

# 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

Competition	Typical Activity	Maintained horizontal illuminance (lux)	Minimum horizontal uniformities		Maximum glare rating
			U1	U2	
<b>Amateur</b>					
All other competitions	Ball and physical training <sup>^</sup>	50	0.3	N/A	N/A
	Competition/match practice	100	0.5	0.3	50
<b>Semi-professional</b>					
State League (Seniors)	Ball and physical training <sup>^</sup>	50	0.5	0.3	50
	Competition/match practice	100	0.6	0.4	50
National Premier Leagues (Seniors)	Ball & physical training <sup>^</sup>	50	0.5	0.3	50
	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))*

<sup>^</sup> 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

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.

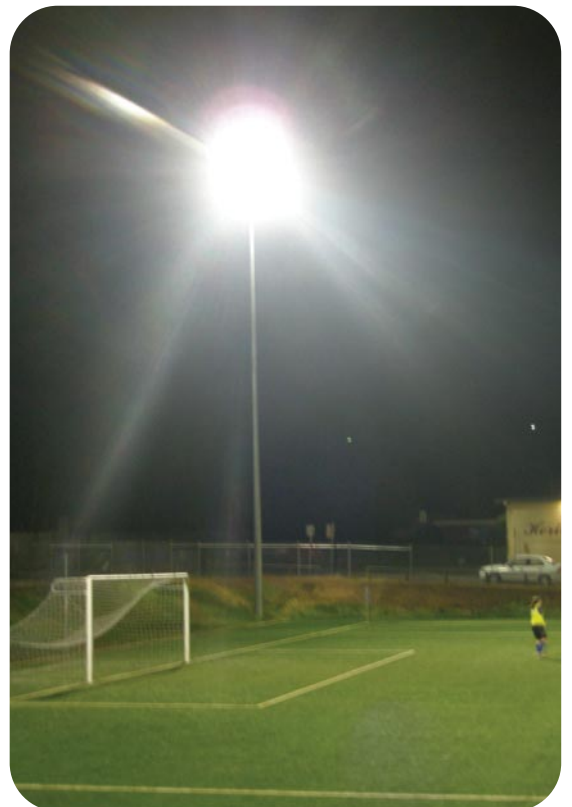
Uniformity ratios are an important part of a complete set of lighting criteria and can have a positive effect on the quality of lighting installations. Adequate uniformity is required to create balanced lighting conditions so that people's eyes do not have to continually adapt to a different light level. 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 requirements. Match lighting requirements and process for approving night match venues can be found on their website:



# 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.

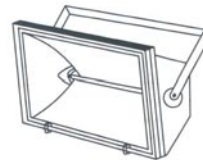
Lighting constructed with an Ingress Protection rating of 'IP6x' results in improved maintenance benefits and helps reduce costs through the ability to apply higher 'light loss factor' allowances.

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.

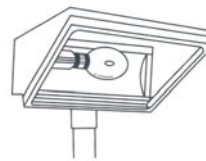
The pictured floodlights are commonly used in four pole arrangements for lighting playing surfaces.



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.  $40m \times 0.36 = 14.4m$ .

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  $77.6\text{m} \times 0.36 = 27.9\text{m}$ .

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.

# Football (Soccer) Lighting

## 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.

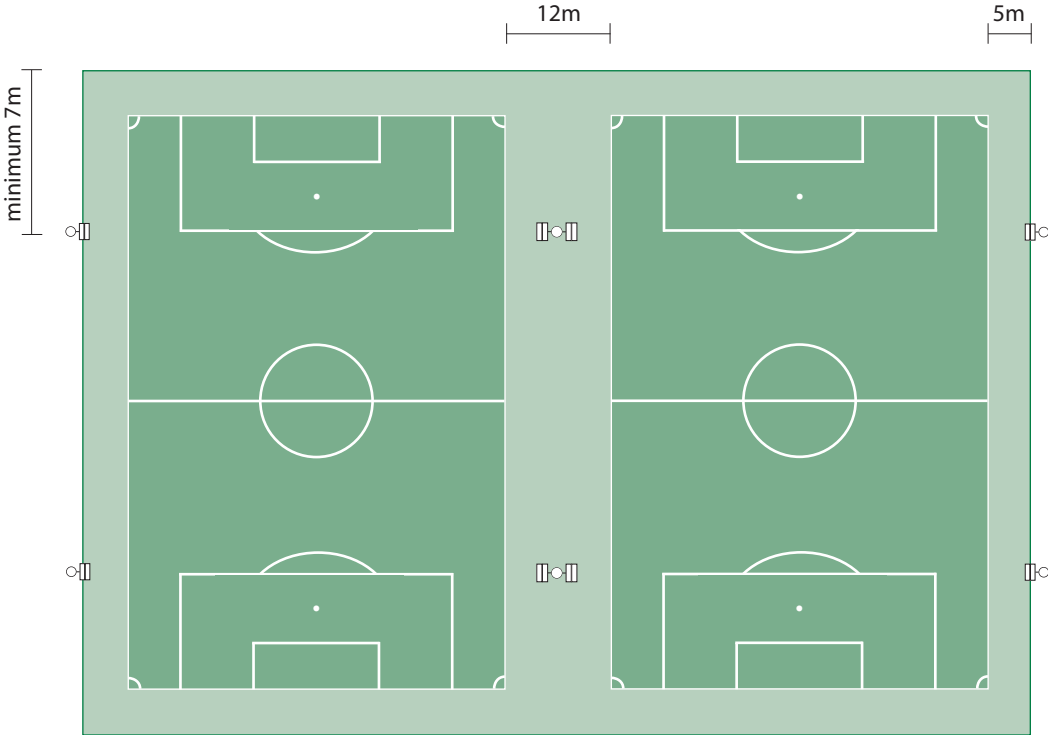
Pole infrastructure is a major component of lighting costs. Consideration of lighting implications when planning for multiple pitches may minimise the number of poles required and therefore the costs. Diagram 6 shows a side by side pitch arrangement.

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.

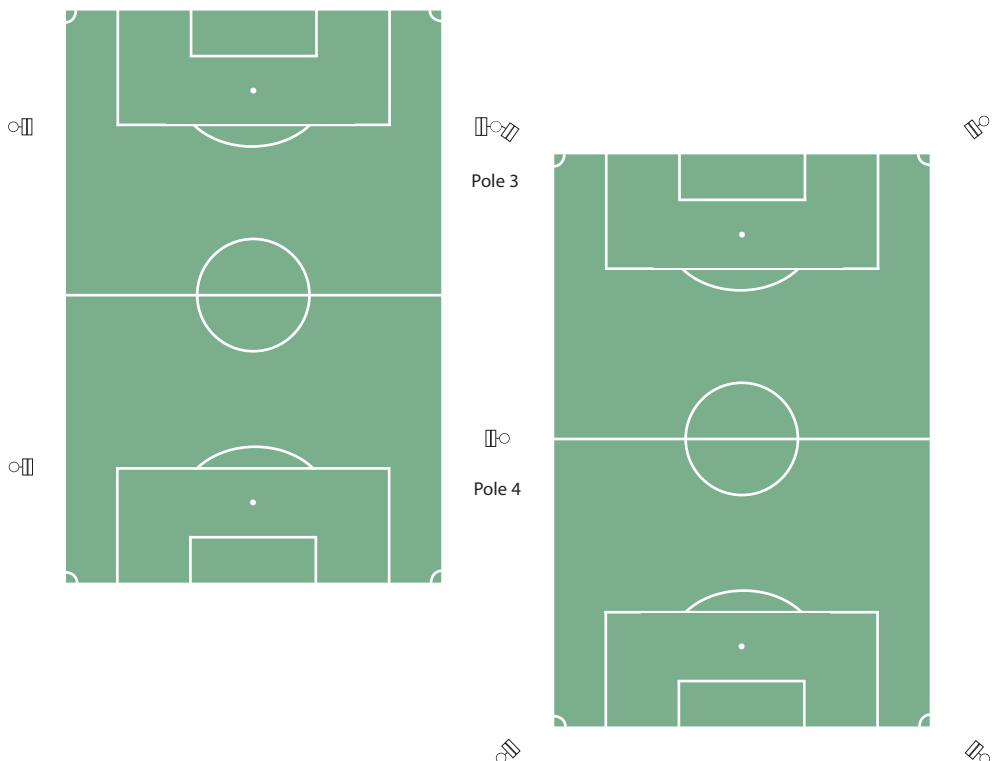
Offsetting pitches by more than 7m means an alternative layout for one of the pitches resulting in additional poles. Depending on the offset between pitches solutions could include:

- 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.

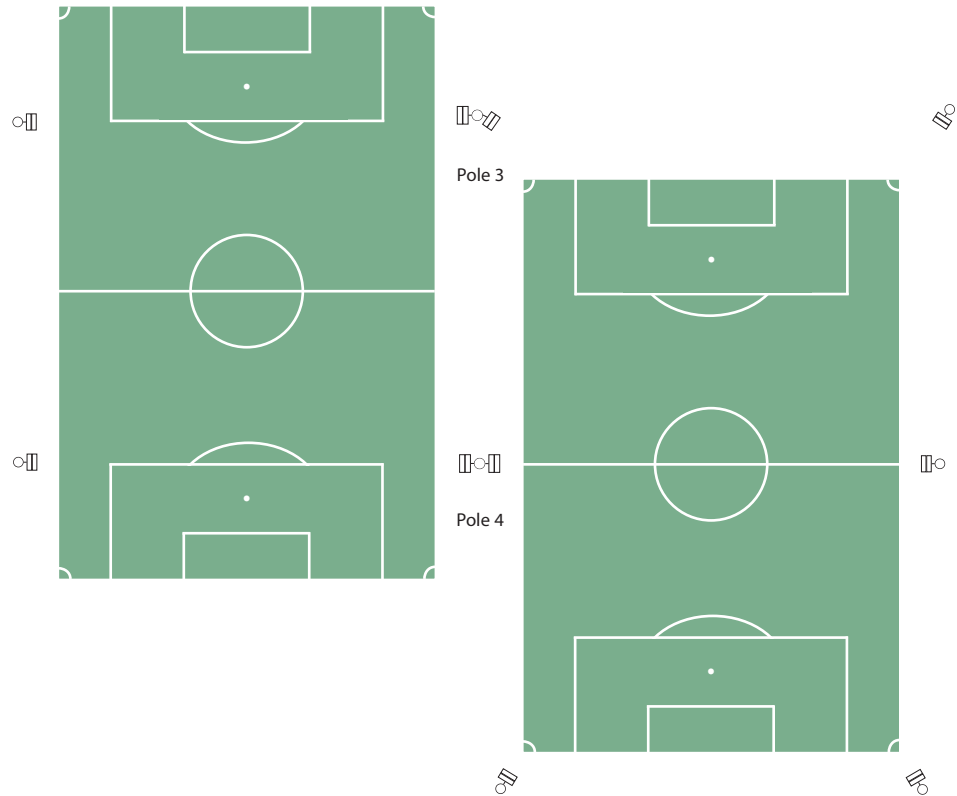
Figure 2: Pitches offset 4 pole side (Pitch 1) + 4 pole corner (Pitch 2)





## 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).

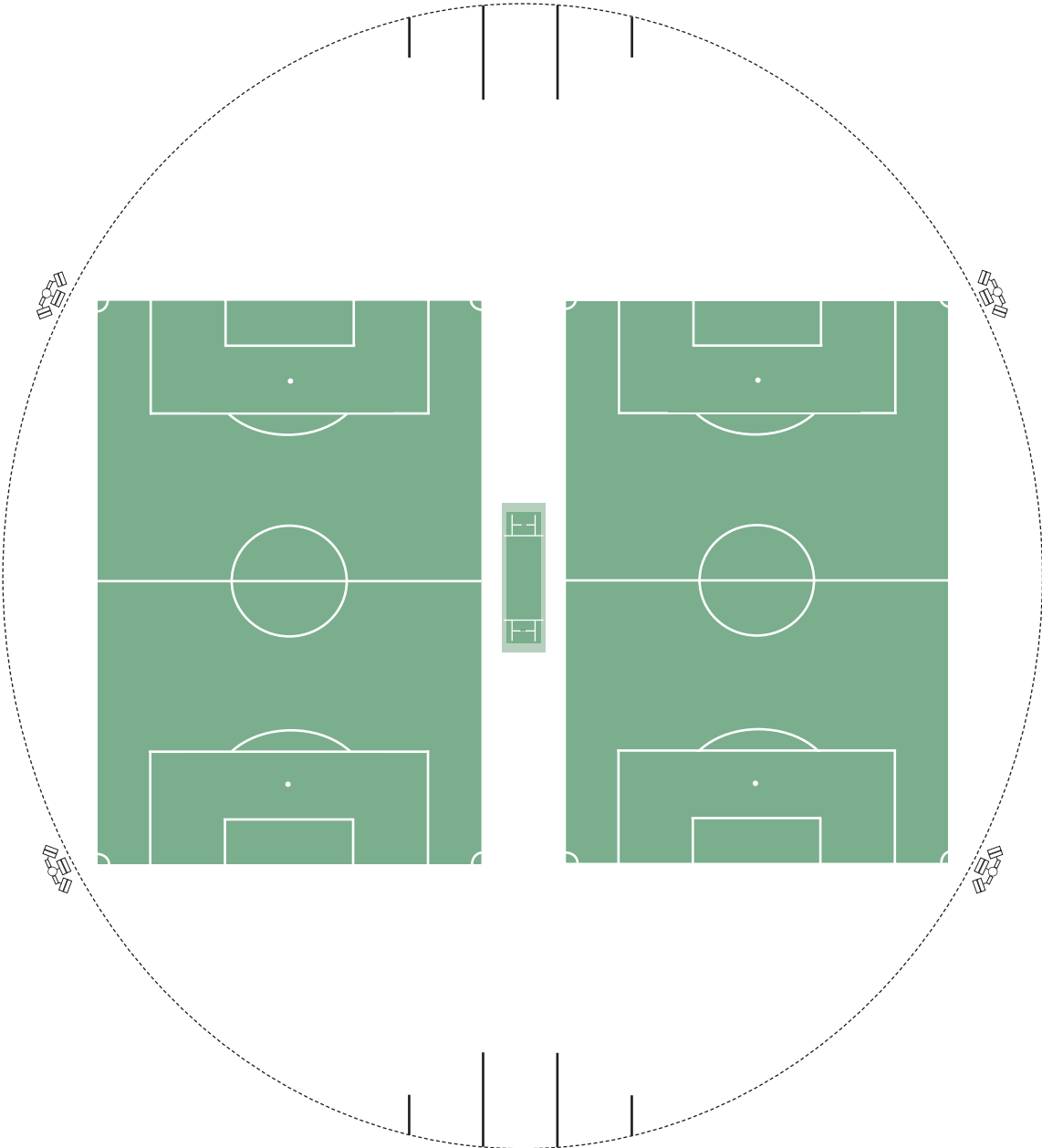
# Football (Soccer) Lighting

## 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 overlaid 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*

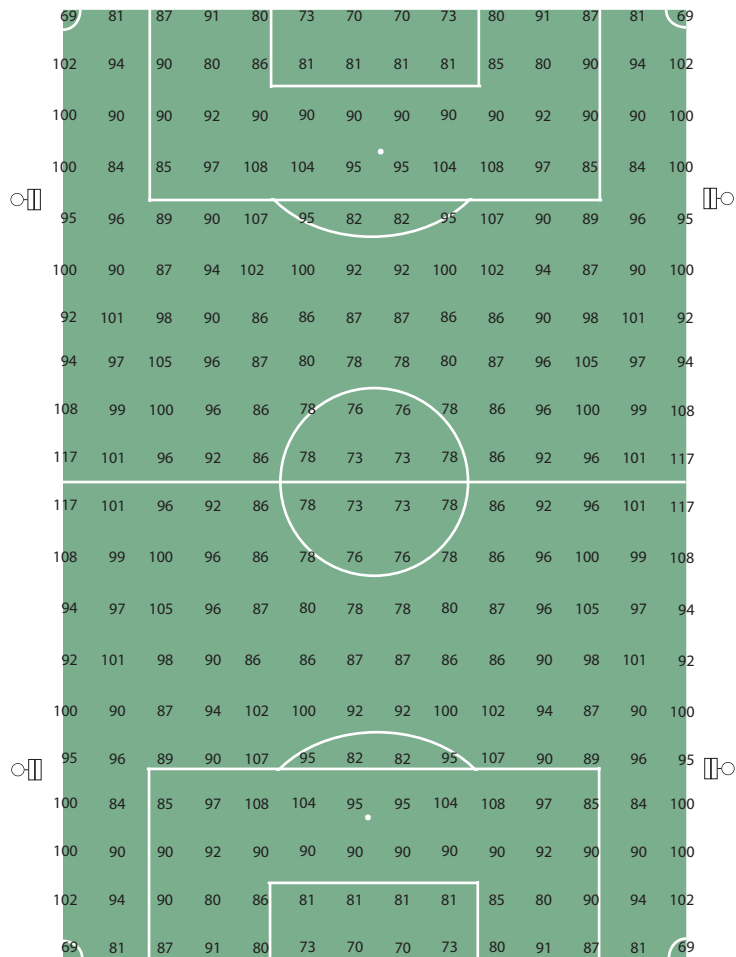
- Design of lamps may confer better maintenance of light output performance.
- Design should be carefully determined in consultation between designer and client/club for each site with an agreed practical maintenance regime.



# Football (Soccer) Lighting

## Football (soccer) lighting plan example 1

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



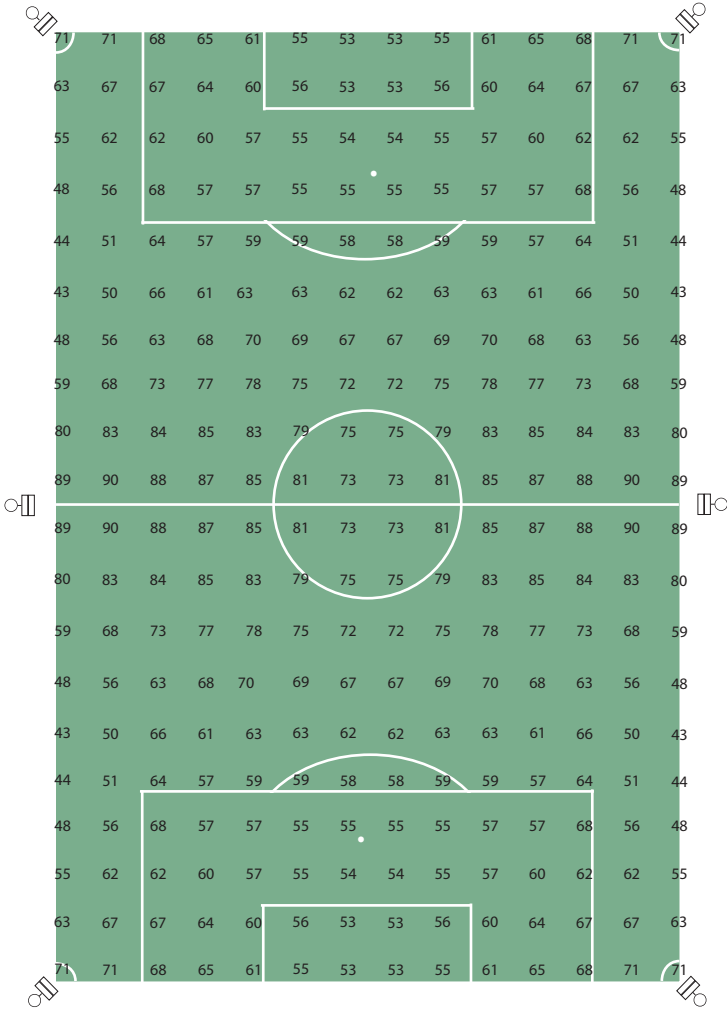
### Design summary

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)



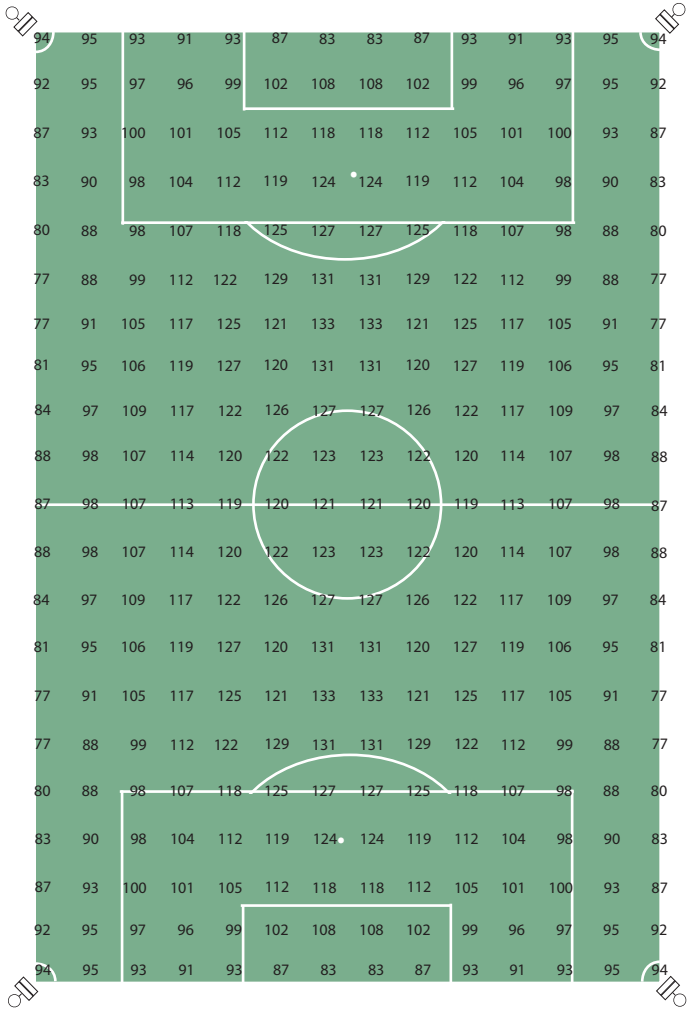
### Design summary

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)



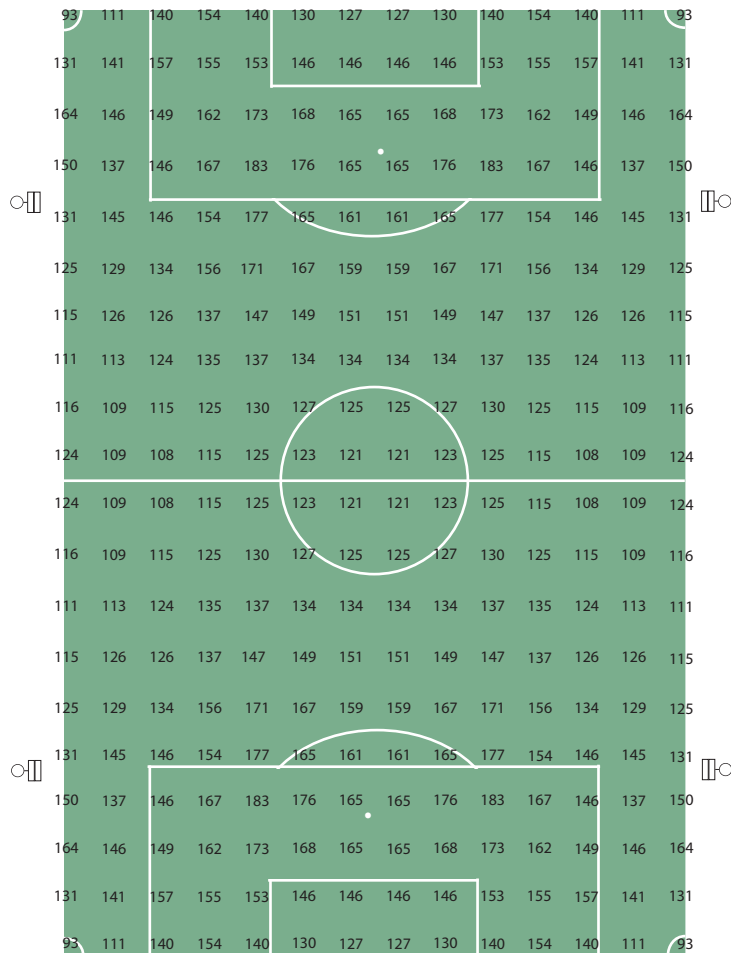
### Design summary

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

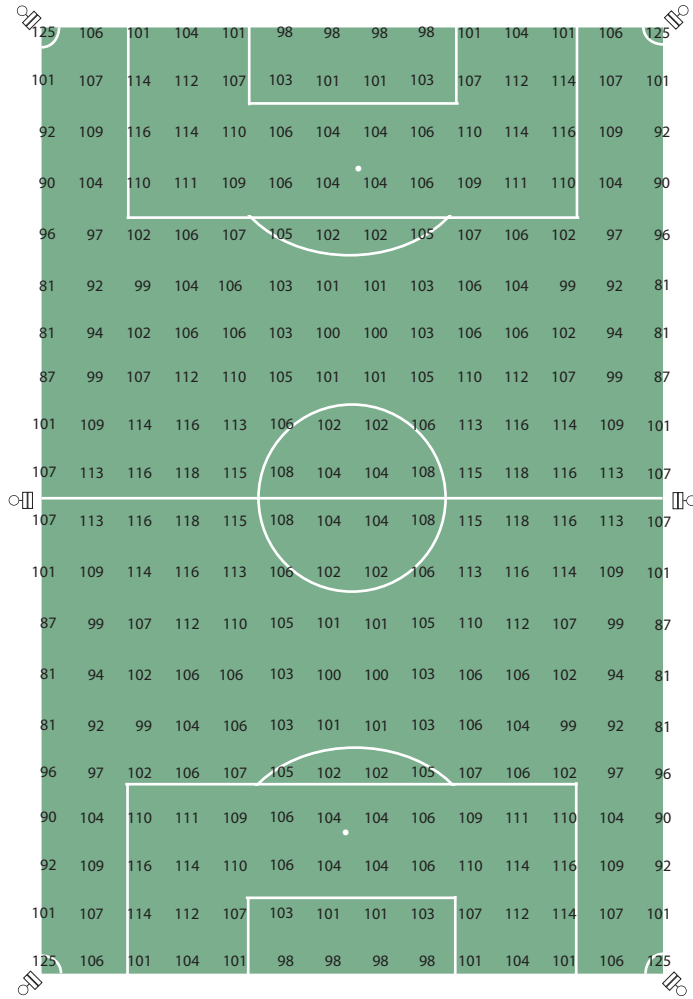
Level of play	Amateur match practice and competition
Average lux	149
Number of lamps	12
Number of poles	4
Pole height	18m
Type of floodlight used	2kW luminaires



# Football (Soccer) Lighting

## Football (soccer) lighting plan example 5

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



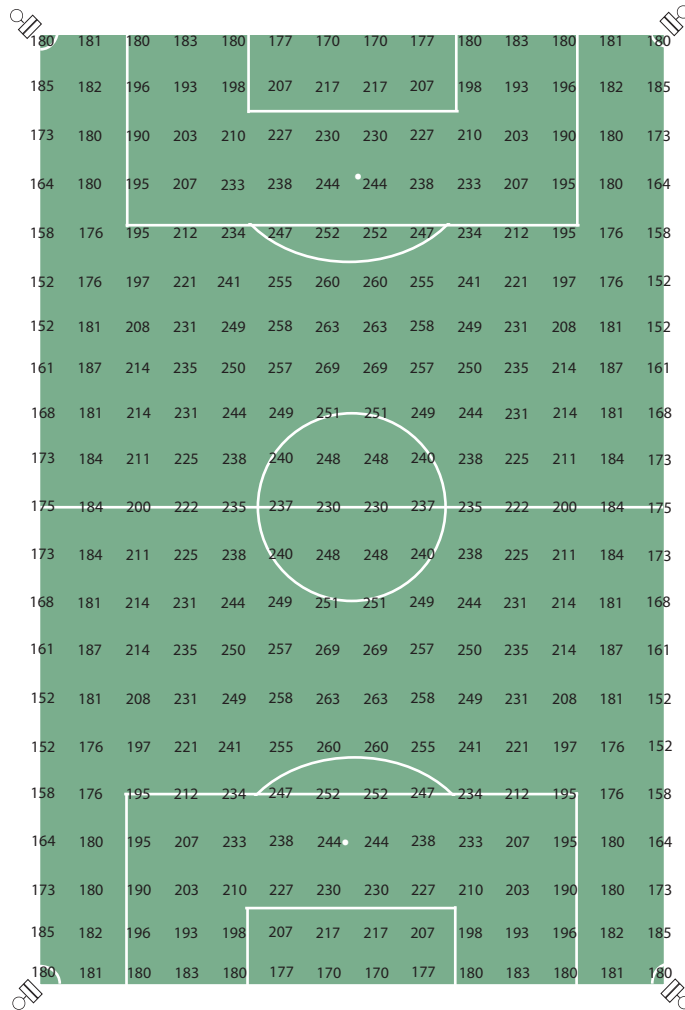
### Design summary

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)



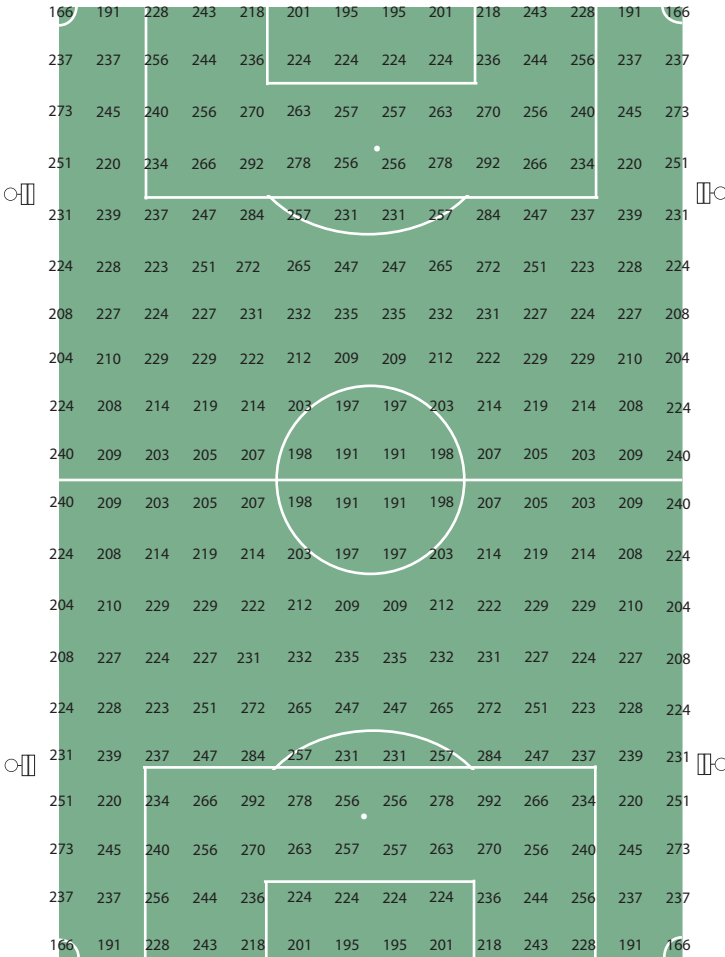
### Design summary

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)



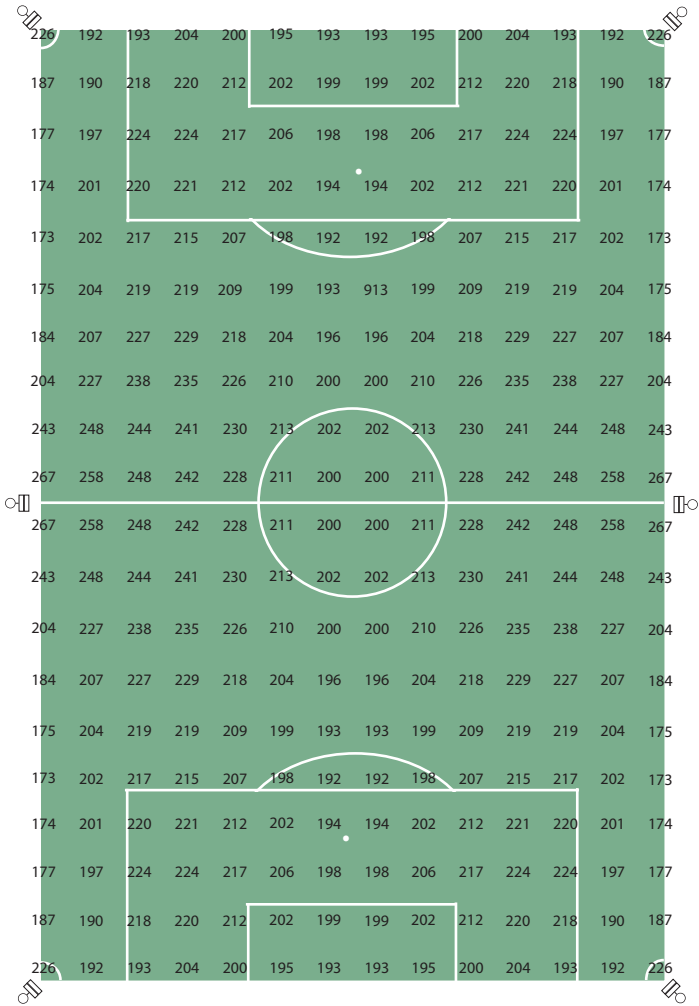
### Design summary

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
<b>Capital – Initial Cost</b>						
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
<b>TOTAL CAPITAL COST</b>	<b>\$207,200</b>	<b>\$173,000</b>	<b>\$199,000</b>	<b>\$280,100</b>	<b>\$233,700</b>	<b>\$265,300</b>
Energy <sup>#</sup> Avg pa	\$840	\$840	\$840	\$1,680	\$1,680	\$1,680
Maintenance <sup>#</sup> Avg pa	\$1,060	\$1,060	\$1,060	\$1,960	\$1,980	\$1,980
<b>TOTAL 10 YEAR COST</b>	<b>\$226,200</b>	<b>\$192,000</b>	<b>\$218,000</b>	<b>\$316,700</b>	<b>\$270,300</b>	<b>\$301,900</b>

<sup>#</sup> 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.*

