

FLOODLIGHTING INSTALLATION AND MANAGEMENT GUIDE



England
Rugby

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1. INTRODUCTION

The RFU has a long-term commitment to establishing and supporting a high quality and accessible facilities network for rugby union in England. Facilities that are well designed, built to last and well maintained are a pleasure to use and give a significant return on the time and money invested in their construction.

High quality floodlighting can provide an opportunity to extend the use of rugby facilities during dark evenings throughout the season. This Guidance Note is designed to guide you through the technical regulations, design, procurement and maintenance of floodlights for rugby union.

2. REGULATIONS

Before looking at the regulations in detail it is important to understand some basic terminology relating to sports floodlighting.

- **Lux** is a measurement used to identify lighting levels and represents a measure of lumens per square metre. It is sometimes referred to in technical documentation as Eh (horizontal illuminance)
- **Uniformity** is a measurement of the evenness of the lighting over a whole area and is referred to in technical documentation as U. Uniformity is worked out by dividing the minimum lux by the average lux.
- **Glare** refers to the difficulty seeing in the presence of direct bright light. On a rugby pitch it is measured on 9 points on the halfway line, 22m lines and Try lines. This provides a Glare Rating or GR.
- **Colour** refers to the accuracy, or ‘life-like’ quality of the lighting. On technical documentation this is referred to as Ra. On the Ra index, the figure of 100 is used to represent bright daylight.
- **Maintained illuminance.** Lighting will not always remain as bright as when it is first switched on and a lamp can lose up to 20% of its effectiveness after the first 100 hours use. For this reason, schemes are usually specified in terms of the minimum average maintained illuminance. In technical documentation this is referred to as Eav.



Using the measurements explained above, the RFU Regulations for floodlit matches and recommendations for floodlit training activity are summarised in table 1 below. RFU minimum requirements conform to CIBSE (Chartered Institution of Building Services Engineers) Lighting Guide 4.

	Levels 2-5		Levels 6-12	
	Matches	Training	Matches	Training
Maintained Illuminance	200 lux	100 lux	100 lux	100 lux
Uniformity	0.6	0.5	0.5	0.5
Glare	<50	<55	<55	<55
Colour	>60	>20	>20	>20

*The standards for PRL and International fixtures are not covered in this Guidance Note.
** A more detailed breakdown of the range of floodlighting standards forms Appendix 1 of this guidance note.

Lighting levels for league competition should be evidenced through the production of a lux certificate not less than 3 years old. Where lighting levels for training can not be achieved a comprehensive risk assessment should be carried out in order to identify what type and intensity of training activity is appropriate.

The figures in table 1 apply to the playing area of the pitch, which includes the field of play and the in-goal areas. Beyond the playing area is the run off, which should be not less than 5m (where practicable) from the touchline and which should be illuminated to a level of 25% of that of the playing area. Lighting columns should not be situated within this 5m ‘run off’.

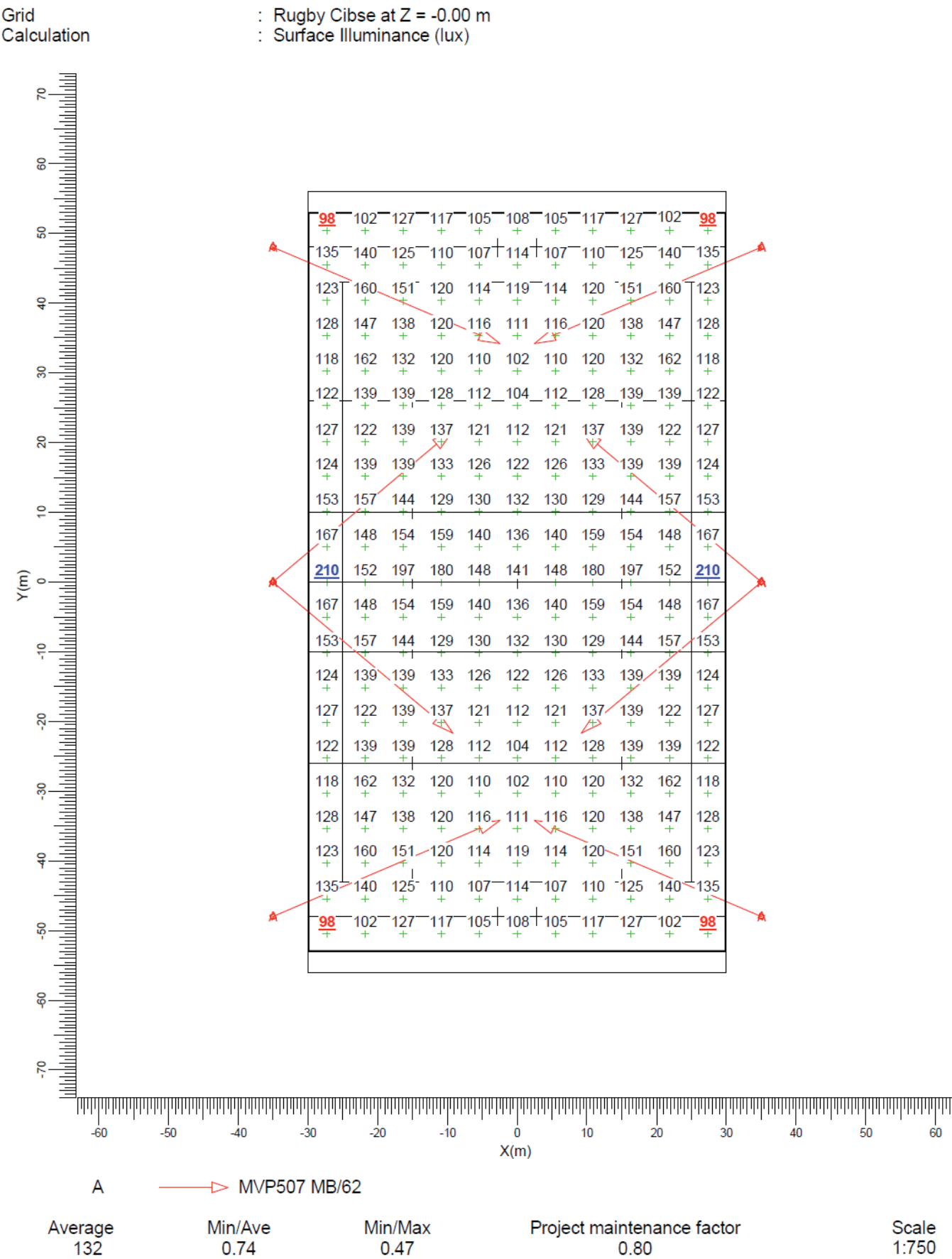
Table 2 (overleaf), shows a typical lux diagram for a rugby union training pitch

The actual lighting columns and lamp units are also subject to regulation and must meet the current European Standard (EN) or the relevant British Standard, currently BS EN 12193:2007. The manufacturer must also be Quality Assured, in compliance with BS EN ISO 9000:2000.



3. Calculation Results

Table 2 : Typical Lux Diagram



3. COSTS

Before commencing the design process it is important to consider the whole-life costs involved with the installation of floodlights.

Capital costs will include not just the floodlights themselves but also professional fees, planning application fees and any electrical upgrade, connection or supply charges.

Typical costs are as follows:

100 lux training area (60m x 40m) = £25,000 - £30,000
100 lux full pitch = £40,000 - £45,000
200 lux full pitch = £45,000 - £50,000

100 lux lighting to a full pitch is likely to cost between £35,000 and £40,000. These figures exclude VAT and any additional costs required for upgrading the power supply or to comply with site specific planning conditions.

Cabling is another potential cost and clubs should always consider the proximity of the pitch in relation to the power supply when scoping a floodlighting system.

Indicative trenching and cabling costs are as follows:

20 metres trench and cabling = £646
50 metres trench and cabling = £2,304
100 metres trench and cabling = £5,247

Running costs will include energy charges, depreciation, and maintenance charges. Every scheme is different and energy costs may vary over time and between different suppliers, but it may be helpful to use the bullet points below to identify some broad-brush costs for budgeting purposes

- A typical **100 lux pitch system** uses 8 x 2100w luminaires so the total load is 16,800w (16.8Kw)
- 1 unit of electricity is 1000w over a one hour period.
- Therefore a typical 100 lux pitch system equals 16.8 units of electricity per hour @ 10p per unit (depending upon supplier) = £2.01p per hour
- A typical **200 lux pitch system** uses 18 x 2100w luminaires so the total load is 37,800w (37.8Kw)
- 1 unit of electricity is 1000w over a one hour period.
- Therefore a typical 200 Lux pitch system equals 37.8 units of electricity per hour @ 12p per unit (depending on supplier) = £4.54p per hour

There are additional charges such as monthly meter rental, which will vary from each supplier so clubs should contact their current electricity provider for more detailed information.

*All costs accurate as of March 2014



4. DESIGN

Good design needs to be embraced right from the start. Rugby clubs rarely have the expertise within their membership to specify and commission a floodlighting project themselves. Floodlights must be designed and installed to professional standards and this guidance note is not intended to be a substitute for the use of an electrical or lighting engineer who can provide support with the following elements of the scheme;

- Preparation of the specification
- Planning Permission
- Analysis of tenders
- Appointment of a contractor.

At the outset of the design process, you should consider the long term plans that your club or site has in place. This will enable you to determine whether further lighting is likely to be required in the future. This should include pitch lighting but also lighting for the clubhouse, car parking or other external areas. This may affect the routing of cables, and will also influence the future required capacity of the incoming power.

Design Options

Lamps

- There are currently three types of lamp unit which could be considered during the design process:
- ‘Projector’ type lamps are circular, producing a cone-shaped narrow beam of light which is effective for long projections and is usually employed where the layout requires high (30m) columns positioned in the four corners of the ground.
- ‘Double asymmetric’ floodlights give a fan shaped beam and are now the most commonly used. They are particularly suitable for layouts with columns at the side of the pitch, but have the marked disadvantage of causing light pollution as a result of the spillage of light.
- ‘Flat glass’, or zero upward lights have the front face parallel to the playing surface, thus limiting upward light and light trespass. For this reason, they are more likely to find favour with planning authorities.

Lamp Types

- There are two main light systems to be considered during the design process:
- High pressure sodium (SON) is good value for money and has a long lamp life with a low replacement cost, but the main disadvantage is the poor colour rendering. For this reason, high pressure sodium is more suitable for training areas than for match pitches.
- Metal halide (MBI), while more expensive, provides a good quality colour rendering and is the favoured choice for match lighting. The RFU currently recommend this system for both training and match standard systems.

Tungsten halogen and high pressure mercury lamps are no longer used for permanent floodlight systems.

Control Systems

Control gear should always be considered when installing floodlights. Typically this will add 10% to the pure lamp consumption, a 2kW lamp will use an extra 200w in the control gear which operates it.

Modern control gear systems are available to optimise this consumption, reducing the system consumption by 50% or more. These systems also lower maintenance costs as the lamps are controlled better reducing the burn factor on the lamps leading to less frequent replacements and more consistent output over the lamp lifespan.

Other system considerations include

- Control & Zoning – planning your switching options so that lighting can be switched on to suit usage, a pitch may have 2 to 4 zones, which can be turned on independently so that a small training session doesn’t use all the lamps on the pitch.
- Switching options & hours of use, energy is power(W) multiplied by time. measures to limit the time lights are in use will save money and prolong asset life. Options include, curfew timers or key switch controls where a key is required to switch on the floodlights, helping to restrict their use to official functions only. These are relatively inexpensive to install (£200 to £300) and can be retrofitted and typically will payback pretty quickly where lights are misused.



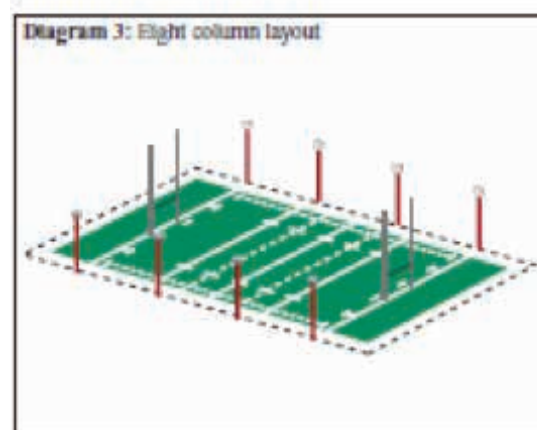
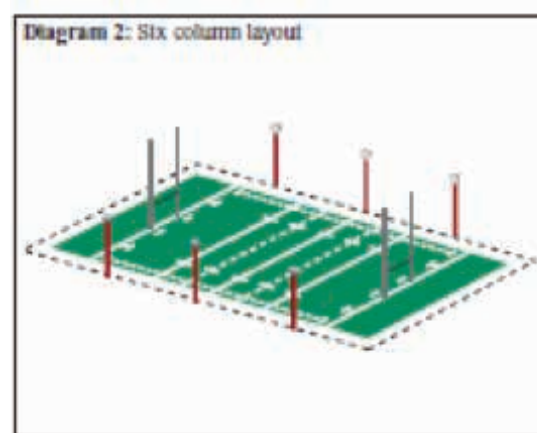
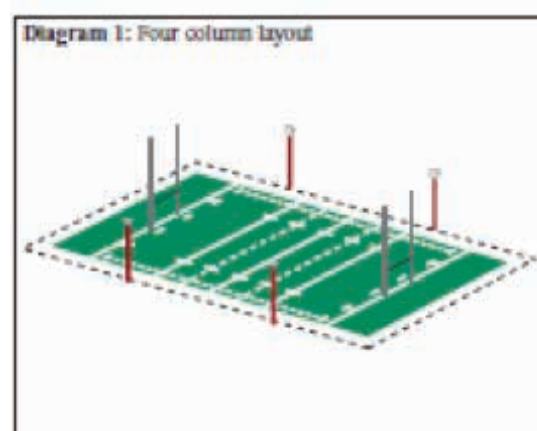
Layouts

200 lux systems can also be based on four, six, or eight column systems, with poles at 13, 15, 16 or 18m height. If there is any indicative fall-off in illuminance in the in-goal areas, this must be corrected in the positioning of the lighting columns rather than by placing additional masts behind the goals as this will direct light along the main axis of play and cause excessive glare for the players.

Corner lighting is another design consideration as it avoids placing the columns between the spectators and the game, but it relies upon higher columns which may cause additional planning objections.

100 lux systems can be achieved with four, six or eight columns, preferably covering the full pitch in order to distribute wear and tear of the surface. If only half of the pitch can be used, four columns (two opposite two) are recommended. The RFU do not normally recommend a single row of floodlights, for safety reasons.

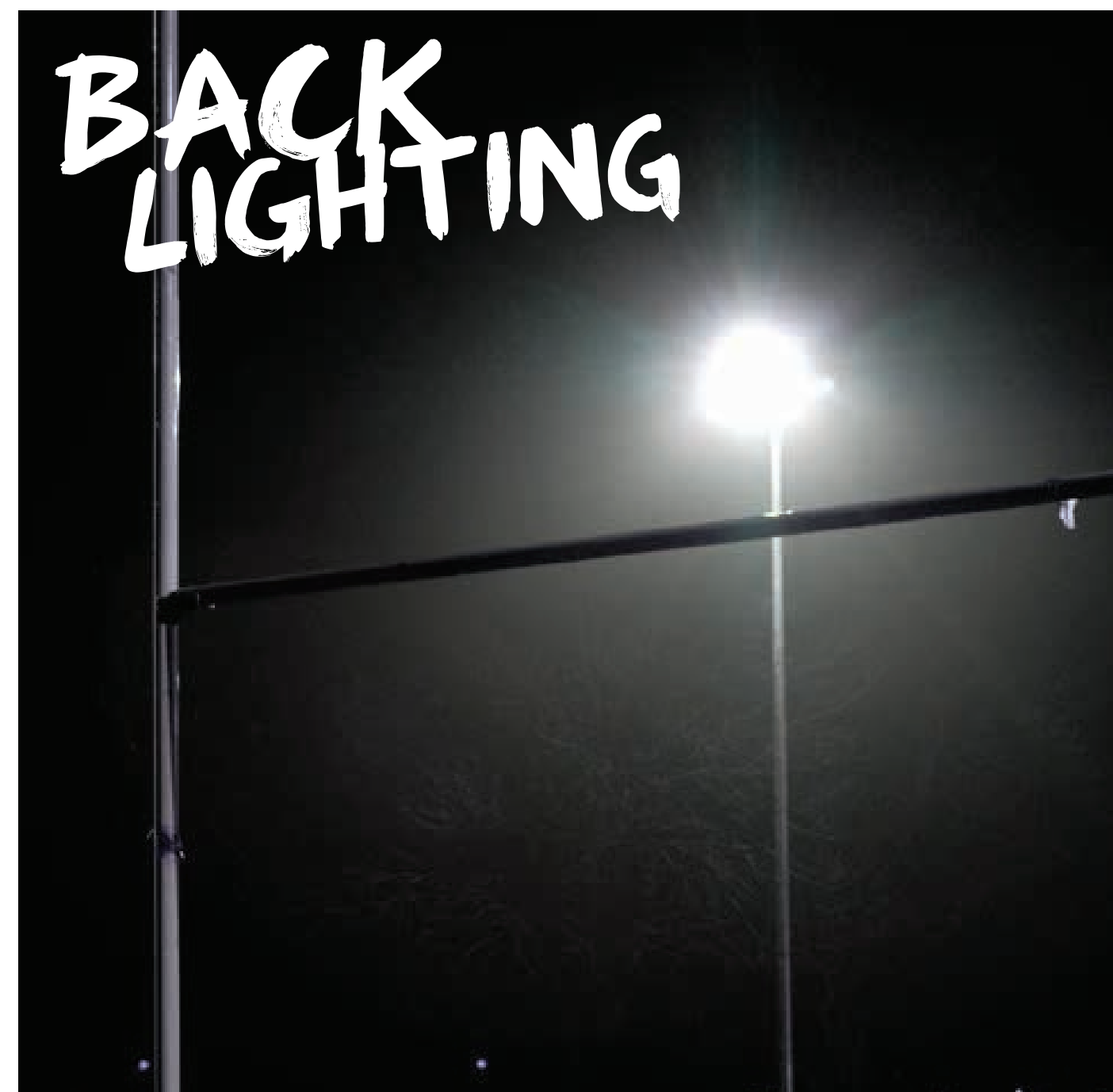
Diagrams 1, 2 and 3 show typical column layouts.



Back Lighting

Installing additional luminaires onto existing floodlight columns can be a cost effective way of increasing the floodlit capacity of a site. However there are a number of factors that need to be considered when investigating this option further.

- The load bearing capacity of the existing columns should be assessed to ensure they are strong enough to withstand the extra weight of the extra luminaires.
- To be able to have separate switch systems for the back lighting additional underground cables will be required.
- To be able to use the back lighting at the same time as the main floodlighting system an assessment of the underground cables will be required to identify whether or not they are large enough to cope with the extra electrical load.
- If simultaneous use is not required, changeover switches can be installed to the lighting columns to enable a choice between the back lights and the pitch lights. Use of this solution does not require any additional electrical load so the cabling can remain the unaltered.



Design Criteria

All floodlighting systems installed for the playing, training or recreational use of rugby should adhere to The Society of Light and Lighting; Lighting Guide 4: Sports (LG4) and the regulations within this guidance note.

The design should adopt the logarithmic calculation and comply with all requirements as stipulated within LG4 Appendix 1. This calculation requires the following dimensions to be considered:

- The length in metres of The Playing Area
- The width in metres of The Playing Area
- The length in metres of the in-goal areas, i.e. the length in metres from the goal-line to the dead ball line
- The length in metres that the light level will be retained into the in-goal areas from the goal-line. This should be a minimum of five metres
- The distance from the touchline to the base of the floodlight columns.

These dimensions should be clearly stated on the design plan so the Club are fully aware of the extent of lighting their proposed system will achieve.

On Site Measurement for a Lighting System

After the installation of your lighting system, it will be necessary to measure the actual illuminance levels provided by the new system. This test will involve the measurement of lux levels and uniformity and should be carried out by a suitably qualified lighting engineer. It may also be a condition of your planning approval that a lux level test is submitted to show compliance with original designs.

In line with LG4, a reduced number of grid points can be used for the onsite measurement as this process should be used as a check against the values in the design.

To satisfy this requirement, all systems installed for the playing, training or recreational use of rugby union (regardless of size), should be measured on site utilising a regular grid of 13 x 7 points. For clarity, this grid requires 13 points parallel to the touchlines and touch-in-goal lines. Seven points are required parallel to the half-way line and goal-lines.

An example of the 91 point illumination template is outlined in **Table 3** overleaf.

**Table 3:** 91 Point Illumination[illegible]

Contractors

For information on the selection of specialist lighting consultants and contractors, consult:

- The Society of Light and Lighting (CIBSE) www.cibse.org
- Sports and Play Constructors Association (SAPCA) www.sapca.org.uk
- The RFU's framework list of lighting contractors www.englandrugby.com/floodlights

Power Supply

An electrical engineer needs to be used during the design stage to establish the following:

- Whether the existing power supply to your site will be capable of bearing the necessary load for your new floodlights.
- The scale of the required electrical upgrade, as this will influence the type of metering required. This will be either whole current metering or CT metering, which carries a higher monthly standing charge.
- Who your local electricity distributor is.
- How the power cabling will reach the lighting columns, whether the routing will require ducting (e.g. under roads or car parks) and whether the main lighting will also be used for training (e.g. for half of the pitch).
- Whether the switchgear will be accessible to users (e.g. players) or whether a remote control is preferable.

Design considerations for future maintenance programme

Some thought should be given to the way in which the lighting will be maintained, as this affects the type of lighting column that will be installed.

Major servicing will normally be carried out by a contractor, but minor work (e.g. lamp cleaning) can be undertaken at club level if hinged columns are specified. Mid-point hinged columns avoid the need for expensive lowering equipment. In the use of mid-hinged or base-hinged columns clubs should be aware of the training requirements in carrying out their own maintenance equipment.

Consideration should also be given to the on-going maintenance requirement that the club may be liable for in order to maintain any warranties that the club may be liable for the floodlight supplier and/or contractor.



5. PLANNING PERMISSION

Floodlighting is a sensitive environmental issue, both for your local planning authority and also for local residents. Your first step should be to consult the local authority planning department, and outline exactly what what you are planning to do.

If you have a lighting engineer acting on your behalf, they can help you prepare your submission. It may also be worth inviting local residents and pressure groups to view your proposals, otherwise the first they will hear about the project will be the formal consultation from the planning department. It is wise to be responsive to people's views, and not to adopt an entrenched position.

As well as its existing planning policies, including the local Playing Pitch Strategy. The local authority will be influenced by the practical details of your particular scheme and there are a number of features which the club can influence to help overcome the factors which often lead to a planning refusal:

Visibility, which includes both the height of the columns and sky glow (the contribution made by your lighting to the general night-time glow). Some of this glow is unavoidable and is reflected from the ground surface, but some may be from wrongly specified or badly adjusted lighting units.

Spillage. This is sometimes called light trespass and is the amount of 'wasted' light shining beyond the specific area that you wish to illuminate. This can affect surrounding properties, and can be minimised by carefully aligned lighting units. By a seeming paradox, the higher the columns are the less spillage there will be. Because of the sensitivity of this issue, the Institution of Lighting Engineers (ILE) have published an advisory document, "Guidance Notes on the Avoidance of Light Pollution", which can be downloaded from the RFU website.

Glare can also cause problems when the lamps themselves are directly visible to residents or to nearby motorists. Glare can be reduced or avoided by ensuring floodlights are mounted at the correct height and carefully aligned.

Multi-sport sites

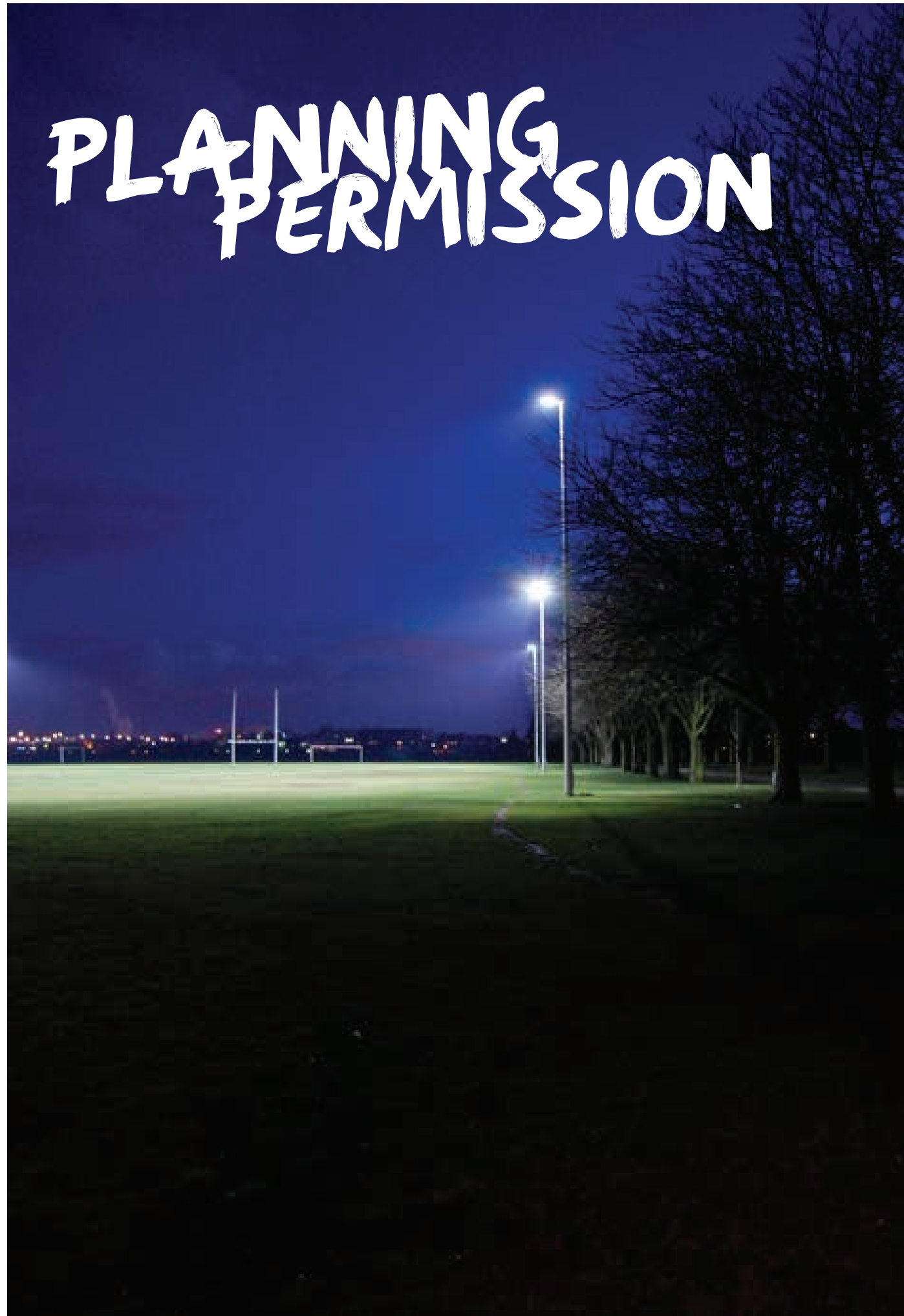
Clubs often ground share with football or cricket clubs, and as such the location of the columns should be considered so as to minimise the effects of the columns on the other sports. Where it is not possible to locate the columns in a neutral area, measures can be taken to minimise their impact. In all events this process should begin with a discussion between the clubs prior to the submission of a planning application.

For example, it may be that the locations of columns along one touchline of the Rugby pitch intrude onto the outfield of a cricket pitch. In these circumstances demountable columns could be installed, with an agreement between both the rugby and cricket club as to when the columns will be erected and dismantled.

This inevitably increases not only the capital cost of the project, but also the running costs as the club would be committed to the works for removing and installing the columns annually. This can be a significant cost per annum and the club should ensure they have the finances in place to support the carrying out of the works year-on-year.

The Club should also consider how and where the columns are to be safely stored whilst they are not in use. Additional foundation bases could be cast so that when the columns need to be removed from the cricket square they can be stored vertically on site out of the way of other activities. The location of additional foundations for storage will need to be identified and approved in your planning application. Other options include storing the columns horizontally, although the Club should seek clarification from the manufacturer of the columns as to what affect this may have on the warranties and performance of the floodlights.

PLANNING PERMISSION



Restrictions of Use

Your planning application will require you to state at what hours the lights will be used and what the pattern of use will be. Local residents may not object to the lighting itself but they may object to matches taking place in the evening if this involves noise or extra traffic movements. If planning consent is granted, there may be conditions attached which set out the times at which the lights can be used. Any objectors to the scheme are likely to monitor your compliance with these conditions closely.

Whilst it is important to take into account the views and comments of local residents, the club should ensure that in stating the hours of usage they do not overly restrict their use. Stating that the lights will only be used for training on Tuesdays and Thursdays between 1930hrs and 2100hrs, may well result in a condition of planning meaning that the lights are only in use for 3hrs a week. Careful consideration should be given to the stated hours of use, so that neighbours can be appeased and the club can feel the full benefits of a new floodlighting system. However, it would be reasonable to state that the lights will only be in use between 1st September and the 31st March in any calendar year.

Other Planning Issues

It is advisable that the Club consider the installation of a time-clock system. This system can be set to automatically switch off all, or most of the lights avoiding wasted energy and also finding favour with the Local Planning authority.

The preferred column finish should be galvanised steel. Try to avoid pointed columns due to the extra maintenance costs involved unless this is specifically required by the planning conditions

It is advisable that a flood risk assessment is carried out prior to submission of a planning application. This comprises a review of the site using the Environmental Agency website and subject to the results, relevant remedial action taken.

Information may also be requested with regard to the impact on local woodland and wildlife. This request can be mitigated by considerations such as cable routes avoiding the path of tree roots, especially where Tree Preservation Orders (TPOs) are in place.



6. AFTER INSTALLATION

Following completion of the installation, Clubs should be aware of potential snagging items prior to accepting handover of the lights from the contractor. These can typically include the following:

- Trenches should be back-filled to ensure the full coverage of services and that the ground level remains even to prevent risk of tripping and injury. The trench should be seeded to encourage grass coverage.
- Column bases should not show any exposed concrete, base plates or foundation bolts. These should be covered below ground level to prevent risk or tripping and injury.
- Cabling that runs up the wall of the building should be encased to prevent malicious damage or removal. Refer to photo's 3 & 4.

Further to the rectification of snagging items, clubs should ensure their contractor provides them with the following information prior to use of the lights:-

- Operation and Maintenance (O&M) manual. This document should include all relevant information to the running of the lights, successful testing that has been carried out and any warranties or performance guarantees.
- The contractor should ensure adequate training has been given to club operatives where the columns installed are hinged and clubs have taken the option to purchase raise and lower equipment.

7. MAINTENANCE

Maintaining your floodlights properly is very important to maximise their long term efficiency. clubs will have to decide (on the advice of the lighting engineer acting on their behalf) whether their members and/or ground staff can carry out this work or whether it should form part of a maintenance contract. Where staff carry out maintenance, clubs should be mindful of health and safety procedures and training implications. Longer term maintenance will be the responsibility of a maintenance contractor and a report of all maintenance should be kept in written form, dated and signed.

In any case, clubs should be aware that some floodlight installations have a permanent 240 volt supply within the lighting column even when the floodlights are off. This type of installation will require the power supply to the the column to be switched off. This work should only be carried out by a suitably qualified and competent person.

To guarantee the best lighting systems, the following maintenance should be undertaken:

- Simple visual inspection carried out annually
- Every three years, fittings should be cleaned and electrical terminals re-torqued. Electrical tests should be carried out to ensure the electrical integrity and safe disconnection times can be achieved. A lux test should be carried out to ensure the system still complies with RFU regulations.
- After approximately 4000 hours usage or six years of lamp life a bulk lamp replacement should be carried out.

NICEIC Electrical test – this is required by law for every 5 years for public use electrical installations. This has to be undertaken by a NICEIC registered contractor.

NDT Test – an NDT test is an ultra sonic test to check any fractures or breakages to foundation bolts, this is required every 12 years and reports on the bolts only, not the surrounding concrete.

Every year, each floodlight should be cleaned, with the floodlighting alignment checked to ensure that the floodlights are aimed in the correct position to maintain the highest lighting level. The type of column installed will determine the type of maintenance undertaken.

Hinged-columns mean that the columns can be lowered to ground level for maintenance. This saves the need for heavy plant on site, but clubs should be aware of the training requirements in order for columns to be lowered correctly.

Where masts are fixed (they are not hinged and cannot be lowered to ground level) maintenance should be undertaken through use of appropriate plant and machinery.

In all cases the RFU would recommend that a suitably qualified engineer is employed to undertake maintenance in order to minimise risks to the club and club members and to protect any warranties or guarantees.



8. MOBILE LIGHTING UNITS

Mobile lighting units are only recommended where it is not possible to install permanent training lights. Planning consent is not normally required, but the RFU recommends that this is confirmed with your local planning department.

Mobile lighting units are self-contained, and typically use a diesel-powered generator but some battery powered systems do exist. Lamps are metal halide or, occasionally, tungsten halogen. Typically four or six units will provide light for a training area for medium or low-level training, allowing clubs to rotate the grassed area they use for training.

Units can have extending masts rising to about 9m. The lux level and the area lit by the mobile units cannot be calculated accurately and for this reason, clubs should exercise caution and should recognise that mobile light training may not meet the 100 lux level recommended for training lights. Fig 1 below shows a typical mobile training light unit.

9. SUMMARY

The installation of high quality floodlighting can have a significant impact upon any rugby facility. To ensure the maximum benefit is derived from any installation, an appreciation of the relevant technical regulations, life cycle costs, design best practice, planning permission factors and typical procurement routes is invaluable.

10. APPENDICES

Appendix 1: Detailed Breakdown of lux levels and levels of activity

Activity	Age Group	100 lux	200 lux
Competition			
CB Representative Matches / Trials	All	No	Yes
Area Schools	U16 – U18	No	Yes
Divisional Schools	U16 –U18	No	Yes
Schools Sports Partnership	All	Yes	Yes
Emerging Schools	All	Yes	Yes
Non Emerging Inter School	All	Yes	Yes
Daily Mail*	U15	Yes	Yes
Daily Mail*	U18	Yes	Yes
Club Competition			
Levels 3,4 & 5	Adult	No	Yes
Levels 6 and below	Adult	Yes	Yes
County Cup linked to club levels	Adult	Yes	Yes
Club	U19/U17	Yes	Yes
Club	U13 - U16	Yes	Yes
Leisure			
Veterans	Adult	Yes	Yes
20:20/ double tops etc	Adult	Yes	Yes
10's	All	Yes	Yes
7's	All	Yes	Yes
Tag / Touch / Beach	All	Yes	Yes

NOTES