The design of floodlighting for a sports facility is a highly technical topic and it is strongly recommended that a professionally accredited sports lighting engineer be consulted.

Reference should be made to the latest version of the 'Guide to the Artificial Lighting of Hockey Pitches', *a*vailable from www.englandhockey.co.uk/facilities. This is a specialised, detailed guide, specifically for outdoor hockey arenas and will help prospective purchasers to understand the information that the specialist designer will require. Do not be discouraged by the technicalities in some of the sections – they are for the use of the specialist and the ultimate installer.

England Hockey Recommendations

Masts

Lighting masts must not be erected within the run-off areas (minimum of 2m on each side-line and minimum of 3m on each back-line). For non-competitive activities, the recommended mounting height is 15m, however for club competitions and ball training the mounting height needs to be at least 18m so as to avoid glare.

Shadows

To avoid disturbing shadows for the goalkeeper, it is recommended that 8 or at least 6 masts are used.

Minimum Lux Levels (Maintained)

Class	Maintained lux	Activity
I	750	High-grade national club and international competition
II	500	Junior and low-grade club competition
III	300	Non-competitive training

Please note televised events may require higher lux levels.

The Need for Good Lighting

All sporting events require good light to enable the sport to be played properly and safely, for the best results to be achieved, and to provide enjoyment for participants and spectators whether they are present in the venue or watching on television.

To maximise the use of limited space and expensive facilities, venues are increasingly being used for a range of different sports and even for other (non-sporting) events. This needs to be considered in the lighting design. Media coverage, and television coverage in particular (if this is being contemplated), is playing an ever-increasing part in sporting events and this means there is a demand for lighting that will enable excellent image quality whilst also limiting the glare and distraction for players, officials and spectators. This media exposure has also encouraged more people to take an interest in sport and this, in turn, has led to a demand for better venues. The quality of the lighting installation is one of the main factors that determine the quality of a venue.

It is important that the purchaser is clear from the outset what level of artificial lighting is desired; in some cases, lighting is not given the consideration it deserves and the installed system is not adequate. This almost always proves to be a false economy and at some stage the participants, spectators and (if applicable) television companies demand an upgrade – at considerable extra cost. The end result is that expensive work is carried out twice.

Further, when venues are developed and refurbished, it is important to incorporate energy efficient installations so that energy wastage is minimised.

Key Terms in Sports Lighting

It is important to try to understand the basic elements of good lighting design which aim to achieve four things:

- to ensure optimum visibility for participants and spectators (including television spectators, if appropriate);
- to create a visually satisfying and interesting scene;
- to ensure that the lighting system integrates well with the surrounding architecture;
- to minimise light spillage and make good use of energy resources.

Illuminance

Is the amount of light (measured in lux) necessary for the sport to be played. As hockey is a relatively fast sport using a relatively small ball travelling at speed, the level of lighting will need to be higher than for many other sports. However, consider installing a system with several settings that, for economical reasons, can be switched from a training mode through non-televised match play right through to an international televised mode.

Average maintained horizontal illuminance (Eh)

Is the average lux value achieved over the longest maintenance cycle period for an installation. Regular maintenance is intended to include replacement of lamps and cleaning of luminaires.

Where television coverage is contemplated, it is becoming increasingly common for minimum light levels to be specified and this applies to the vertical illuminance described below.

In this connection, it should be noted that new lamps tend to lose up to 25% of their illuminance in the first 100 hours of use. Thereafter, the degradation is very much slower until they finally burn out. It is recommended therefore that, to achieve a particular maintained value of illumination, the installation be designed for 1.35 times the target maintained illumination.

Average maintained vertical illuminance (Ev)

Is the quantity of light on a vertical plane and should be calculated for unrestricted camera positions.

Camera illuminance

Is the quantity of light that shines in the direction of a fixed camera position. Calculations should be carried out using the actual angles perpendicular to the camera positions. Ideally, this should also be considered for a ball in flight as the readings will differ. If it is considered important to provide television shots of the crowd, the contrast ratio between participants and spectators should be considered (but often taken as 15% of the average camera illuminance). For hockey, the point of reference for such measurements is defined as 1.5 metres above the pitch.

Illuminance uniformity

An adequate level of uniformity is required to create balanced lighting conditions so that people's eyes and the television cameras do not continually have to adapt to a different light level. To achieve this, the ratio of the lowest to the average level of illuminance, and the ratio of the minimum to the maximum levels of illuminance are often specified.

Uniformity gradient

Even when the illuminance ratios are acceptable, changes in illuminance can be disturbing if they occur over too short a distance. This problem is most likely to occur when panning a television or film camera to follow rapid action. Therefore, the illuminance uniformity coverage at a certain grid point (expressed as a percentage change from the illuminance in eight adjoining grid points – referred to as the uniformity gradient) is often limited.

Other matters that need to be discussed and decided upon with the help of the specialist adviser include:

- emergency escape lighting in the event of an emergency;
- switching mode to cover different levels of play or activity;
- emergency (continuity) television lighting and hot restrike luminaires to enable play to restart as soon as possible in the event of a failure of the principal power source;
- obtrusive light, ie the light that is directed up and beyond the boundary of the sports facility.

The Design Process

It will be apparent from the preceding paragraphs that there are many factors to consider in the design of hockey floodlighting. Supplying as much information as possible to the specialist sports lighting designers will make their work easier and the final installation better. It is also advisable to consult broadcasting companies if it is intended that any events be televised.

Various types of lamps are available but it is suggested that only metal halide high-intensity discharge lamps be selected for a high-speed game such as hockey. They are suitable for television coverage having very good colour rendering and excellent focussing potential. However, they have a shorter life than other types and are more expensive.

Colour rendering is the ability of a light source to reproduce surface colours accurately. The apparent colour of a light source is often described as ‘warm’, ‘white’ or ‘cool’. A cool colour temperature is preferred for hockey.

Luminaires providing direct lighting rather than indirect lighting are preferred as the overall system is likely to be more efficient. In fact it is the only option if television coverage is required, because it is the only way that adequate vertical illuminance can be achieved.

The arrangement of luminaires needs to take account of the various factors and criteria described above so that the appropriate vertical and horizontal illuminance levels are achieved without compromising the necessary uniformity and glare control.

Alternative installation arrangements should be explored, including four mast, six mast and eight mast variations. Stadiums with spectator stands along the sides can have luminaires attached to the front edges of their roofs to assist in the illuminance uniformity. Access and, therefore, maintenance to such lamps becomes easier and safer.

The use of four corner masts or towers is usually reserved for major pitch installations where there are minimal restrictions on cost or height. For standard club facilities, the eight mast arrangement is preferred because:

- it is easier to achieve and maintain proper levels of light uniformity;
- the masts need not exceed 18 metres in height and so light pollution with neighbours is easier to control;
- the masts can be of minimum cross section and thus not likely to obstruct too seriously the views of spectators seated behind them; and
- the lower height facilitates maintenance inspections and replacements.

Note: Information adapted from the FIH Guide to installing Hockey pitches and facilities