possible to light only one of the soccer pitches as is the case when poles are positioned between pitches.

Newer venues accommodating the growth of rugby codes will also see multi-use lighting opportunities with soccer having virtually the same lighting standards, levels and pitch sizes.

Tips & Suggestions

- Design to incorporate multi-use where possible (e.g. soccer and cricket, football and rugby codes).

Project Insight

Quay Reserve, Torquay is an example of a ground designed to accommodate multi-use. Poles are 28m high and set out as a corner pole installation to a central football pitch, but setback to allow a large open space adequate for a cricket oval. The additional lit space around the central pitch is used for small sided football.

(See page 58 for more details.)

Football (Soccer) Lighting

Soccer Lighting Plan Examples

Sample Layouts in the guide are provided as a visual aid. Acknowledgement and appreciation is extended to the following companies who have contributed indicative sample layout information:

- Pierlite Lighting (Philips)
- Sylvania Lighting Australia
- Thorn Lighting

These layouts are indicative only and should not be used or relied upon without seeking professional advice for their suitability for a particular site.

Please note there is a wide variation in 'light loss (maintenance) factors' applied by the floodlight suppliers.

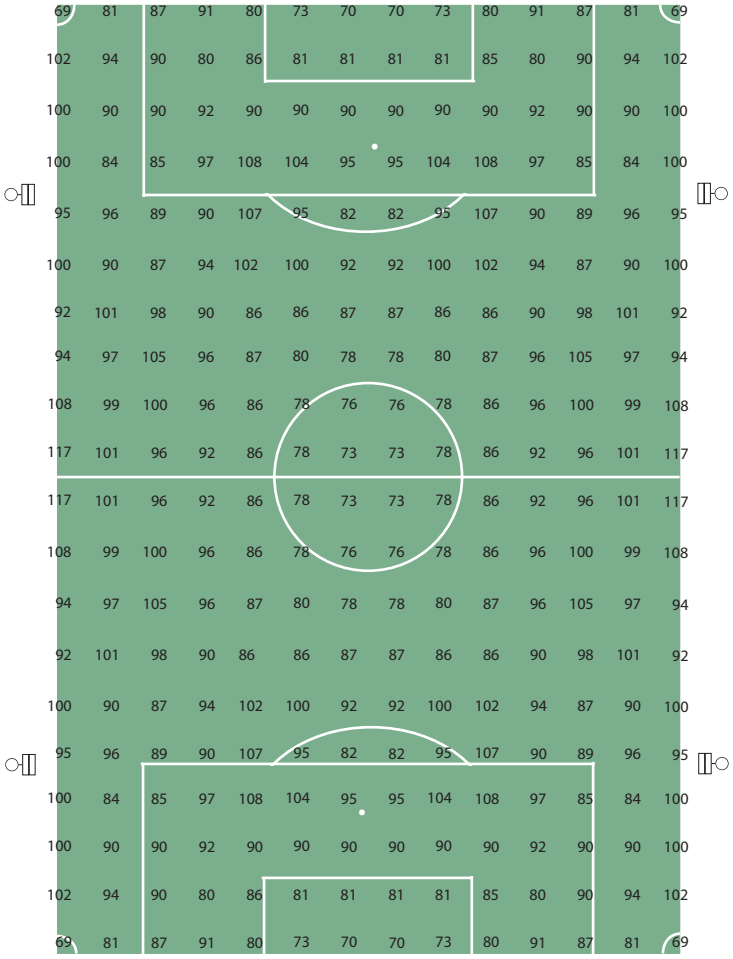
Tips & Suggestions

- Design of lamps may confer better maintenance of light output performance.
- Design should be carefully determined in consultation between designer and client/club for each site with an agreed practical maintenance regime.

Football (Soccer) Lighting

Football (soccer) lighting plan example 1

**Amateur Ball and Physical Training –
Side Four Pole (50 lux)**



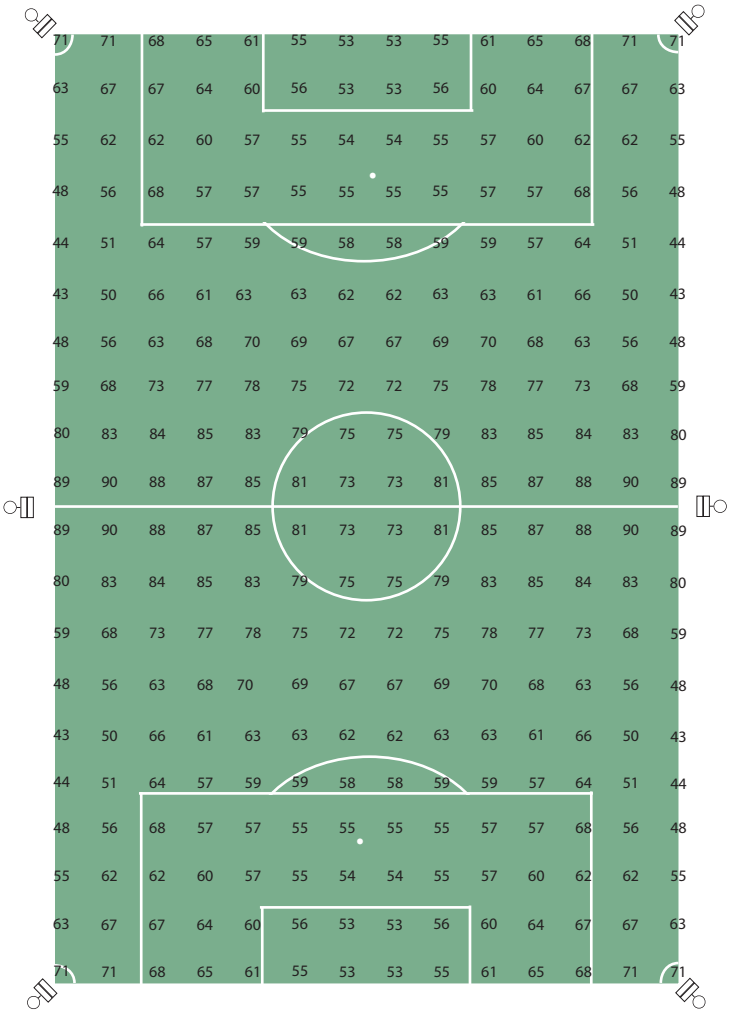
Design summary

Level of play	Amateur ball and physical training
Average lux	91.8
Number of lamps	8
Number of poles	4
Pole height	18m
Type of floodlight used	2kW luminaires

Football (Soccer) Lighting

Football (soccer) lighting plan example 2

Amateur Ball and Physical Training – Side Six Pole (50 lux)



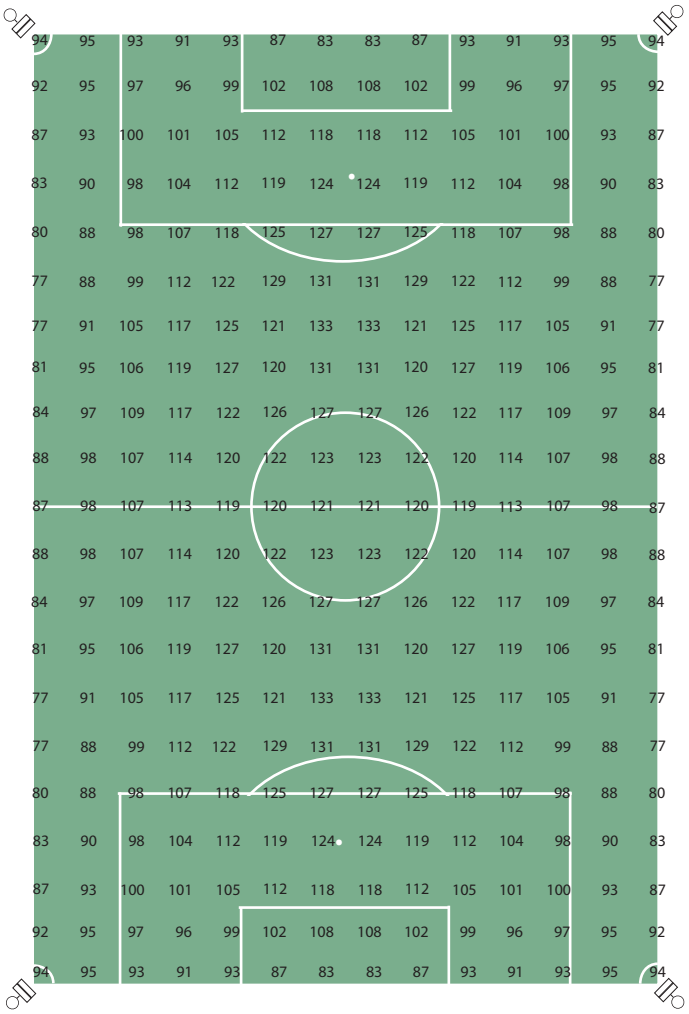
Design summary

Level of play	Amateur ball and physical training
Average lux	65.2
Number of lamps	8
Number of poles	6
Pole height	18m
Type of floodlight used	2kW luminaires

Football (Soccer) Lighting

Football (soccer) lighting plan example 3

Amateur Match Practice and Competition – Corner Four Pole (100 lux)



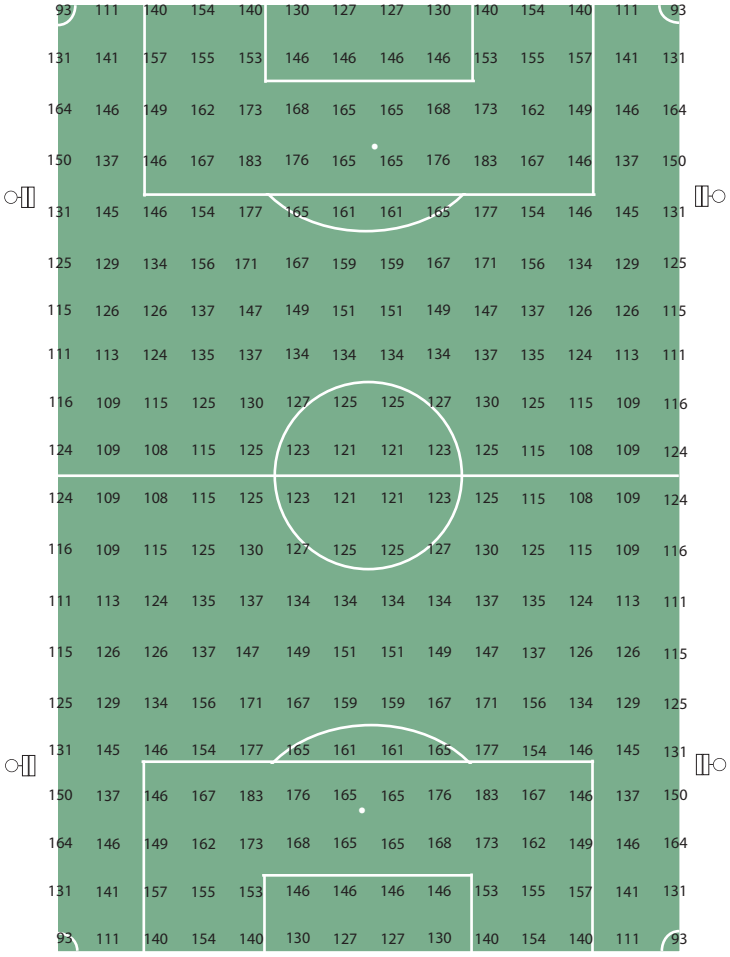
Design summary

Level of play	Amateur match practice and competition
Average lux	105.8
Number of lamps	12
Number of poles	4
Pole height	28m
Type of floodlight used	2kW luminaires

Football (Soccer) Lighting

Football (soccer) lighting plan example 4

Amateur Match Practice and Competition – Side Four Pole (100 lux)

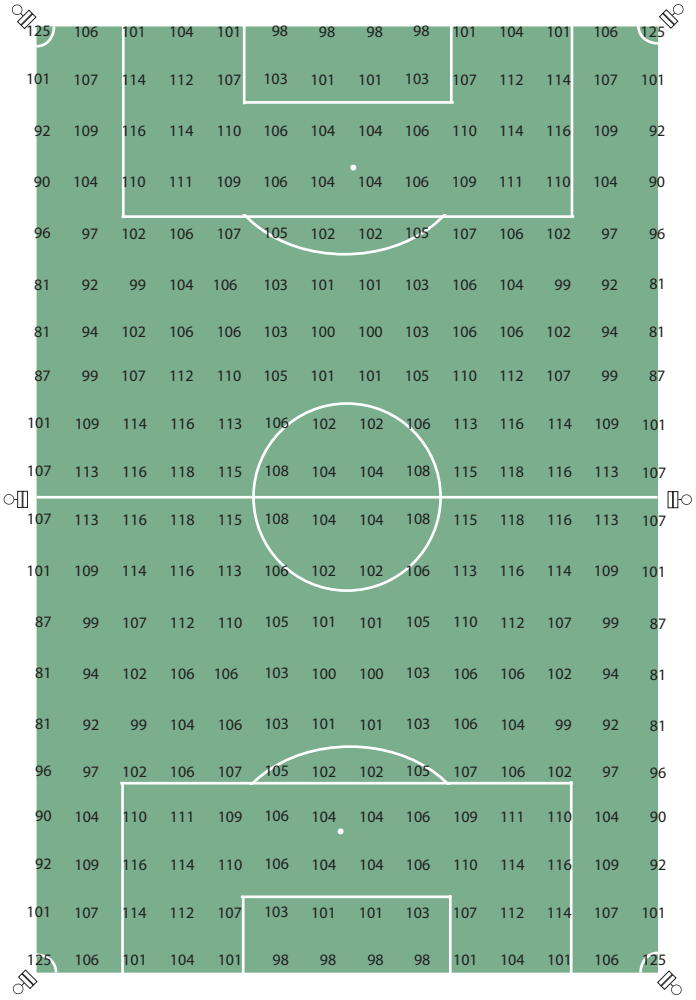


Design summary

Level of play	Amateur match practice and competition
Average lux	149
Number of lamps	12
Number of poles	4
Pole height	18m
Type of floodlight used	2kW luminaires

Football (soccer) lighting plan example 5

Amateur Match Practice and Competition – Side Six Pole (100 lux)



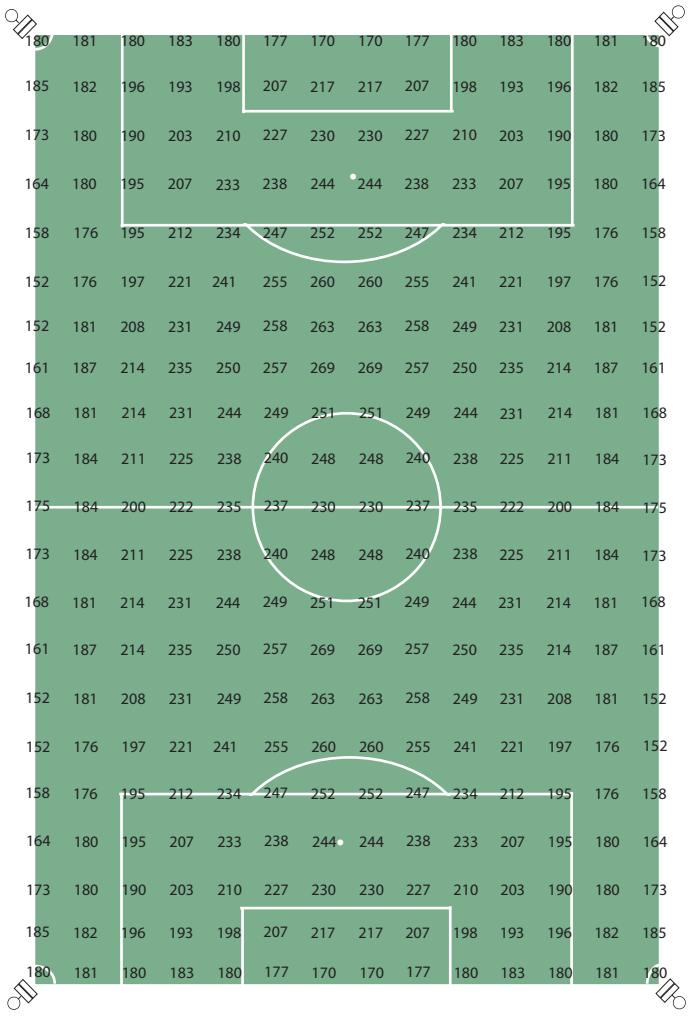
Design summary

Level of play	Amateur match practice and competition
Average lux	104.4
Number of lamps	10
Number of poles	6
Pole height	18m
Type of floodlight used	2kW luminaires

Football (Soccer) Lighting

Football (soccer) lighting plan example 6

Semi-Professional Competition –
Corner Four Pole (200 lux)



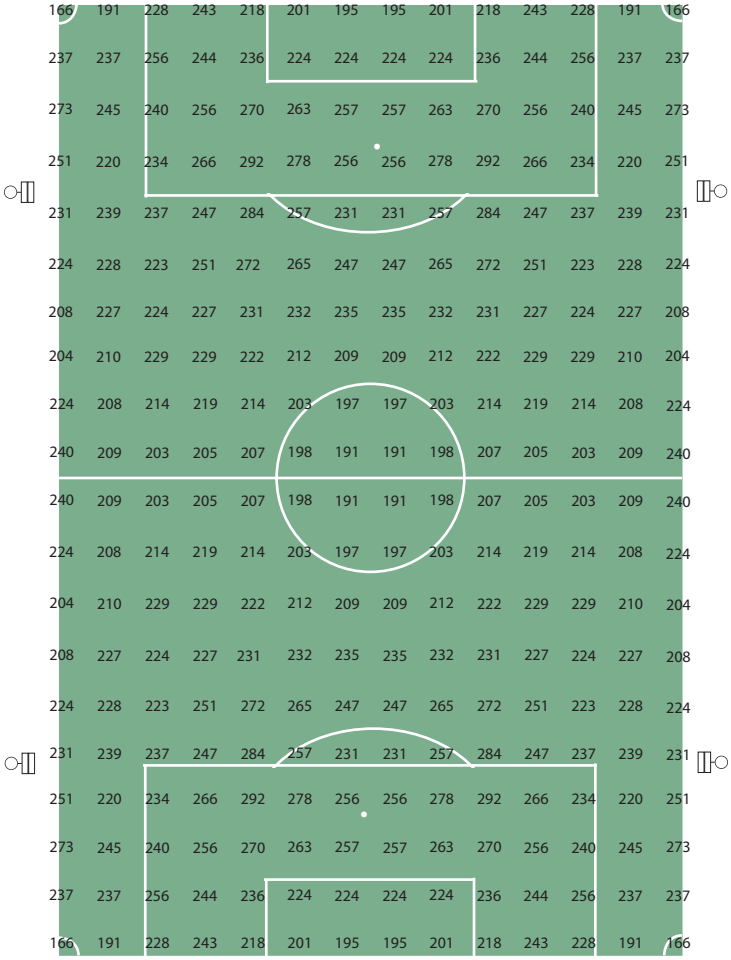
Design summary

Level of play	Semi professional competition
Average lux	210.3
Number of lamps	24
Number of poles	4
Pole height	28m
Type of floodlight used	2kW luminaires

Football (Soccer) Lighting

Football (soccer) lighting plan example 7

Semi-Professional Competition –
Side Four Pole (200 lux)



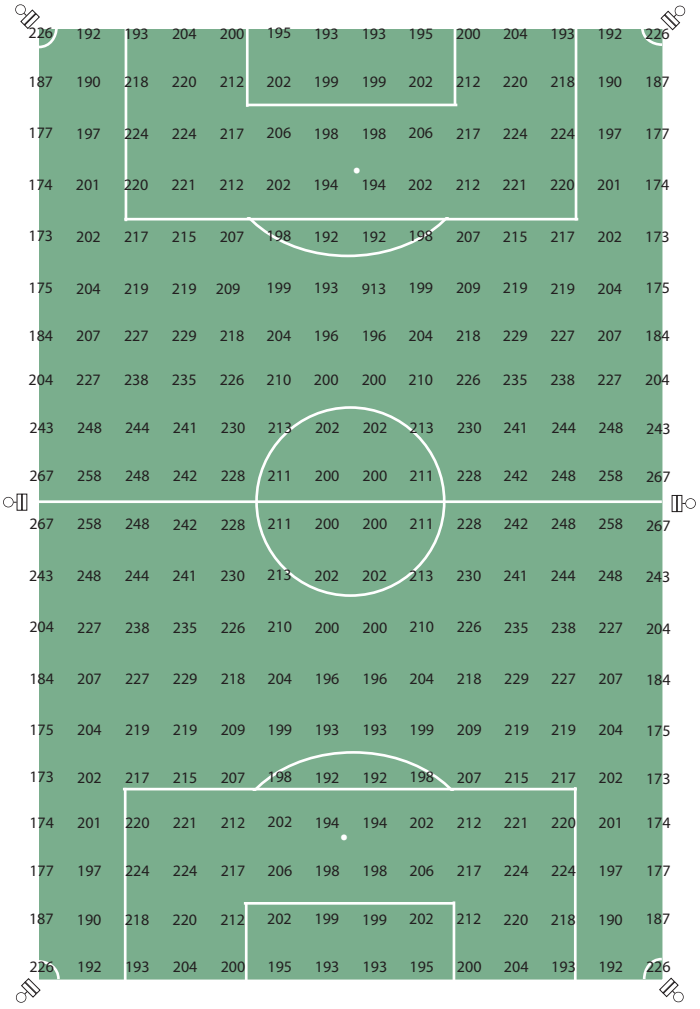
Design summary

Level of play	Semi professional competition
Average lux	231
Number of lamps	20
Number of poles	4
Pole height	18m
Type of floodlight used	2kW luminaires

Football (Soccer) Lighting

Football (soccer) lighting plan example 8

Semi-Professional Competition –
Side Six Pole (200 lux)



Design summary

Level of play	Semi professional competition
Average lux	211.5
Number of lamps	20
Number of poles	6
Pole height	18m
Type of floodlight used	2kW luminaires

Football (Soccer) Lighting

Budget

The budget table below should be used as a **guide only**. Costs will vary between manufacturers and will also depend on the quantity and quality of floodlights proposed for use. Costings are current as at June 2011.

INDICATIVE COSTS	Football Match Practice & Club Competition (100 Lux)			Football Semi-Professional Competition (200 Lux)		
	4 Pole Corner	4 Pole Side	6 Pole	4 Pole Corner	4 Pole Side	6 Pole
Capital – Initial Cost						
Geotech (Soil) Report	$2,500	$2,500	$3,500	$2,500	$2,500	$3,500
Floodlights Supply	$25,200	$25,200	$21,000	$50,400	$42,000	$42,000
Floodlights Install	$2,400	$2,400	$2,000	$4,800	$4,000	$4,000
Poles Supply	$28,800	$10,400	$18,000	$28,800	$10,400	$18,000
Poles Install	$9,000	$5,000	$9,000	$9,000	$5,000	$9,000
Foundations	$16,000	$10,000	$18,000	$18,000	$10,000	$18,000
Lifting/Cranage	$2,500	$2,500	$3,800	$3,800	$3,800	$5,000
Power Supply	$10,000	$10,000	$10,000	$15,000	$15,000	$15,000
Floodlighting Distribution Boards	$19,000	$19,000	$21,000	$27,000	$27,000	$29,000
Lighting Controls	$2,000	$2,000	$2,000	$4,000	$4,000	$4,000
Cabling	$24,700	$24,700	$26,000	$42,100	$40,600	$43,000
Underground Works eg Pits & Conduits	$33,000	$33,700	$35,600	$33,000	$33,700	$35,600
Test, Aim & Commission	$2,100	$2,100	$2,100	$3,700	$3,700	$3,700
Maintenance Records	$1,000	$1,000	$1,000	$1,500	$1,500	$1,500
Design & Project Management (15%)	$27,000	$22,500	$26,000	$36,500	$30,500	$34,000
TOTAL CAPITAL COST	**$207,200**	**$173,000**	**$199,000**	**$280,100**	**$233,700**	**$265,300**
Energy[#] Avg pa	$840	$840	$840	$1,680	$1,680	$1,680
Maintenance[#] Avg pa	$1,060	$1,060	$1,060	$1,960	$1,980	$1,980
TOTAL 10 YEAR COST	**$226,200**	**$192,000**	**$218,000**	**$316,700**	**$270,300**	**$301,900**

[#] ***Simple calculation.*** *A Net Present Value Analysis would be slightly less.*

Football (Soccer) Lighting

Pole Supply Costings (Typical)

Pole Height (Fixed Galv Steel)	Pole Supply Indicative Cost / Pole (*)
18m	$2,600 + GST
20m	$3,000 + GST
25m	$5,200 + GST
28m	$7,200 + GST
30m	$9,000 + GST
+ Include Total Freight to Country location (if required)	Approx. $2,000

**Indicative Costs – Courtesy of Ingal EPS for Typical Fixed Galv Steel Poles. Add Installation, Foundation and Floodlight costs separately. Note: costs can be expected to vary depending on such factors as manufacturer, imported vs local fabrication, weight and quantity of floodlights proposed for use. Costs assume a simple single straight crossarm. Current as at June 2011.*

Outdoor Netball Lighting

Key Standards

AS 2560.1 – 2002 Sports lighting Part 1: General Principles

AS 2560.2.4 – 1986 Specific Recommendations – Lighting for outdoor netball and basketball

AS 4282 – 1997 Control of the obtrusive effects of outdoor lighting

The Australian Standards (series 2560.4) contain recommendations and requirements specific to the lighting of outdoor netball and basketball courts. The standard addresses training and competition levels of play.

The standard contains information about maintained horizontal luminance (lux), minimum horizontal uniformities (U1 & U2) and maximum glare rating levels required for 'training' and 'competition' play for netball. The standard deals with training and competition and takes into consideration spectator viewing requirements.

The following table represents the minimum lux required for varying standards of play.

Level of play	Typical Activity	Examples	Maintained horizontal illuminance (lux)
Training	Skills training	Passing and shooting drills	100
Club competition	Match play	Simulating game or parts thereof	200

Outdoor Netball Lighting

Types of Floodlights

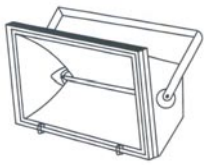
The 1000 watt Metal Halide Lamp is the preferred floodlight for netball court lighting. In comparison to a standard 1500 watt Tungsten Halogen Lamp the 1000 watt Metal Halide provides a more efficient light output and has a longer lamp life, lasting up to 6000 hours compared with 2000 hours of use.

The pictured floodlights are commonly used for outdoor courts.

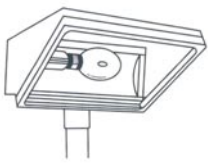
The floodlight proposed should consider the nature of play and take into consideration the current court numbers and the development of additional courts.

In the design of netball court lighting installations, careful consideration should be given to visual requirements to ensure the comfort of the participants and spectators. The selection of suitable floodlights should be the responsibility of the lighting designer who will have access to detailed information and the means to apply it.

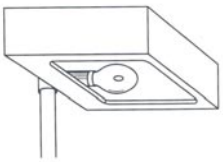
Be aware that all lights lose output from initial switch on over a period of time due to age and the accumulation of dirt and dust on the lamps. To allow for this, a 'light loss factor' should be factored into the design to compensate for the progressive deterioration.



Type A floodlight giving a fan-shaped beam



Type B floodlight giving a fan-shaped beam with asymmetric distribution in the vertical plane



Type C floodlight giving a fan-shaped beam with asymmetric distribution in the vertical plane

Project Insight

- To enable training to take place on their two netball courts, North Shore FNC has two 1000 watt Metal Halide lamps on each of its two 12 metre poles.

(See page 59 for more details.)

Tips & Suggestions

- Consider use of high efficiency longer lasting Metal Halide Lamps particularly for larger installations of multiple courts and competition level.
- Do not rely on nominal designs without seeking advice from qualified persons concerning the site specific installation issues.
- Gain an understanding about the underlying assumptions. For example what 'light loss factor' allowance has been made for light depreciation relating to age and dirt accumulation on light fittings?
- Consider whether the lighting performance depends on use of special lamps with high light output and what restrictions this will impose.
- Use a consistent make and model of floodlight for ease of design, routine maintenance and re-aiming in future.

Outdoor Netball Lighting

Height and Type of Poles

Minimum pole heights are recommended for single courts of eight metres through to 12 metres and for multiple courts 12-15 metres depending on the light output of the floodlight. Therefore, the level of play should be considered at the outset before selecting a pole height.

Poles required for netball are often a fixed design requiring maintenance access through an elevated work platform. It is important that poles be checked for structural adequacy complete with light fittings and any brackets required to suit the recommended mounting heights.

The budget table on page 54 provides indicative pole supply costings.

Layout and Pole Locations

The number of courts proposed for lighting should be established when planning a netball facility.

The Australian Standards (series 2560.2.4), recommends pole locations for single and multiple courts. These recommended pole locations should be considered when planning the court layout. Also see pages 49-52.

'General area lighting' allows fewer poles and is more economical for an area with many courts, where all or a majority of courts are likely to be used at the same time.

Where only a limited number of courts will be used at any one time, it may be preferable to light the courts individually or in pairs to allow for selective switching of the lighting for those courts.

The example lighting plans on the following pages demonstrate pole arrangements for a single netball court and a multi court configuration. For other multi-court arrangements, advice from a specialised lighting designer should be considered.

Economic tip

A side lighting system should be used for outdoor courts for single and multipurpose complexes, located on the perimeters parallel with court sides. Side lighting gives better control of light and is more economical for one or two courts.

Tips & Suggestions

- Consult the Australian Standard (series 2560.2.4) before agreeing upon the layouts of the netball courts to optimise lighting to recommended pole locations. Pages 49-52 show court layouts.
- Take specific advice for multiple courts to determine optimum pole locations.
- Be aware of the minimum obstruction clearances (run-off areas) set out in the Standard from the edge of court when planning the court layouts and pole positions.
- Avoid light poles on the perimeter behind the goal.
- Identify multipurpose use (for example tennis) at the outset as lighting standards may vary.
- Light the court from at least two pole locations.

Project Insight

- Apollo Bay FNC identified the need to provide lighting for both club competition netball and social tennis. As such, a 4 x 15 metre pole side lighting system was selected to light their two courts.

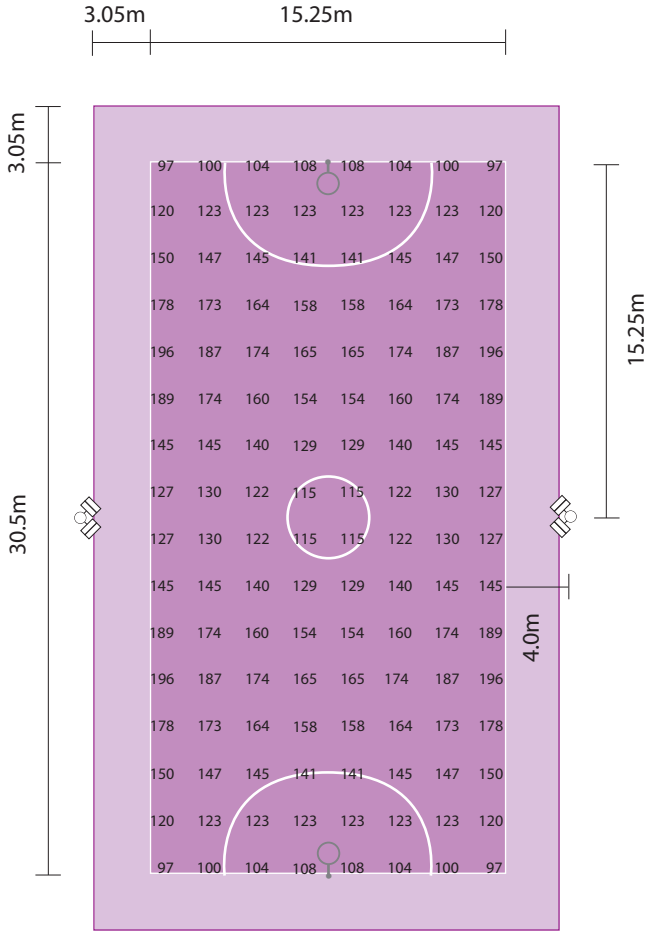
(See page 59 for more details.)

Outdoor Netball Lighting

Netball Lighting Court lighting plan example 1

Netball single court lighting guide

Training – 100 lux



Design summary

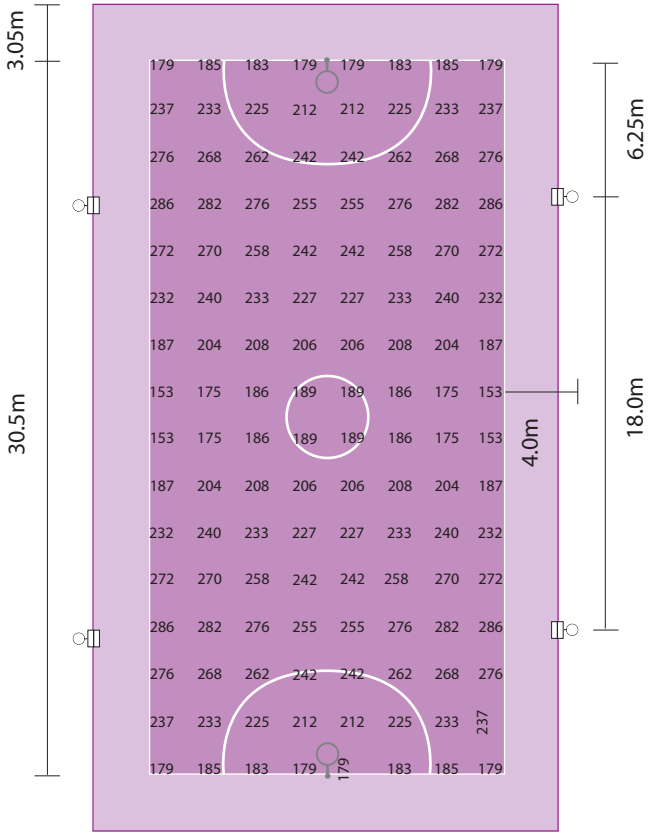
Level of play	Training
Average lux	144
Number of lamps	4
Number of poles	2
Pole height	10m
Type of floodlight used	1kW symmetrical beam

Outdoor Netball Lighting

Netball Lighting Court lighting plan example 2

Netball single court lighting guide

Competition – 200 lux



Design summary

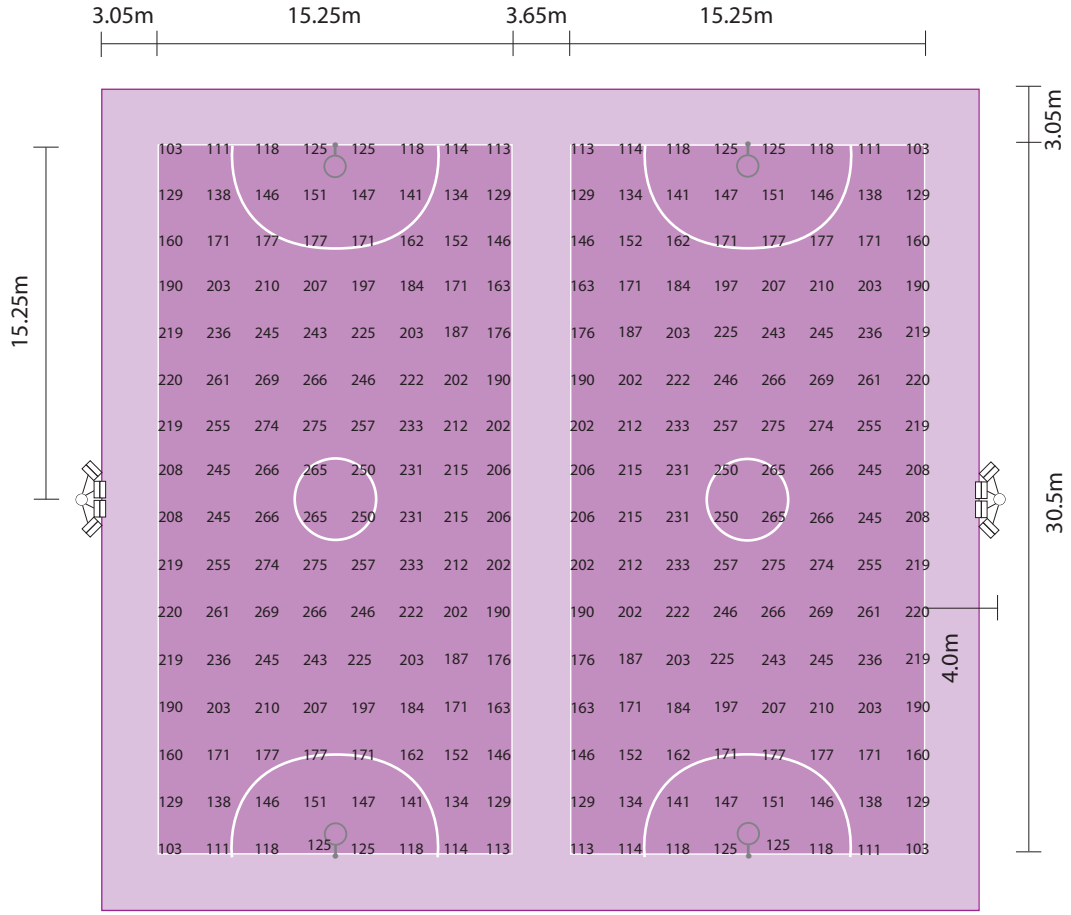
Level of play	Competition
Average lux	227
Number of lamps	4
Number of poles	4
Pole height	12m
Type of floodlight used	1kW symmetrical beam

Outdoor Netball Lighting

Netball Lighting Court lighting plan example 3

Netball dual court lighting guide

Training – 100 lux



Design summary

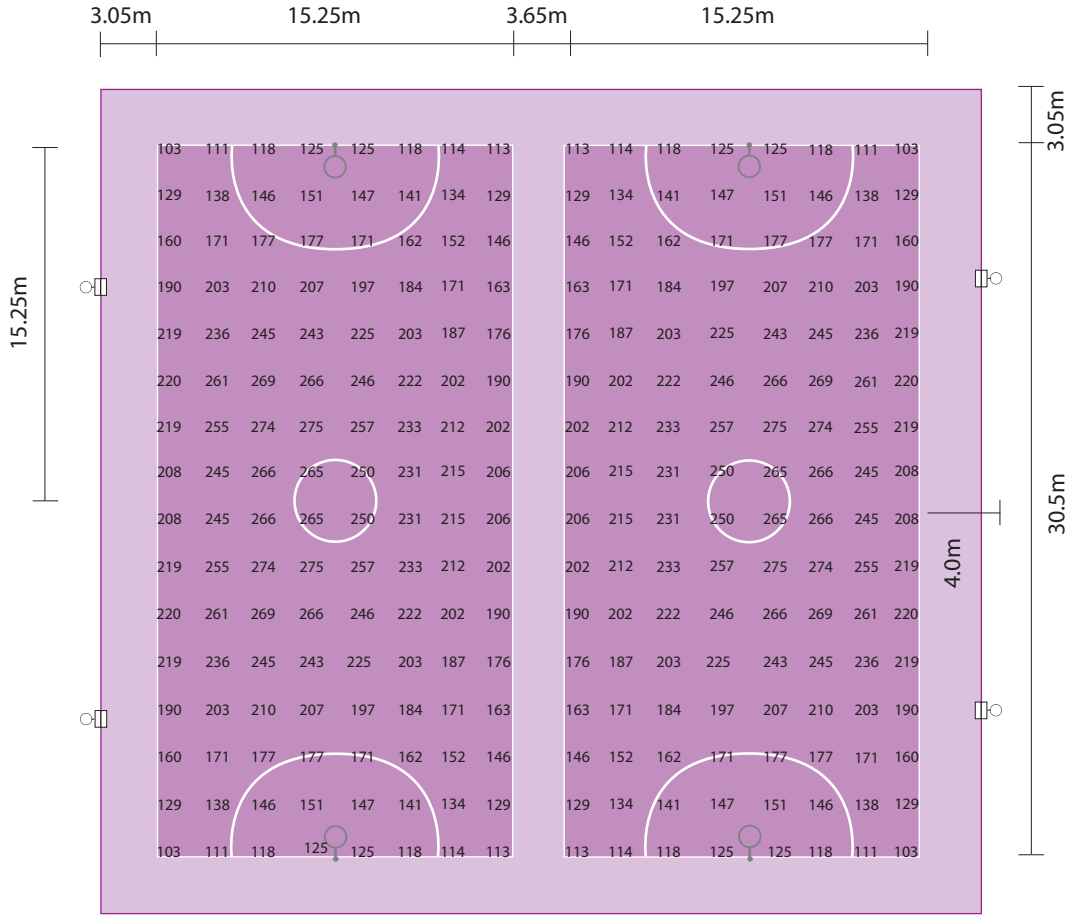
Level of play	Training
Average lux	190
Number of lamps	8
Number of poles	2
Pole height	12m
Type of floodlight used	1kW symmetrical beam

Outdoor Netball Lighting

Netball Lighting Court lighting plan example 4

Netball dual court lighting guide

Competition – 200 lux



Design summary

Level of play	Competition
Average lux	208
Number of lamps	8
Number of poles	4
Pole height	12m
Type of floodlight used	1kW symmetrical beam

Outdoor Netball Lighting

Budget

The budget table below should be used as a **guide only**. Costs will vary between manufacturers and will also depend on quantity and quality of floodlights proposed for use. Estimates should be used when planning the development of a new lighting facility. Current as at June 2011.

INDICATIVE COSTS	Netball Single Court Training (100 Lux)	Netball Single Court Competition (200 Lux)
Capital – Initial Cost		
Geotech (Soil) Report	$1,250	$2,500
Floodlights Supply	$4,000	$4,000
Floodlights Install	$800	$800
Poles Supply	$2,700	$5,350
Poles Install	$1,000	$2,000
Foundations	$1,800	$3,600
Lifting/Cranage	$750	$750
Power Supply	$350	$350
Floodlighting Distribution Boards	$1,500	$1,500
Lighting Controls	$300	$600
Cabling	$650	$1,100
Underground Works eg Pits & Conduits	$2,650	$4,150
Test, Aim & Commission	$1,500	$2,050
Maintenance Records	$500	$500
Design & Project Management (15%)	$2,850	$4,300
TOTAL CAPITAL COST	**$22,600**	**$33,550**
Energy Avg pa	$55	$105
Maintenance Avg pa	$240	$340
TOTAL 10 YEAR COST	**$25,550**	**$38,000**

*Note: **Energy costs** have been estimated using a 'typical pattern' for netball clubs; 6 hours per week x 24 weeks = 144 hours per annum. Energy costs on average have been estimated at $0.12 /kWhr.*

Estimates have been provided assuming works are for a new project on a green field site. The figures have not taken into account cost estimates to upgrade lighting infrastructure.

Outdoor Netball Lighting

Pole Supply Costings (Typical)

Pole Height (Galv Steel)	Pole Supply Indicative Cost / Pole (*)
8m	$1,250 + GST
10m	$1,330 + GST
12m	$1,400 + GST
15m	$1,820 + GST
+ Include Total Freight to Country location (if required)	Approx. $1,000

**Indicative Costs – Courtesy of Vicpole Pty Ltd for Typical Fixed Galv Steel Poles. Add Installation, Foundation and Floodlight costs separately. Note costs will vary between manufacturers and will also depend on the weight and number of floodlights proposed for use. These can vary between suppliers and depends on their light output performance for a given size and weight of floodlight design. Current as at June 2011.*

Where To Get Further Help

Independent consultant engineers with a background in sports lighting and electrical design should be contacted to assist in the design of sports lighting.

A list of qualified professionals can be found by contacting the Illuminating Engineering Society of Australia and New Zealand Ltd at **www.iesanz.org** and requesting the names of members experienced in the design of sports lighting.

Australian Standards can be sourced at the following website **www.standards.org.au**.

Qualified electrical engineers and structural engineers with Charted Member status in the institution of Engineers Australia and relevant experience in planning sports lighting are qualified to advise on engineering matters.

Councils and State Sporting Associations/Peak Bodies should be consulted prior to the installation of lighting to ensure playing standards are adhered to.

For information on funding opportunities for lighting projects, visit **www.dpcd.vic.gov.au**.

Checklist

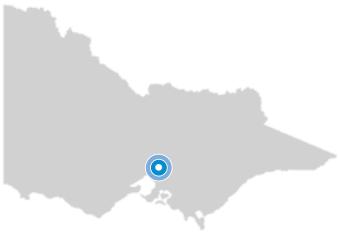
Prior to undertaking a sports lighting project, ensure that you:

- [ ] Discuss the project proposal in detail with your local council planning and recreation departments and your state sporting association/peak sporting body.
- [ ] Agree on the intended purpose of the lights with all user groups including the anticipated costs and maintenance considerations.
- [ ] Select the appropriate type of floodlight for the intended purpose now and in the future. Consider if it is for training or competition and at what level.
- [ ] Seek advice from qualified persons concerning any site specific installation issues and advice on designs and quotes.
- [ ] Obtain the necessary planning and building permits (where applicable).
- [ ] Approach the electrical company in your area responsible for providing power to the site. Ensure power supply is sufficient for lighting requirements.
- [ ] Identify appropriate height, type and location of poles with consideration of lighting additional fields in the future.
- [ ] Consider how the light fittings will be controlled, maintained and ensure safe access can be obtained for routine lamp maintenance.
- [ ] Consider whole-of-life costing including operation, maintenance and replacement.

Examples of Lighting Projects

These projects have been referred to in the 'Project Insight' section of the guide.

Australian Rules Football



Club | Panton Hill Football Club
Council | Nillumbik Shire Council
Location | A E Cracknell Reserve, Panton Hill
Level of play | Training
Average lux | 50
Project total | $140,000
Year completed | 2011
Number of lamps | 28
Number of poles | 4
Pole height | 25m
Type of floodlight used | 2kW Metal Halide

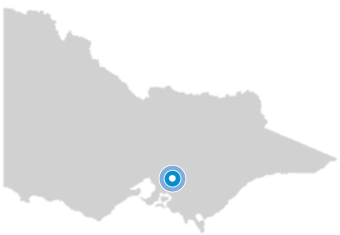
Key features of this venue:

- Includes cabling, light towers and crossarms to accommodate an upgrade to 100 lux in the future.

Club | Learmonth Football and Netball Club
Council | Ballarat City Council
Location | Laidlaw Street, Ballarat
Level of play | Club competition
Average lux | 153
Project total | $24,000 (the majority of infrastructure was in place prior to this upgrade)
Year completed | 2008
Number of lamps | 16
Number of poles | 4
Pole height | 30m

Key features of this venue:

- The Club used second hand light poles which were rigorously tested to ensure structural integrity.
- The initial installation in 1991 included infrastructure to enable further upgrades in the future. Some 17 years later the club was able to upgrade from training to club competition lighting whilst still maintaining the Australian Standards.



Club | Woori Yallock Football and Netball Club
Council | Yarra Ranges Shire Council
Level of play | Club competition
Average lux | 150
Project total | $150,000
Year completed | 2011
Number of lamps | 24
Number of poles | 4
Pole height | 25m
Type of floodlight used | 2kW Metal Halide

Key features of this venue:

- Geographically centric within the Yarra Valley Mountain District League.
- Includes cabling, light towers and crossarms to accommodate an upgrade to 200 lux in the future.

Examples of Lighting Projects

Football (Soccer)

Club | Surf Coast Football Club
Council | Surf Coast Shire Council
Location | Quay Reserve, Horseshoe Bend Road, Torquay
Level of play | Training
Average lux | 67
Project total | $132,000
Year completed | 2009
Layout | Multi use layout
Number of lamps | 12
Number of poles | 4
Pole height | 28m
Type of floodlight used | 2kW Metal Halide

Key features of this venue:

- The facility has been designed with the capacity for a future upgrade to semi-professional competition level (200 lux).
- The existing pole closest to the pavilion was offset out of alignment with the other poles, due to rocks at the proposed drill location.

Club | Fawkner Secondary College – 16 current users from local football (soccer), Australian Rules, football (soccer) academies, primary and secondary schools
Council | Moreland City Council
Location | Jukes Road, Fawkner
Level of play | Club competition
Average lux | 177
Year completed | 2010
Number of lamps | 16
Number of poles | 8
Pole height | 18m
Type of floodlight used | 2kW Metal Halide

Key features of this venue:

- FIFA accredited synthetic pitch.
- The installation has the ability to accommodate 3 smaller playing areas arranged across the existing pitch. The idea being that each mini-pitch can be evenly lit between 4 poles. This flexibility explains the facility having more than the usual 4-6 pole arrangement for a standard pitch.

Examples of Lighting Projects

Netball

Club | North Shore Football and Netball Club
Council | Greater Geelong City Council
Location | Rose Avenue, Norlane
Level of play | Training
Average lux | 100
Project total | $59,200 (lighting component only)
Year completed | 2006
Number of lamps | 8
Number of poles | 2
Pole height | 12m
Type of floodlight used | 1kW Metal Halide

Key features of this venue:

- The installation of training lights has enabled teams to train in the evenings, increasing the amount of time available on the courts.
- The facility is used by other local clubs when the home teams are playing away matches.

Club | Apollo Bay Football and Netball Club
Council | Colac Otway Shire Council
Location | Great Ocean Road, Apollo Bay
Level of play | Club competition
Average lux | 235
Project total | $76,900
Year completed | 2006
Number of lamps | 16
Number of poles | 4
Pole height | 15m
Type of floodlight used | 2kW Metal Halide

Key features of this venue:

- Courts are located within Apollo Bay Reserve and Camping Grounds which sees them used for informal sport and competitive tennis.
- The project involved joint planning, on-site meetings and ongoing consultation with all parties during each stage of the project.

Acknowledgements

Sport and Recreation Victoria (SRV) engaged Martin Butcher Lighting Design to provide technical content for this guide.

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- Department of Sustainability and Environment
- Standards Australia
- Australian Football League
- AFL Victoria
- Victorian Country Football League
- Netball Victoria
- Football Federation Victoria
- Ballarat City Council
- Greater Geelong City Council
- Colac Otway Shire Council
- Fawkner Leisure Centre
- Moreland City Council
- Surf Coast Shire Council
- Learmonth Football and Netball Club
- Apollo Bay Football and Netball Club
- North Shore Football and Netball Club
- Surf Coast Football Club
- Eye Lighting
- Pierlite Lighting (Philips)
- Rexel Lighting (Impel)
- Sylvania Lighting Australia
- Thorn Lighting

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