focus on outdoor lighting

MINISTRY OF SPORT AND RECREATION

ANOTHER MSR INITIATIVE TO IMPROVE THE PLANNING, DESIGN AND MANAGEMENT OF SPORT AND RECREATION FACILITIES

ISBN 0730988112 • March 1998

Increasing amounts of leisure time and disposable income have seen a greater demand for sport and recreation facilities.
As well as generally upgrading outdoor facilities, operators have turned to floodlighting to not only extend the options for the participants, but to seek better returns on their investments.
This Focus Paper examines artificial lighting for outdoor sport and recreation facilities. It covers the technology available and provides a guide to planning a lighting system.

INCLUDING:

The Value of Floodlighting

There are several reasons for lighting an outdoor sport and recreation facility:

- Increased usage through night training and midweek matches can double or triple usage factors.
- Multiple usage can be developed more easily, such as the tennis court being used by a mothers' club during the day and becoming a basketball court for a youth club at night.
- Extended playing time at night can increase the revenue earned by a "user-pays facility", especially in hot weather.
- Night lighting can increase the range of uses of a facility so that a sports ground can be used for outdoor exhibitions and concerts.
- Floodlighting a facility increases player safety and also reduces vandalism in the area.
- Prestige sports generally find that high-intensity floodlighting is essential to meet television standards.

Selecting a Lighting System

The diagram *below* provides an outline of points to consider in the process of planning an outdoor lighting installation.

In choosing an outdoor lighting system, it is essential to get expert advice. Purchasers of lighting systems often do not have the expertise to design their own lighting systems and need to be guided by the recommendations of a qualified lighting consultant.

OUTDOOR LIGHTING SELECTION PROCESS

define the need
- type of usage — specialist or multipurpose?
- players' needs — social, training, competition?
- level of players — junior, recreational, club?

define lighting required
- nature of game — illuminance levels, uniformity, glare control?
- method of control — manual, automatic, computers?
- critical factors — sighting ball, aerial shots?
- cleaning and maintenance — who does it? how often?

define budget limits
- raising capital — donations, grants, loans?
- long term goals — complete or staged development?
- maintenance costs — changing lamps, vandalism?
- running costs — electricity, cleaning?

consult lighting designer
- designer's experience in sports lighting-referee checks?
- designer's proposals — are they satisfactory?
- inspection — visit other facilities to check quality
- budget limits — are they realistic?
- aesthetics — integration of design?

evaluate proposals

Does the design meet your requirements for:
- quantity of light? (lux levels)
- quality of light — uniformity, colour, glare control?
- capital cost — within budget limits?
- running costs — within budget limits?

Planning New Installations

Most lighting installations are designed by a professional lighting designer so it is essential that you clearly state your specific requirements at the planning stage. It is most important to decide on the range of activities which will take place on the playing area before planning begins.

Lighting is installed principally to provide a safe environment for the playing of sport. A secondary but equally important function is the provision of spectator viewing of the sport.

In general terms, the level of illumination required needs to be higher where the physical contact occurs, and higher still as the ball size decreases and speed increases.

Three factors must be considered in providing artificial lighting for an outdoor sport and recreation facility:

Quantity of Light
There should be sufficient intensity of light to provide visibility and contrast appropriate to the game and standard of play.

Quality of Light
The light sources should provide correct colour balance, directional control and freedom from glare.

Distribution of Light
The light distribution pattern should be uniform across the playing area, without noticeable bright or dark spots.

Very often sport and recreation facilities are located close to residential homes. Lighting must be properly designed and controlled to minimise a nuisance to residents, including imposing a curfew on operating hours if required.

Any new lighting installation may need approval by the local authority.

GLOSSARY

BEAM DIVERGENCE
The spread of the beam of light that a floodlight emits, measured in the horizontal and vertical planes.

BRIGHTNESS
The amount of light produced by a surface that reflects or emits more light. It is a subjective term and is not used to describe lighting on a technical level.

CLEANING CYCLE
The time between the cleaning of the floodlights. This time interval varies according to the atmospheric pollution at the lamps location and the capability of the floodlight to resist soiling and corrosion.

COLOUR RENDERING
The effect of a light source on the colour appearance of objects in conscious or subconscious comparison with a reference light source such as daylight.

CONTRAST
The differences in appearance between two parts of a visual field seen simultaneously or successively. The difference may be in brightness or colour or both.

CONTROL GEAR
The equipment used with a discharge lamp to control its operation, comprising a ballast, capacitor, fuse and ignitor.

GLARE
The discomfort or impairment of vision experienced when parts of the visual field, such as a floodlight, are excessively bright in relation to the general surroundings.

ILLUMINANCE
The amount of light falling on a unit area of a surface. The unit of illuminance is the lux.

LAMP
The bulb which houses the light source. Lamps are classified into three types: incandescent, fluorescent and high intensity discharge.

LUMINAIRE
This is the apparatus which distributes the light emitted by a lamp and which includes all the components necessary for fixing and protecting the lamp and for connecting it to a power supply. It usually consists of lamp, housing, reflector, lens and control gear.

LUMINOUS EFFICACY
A measure of how efficiently a light source converts electrical energy to light. It is determined by the ratio of light output emitted by a lamp and the electric energy consumed by it.

RATED LIFE
The expected average operating life of a lamp, based on laboratory tests.

STROBOSCOPIC EFFECT
A flickering effect produced when a rapidly moving object or player passes through periodically varying light, producing the illusion that the object is changing speeds rather than flowing smoothly along a path. This effect is especially noticeable if discharge lamps are operating on alternating current.

UNIFORMITY RATIO
A measure of the evenness of light distribution provided by a lighting installation. The ratio of the minimum lighting level to the average level over a given area.

Consultants

Consultants can provide purchasers of outdoor lighting systems with specialised knowledge in the areas of lighting design and management. When choosing a consultant consider the following points:

- Qualifications and experience in sports lighting;
- Reputation, professionalism and independence from any one manufacturer;
- References from people who have used their services;
- Interest in your project and desire for it to succeed.

The following information is based on the ACEA booklet *"Guideline Fee Scales for Consulting Engineers Services"* and discussions with consulting engineers. The Guideline Fee Scales allow for negotiation on fees and services.

Full Services
Fees are based on a percentage of the tender price or the estimated cost of installation and range from 10% to 12% of the total cost.

Designing and drawing up a lighting installation (i.e. luminaires, control gear, mounting poles and cabling) also includes:

- Preparing a full specification;
- Preparing a cost estimate;
- Calling tenders or quotations for the work;
- Inspecting the progress of the work;
- Field testing the finished installation.

Partial Services
For client consultation, design and documentation (plans and specification) of a typical lighting installation the fee charged is normally 75% of the fee for full services.

For partial services, fees are generally charged on a time basis. A basic performance specification outlining required light levels, pole heights and locations plus lamp types and performance criteria has been estimated at eight hours.

Where quotes have been obtained from several manufacturers, a consulting engineer can examine these and give an unbiased expert opinion on each quote. The time involved in a review of quotes has been estimated at three hours.

There are few specialist lighting consultants in Western Australia, however, some electrical consultants have lighting expertise in this area.

Suppliers

Lighting manufacturers offer advisory and design services, many of which are based on sophisticated computer aided design systems. These services are offered without charge as an inducement to potential customers to buy their products. Reputable manufacturers have a vested interest in the performance of their products and will assist their customers to select appropriate fittings for each particular application.

As with any design service, the quality of the end product depends largely on the quality of the information supplied by the client. Where a client gives a manufacturer a well-considered list of requirements, including budget limits, a competent and economical design can be expected.

Services offered include:

- General advice on lighting requirements;
- Computer design print-out - luminaires and control gear only;
- Performance data sheet giving luminaire and lamp types, illuminance levels, mounting heights, initial cost and running costs;
- Detailed quotation for the supply of the luminaires and control gear;
- Supply of luminaires and control gear;
- Installation advice to the electrical contractor;
- Field testing of the finished lighting installation.

Pole Manufacturers

The design and manufacture of lighting poles is a specialised field, consequently poles are not cheap. Purchasers should resist the temptation to buy cheap power poles or water-pipe poles in order to save a few hundred dollars. "Cheap" poles are usually not strong enough or high enough to provide a safe and efficient mounting for expensive floodlights.

Information Required BY the Lighting Designer

The following information should be provided to the lighting designer to assist the planning process.

Drawings or sketches—of the playing areas giving main dimensions and showing the proposed locations of spectator areas, change rooms, car parks and any changes in level.

Lighting budget limit—including initial costs and running costs. This information is essential for an economic design.

Type of sport—a brief description of the nature of the game and critical areas, such as goals, sidelines, infield.

Future plans—information on plans for future expansion of the playing areas or the lighting system. This is necessary for calculating cable sizes, switchboard capacity and control systems and will assist in saving money when the next stage is built.

Maintenance limitations—information on maintenance facilities and problems, such as whether access to the luminaires will be by a cherry picker or ladder. Note any special conditions, including smoke, dust, temperature extremes, corrosive atmosphere.

Finishes—information on surface colour and markings. The main point here is the lightness or darkness of materials and finishes used on playing surfaces and surrounds.

Information Required FROM the Lighting Designer

The lighting designer should provide the following information to client groups so the merits of different schemes can be assessed. It is particularly important to have this information if competitive proposals are being considered so a fair comparison can be made.

Lighting layout—this should show the number and positions of the luminaires, their mounting height, the switching arrangements and the proposed method of cleaning and servicing units.

Type of lamp recommended—this should be chosen to suit the type of service, colour rendering and cost structure of the installation.

Luminaire recommended—this information should specify the beam angles, the proportions of light emitted upwards, downwards, and the means of access for cleaning and lamp replacement.

Average illuminance expected in service—this should specify both the general illuminance across the playing area and the illuminance on specific areas (such as goals) if supplementary or localised lighting is to be used.

Initial cost and running cost—the estimate of the initial cost should preferably include installation charges; data on the running costs should include the electrical consumption (including control gear losses), maintenance costs, the replacement cost of individual lamps, and their rated life in hours.

Letter of guarantee—once a particular lighting system and supplier has been selected and the system installed, it is recommended that a "letter of guarantee" be obtained from the supplier. This letter should guarantee the outputs and inputs of the system including average light levels, uniformity ratios and power consumption.

Types of Lamps

Three types of lamps are generally used in outdoor sports lighting:

- **Tungsten Halogen lamps**
- **Fluorescent lamps**
- **High-intensity discharge (HID) lamps**

Each type has its advantages and disadvantages, depending on the type of facility it is intended for.

Tungsten halogen lamps—provide good lighting in terms of colour correctness, are low in initial cost and are easy to replace. However, they are inefficient in energy use and have a short life in comparison with other types.

Fluorescent lamps—provide good lighting in terms of colour correctness, are medium priced, more energy efficient and have a longer life than incandescent lamps. However, because of the lamps' elongated shape, it is practically impossible to produce a concentrated light beam.

High intensity discharge lamps—provide extremely energy efficient lighting and last longer than either of the other types. These lamps are commonly used for outdoor lighting installations, particularly metal halide lamps. Balanced against these advantages are higher initial and higher replacement costs.

Maintenance

Unless a lighting installation is properly maintained, lamp depreciation and dirt accumulation on the luminaires and other surfaces will cause an ever-increasing loss of light. This loss should not be underestimated. In some circumstances it can cut the illumination level by half in the space of only a few months.

To prevent waste of light it is necessary to:

- Make provision for maintenance when planning the installation;
- Establish a regular cleaning schedule and see that it is properly carried out;
- Replace worn-out lamps promptly.

When planning an installation, careful thought should be given to ways and means of maintaining it in efficient working order with the least trouble and expense.

Some practical suggestions include:

1. Choose a luminaire and light source that will be easy to clean and replace.
2. Provide safe and ready means of access. A ladder will usually be good enough if there are only a few low-mounted units to be serviced. For a large installation of high-mounted units more elaborate devices such as hinged poles, or elevating platforms should be considered.
3. Clean units regularly and replace defective lamps immediately.
4. Scratch the installation dates of discharge lamps onto the lamp base so that premature failure can be noted and a warranty claim made if necessary.
5. Removable parts should preferably be hinged or otherwise made fast. Plug-in control gear can also lead to easier maintenance.

Comparison of Lamp Types

There are various types of lamps available for outdoor sports lighting. The following lamp comparison summarises their main characteristics.

Type	Relative Cost	Wattage Range	Luminous Efficacy Lumens/watt	Average Life hours	Colour Rendering	Start-Up Time
Tungsten Halogen	medium	up to 2000	20–25	2000	good	instant
Fluorescent	low	up to 215	40–80 (average 65)	7000–10,000	varies	immediate
Mercury Vapour	medium	up to 2000	35–55	10,000	good	up to 5 minutes
Metal Halide	high	up to 3500	60–100	1000–10,000 (average 5000)	excellent	up to 5 minutes
High Pressure Sodium	high	up to 1000	80–130	8000	poor	immediate to few minutes

Source: AS 2560 — *Guide to Sports Lighting*

REFERENCES

Standards Association of Australia, AS 2560, *Guide to Sports Lighting*.
Part 1 — General Principles
Part 2.1 — Lighting for Outdoor Tennis
Part 2.2 — Lighting for Multi-purpose Indoor Sports Centres
Part 2.3 — Lighting for Football (All Codes)
Part 2.4 — Lighting for Outdoor Netball and Basketball
Part 2.5 — Specific Recommendations—Swimming Pools
Part 2.6 — Specific Recommendations—Baseball and Softball
Part 2.7 — Specific Recommendations—Outdoor Hockey
Part 2.8 — Specific Recommendations—Bowling Greens
HB49.1 — Sporting Facilities Manual
Standards Association of Australia: AS 4282 (Int), *Control of the Obtrusive Effects of Outdoor Lighting*
Frier, J., *Keeping Users Out of the Dark*. Athletic Business, March, 1988
John, G., *Lighting for Sport*. Leisure Management, June, 1988
The Chartered Institution of Building Services Engineers, *Lighting Guide — Sports*. London, 1990.
Tennis West — *Brief for Lighting Outdoor Tennis Courts*.

ACKNOWLEDGEMENT

This paper was revised and updated by Lighting Images Pty Ltd, Lighting Consultants & Planners.
This paper is a summary of the matters relating to outdoor lighting for sport and recreation facilities. The contents should not be used or relied upon as a substitute for professional advice.

Ministry of Sport and Recreation

PERTH
Sir Thomas Meagher Pavilion
Meagher Drive, Perry Lakes
Floreat, Western Australia
PO Box 66, Wembley WA 6014
Telephone: (08) 9387 9700
Facsimile: (08) 9387 9726
info@wamsr.ausport.gov.au
www.msr.wa.gov.au

CENTRAL SOUTH
McIver House
297 Fitzgerald Street
PO Box 55, Northam WA 6401
Telephone: (08) 9622 0150
Facsimile: (08) 9622 0160
msr@avon.net.au

GASCOYNE
1st Floor
Gascoyne Memorial Centre
14 Robinson Street
PO Box 140, Carnarvon WA 6701
Telephone: (08) 9941 2153
Facsimile: (08) 9941 4055
msr@wn.com.au

GERALDTON MID-WEST
Mid-West Sports House
77 Marine Terrace
PO Box 135, Geraldton WA 6531
Telephone: (08) 9964 5333
Facsimile: (08) 9921 6555
msr@midwest.com.au

GOLDFIELDS
Goldfields Sports House
25 Porter Street
PO Box 1036, Kalgoorlie WA 6430
Telephone: (08) 9021 5399
Facsimile: (08) 9021 5335
msr@gold.net.au

GREAT SOUTHERN
1st Floor
234 Stirling Terrace, Albany WA 6330
Telephone: (08) 9841 6800
Facsimile: (08) 9842 1660
msr@omninet.net.au

KIMBERLEY
Shop 24, Kununurra Shopping Centre
Konkerberry Drive
PO Box 1127, Kununurra WA 6743
Telephone: (08) 9168 1987
Facsimile: (08) 9168 3035
cmaclean@wn.com.au

MIDLANDS
McIver House
297 Fitzgerald Street
PO Box 55, Northam WA 6401
Telephone: (08) 9622 0150
Facsimile: (08) 9622 0160
msr@avon.net.au

PEEL
45 Mandurah Terrace
Mandurah WA 6210
Telephone: (08) 9535 0009
Facsimile: (08) 9535 2119
msr_peel@hotmail.com

PILBARA
State Government Offices
Cnr Searipple & Welcome Rds
PO Box 294, Karratha WA 6714
Telephone: (08) 9185 0194
Facsimile: (08) 9185 0198
msr@kisser.net.au

SOUTH WEST
61 Victoria Street, Bunbury WA 6230
Telephone: (08) 9791 7100
Facsimile: (08) 9791 7963
msr@gateway.net.au