

Lighting 2 Adjacent Tennis Courts

West Heath Lawn Tennis Club

Date: 30-10-2014

Designer: Steve Percy

Description: To provide a low level floodlighting scheme suitable for tennis whilst minimising light spill and glare to neighbouring properties.

2 court scheme based on 9 no. 6 metre columns and 16 no. ADVANTAGE luminaires using a Philips 1kW metal halide lamp mounted at a height of 6.7 metres.

Designed to achieve 500 lux maintained at 0.7 uniformity when each court is lit individually which will meet the Lawn Tennis Association's recommended standards.

Predicted light spillage calculated at ground level. Interaction with existing surrounds (i.e. fences, trees etc) have not been considered within spillage plots.

The nominal values shown in this report are the result of precision calculations, based upon precisely positioned luminaires in a fixed relationship to each other and to the area under examination. In practice the values may vary due to tolerances on luminaires, luminaire positioning, reflection properties and electrical supply.

Exclusive Leisure Ltd

28 Cannock Street
Leicester
LE4 9HR

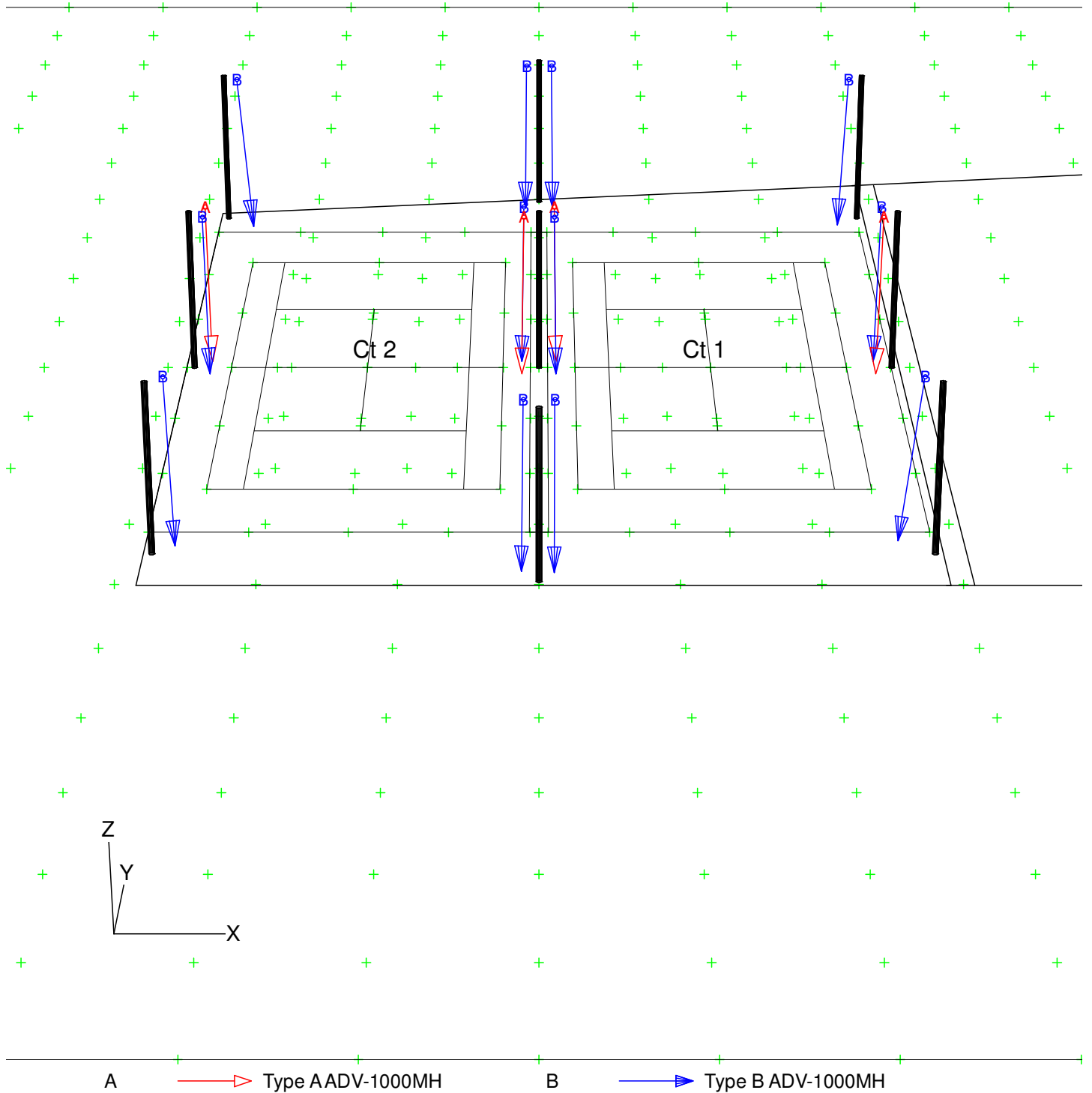
Telephone: 0116 2332255
Fax: 0116 2461561
E-Mail: steve@exclusiveleisure.co.uk

Table of Contents

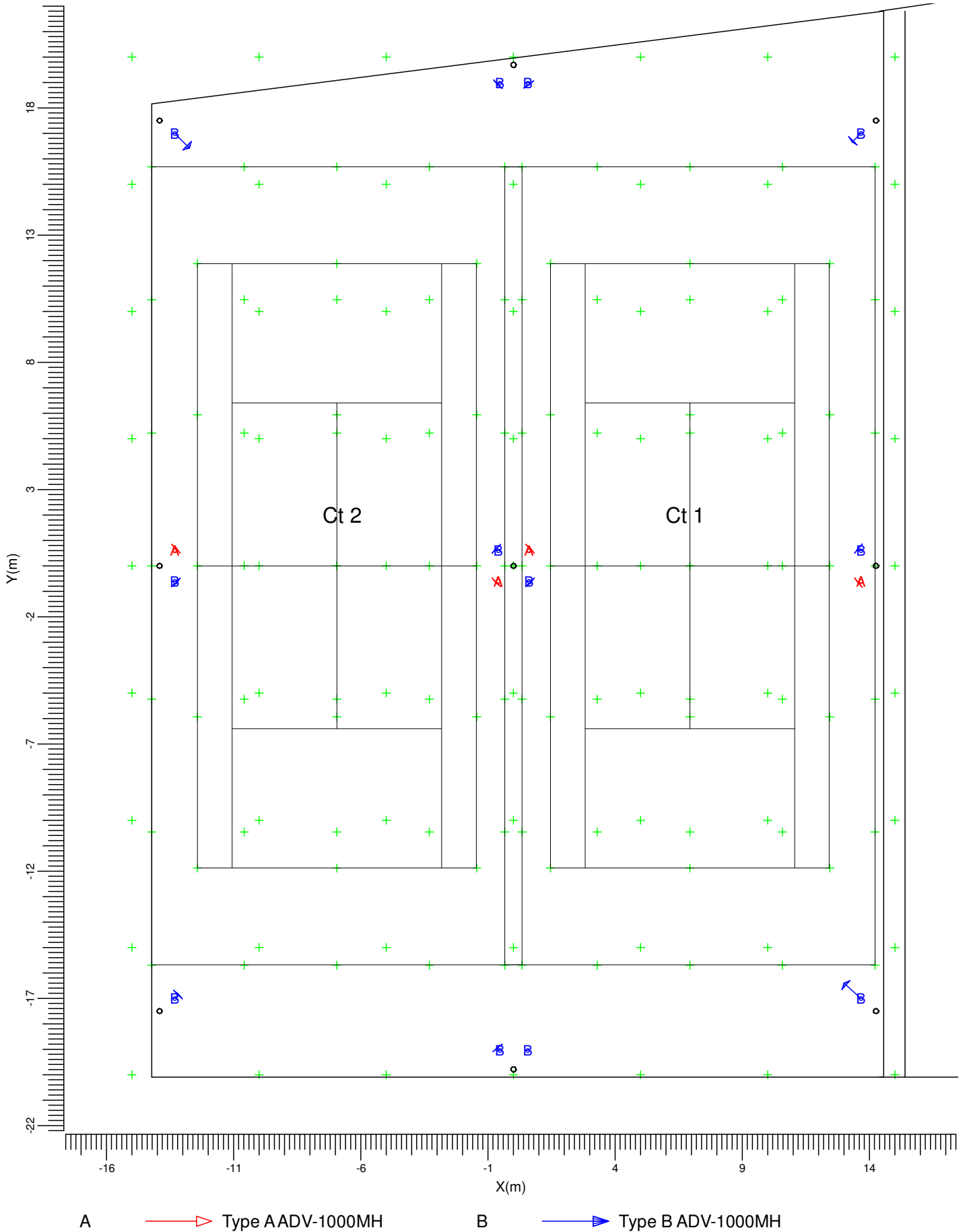
1.	Project Description	3
1.1	3-D Project Overview	3
1.2	Top Project Overview	4
2.	Summary	5
2.1	General Information	5
2.2	Obstacle Information	5
2.3	Project Luminaires	5
2.4	Calculation Results	5
3.	Calculation Results	6
3.1	PPA Ct1: Graphical Table	6
3.2	PPA Ct2: Graphical Table	7
3.3	TPA Ct1: Graphical Table	8
3.4	TPA Ct2: Graphical Table	9
3.5	Spillage: Graphical Table	10
3.6	Spillage: Iso Contour	11
3.7	Spillage: Filled Iso Contour	12
4.	Luminaire Details	13
4.1	Project Luminaires	13

1. Project Description

1.1 3-D Project Overview



1.2 Top Project Overview



Scale
1:200

2. Summary

2.1 General Information

The overall maintenance factor used for this project is 1.00.

2.2 Obstacle Information

Obstacle	Transparency (%)	Position		
		X (m)	Y (m)	Z (m)
C1	100	-13.92	-17.50	0.00
C2	100	-13.92	0.00	0.00
C3	100	-13.92	17.50	0.00
C4	100	0.00	-19.79	0.00
C5	100	0.00	0.00	0.00
C6	100	0.00	19.69	0.00
C7	100	14.25	-17.50	0.00
C8	100	14.25	0.00	0.00
C9	100	14.25	17.50	0.00

2.3 Project Luminaires

Code	Qty	Luminaire Type	Lamp Type	Power (W)	Flux (lm)
A	4	Type A ADV-1000MH	1 * 1000 WATT METAL HALIDE	-	1 * 110000
B	12	Type B ADV-1000MH	1 * 1000 WATT METAL HALIDE	-	1 * 110000

The total installed power: - (kWatt)

Number of Luminaires Per Switching Mode:

Switching Mode	Luminaire Code		Power (kWatt)
	A	B	
Ct 1 only	2	6	-
Ct 2 only	2	6	-
All lights on	4	12	-

2.4 Calculation Results

Switching Modes:

Code	Switching Mode
1	Ct 1 only
2	Ct 2 only
3	All lights on

(II)luminance Calculations:

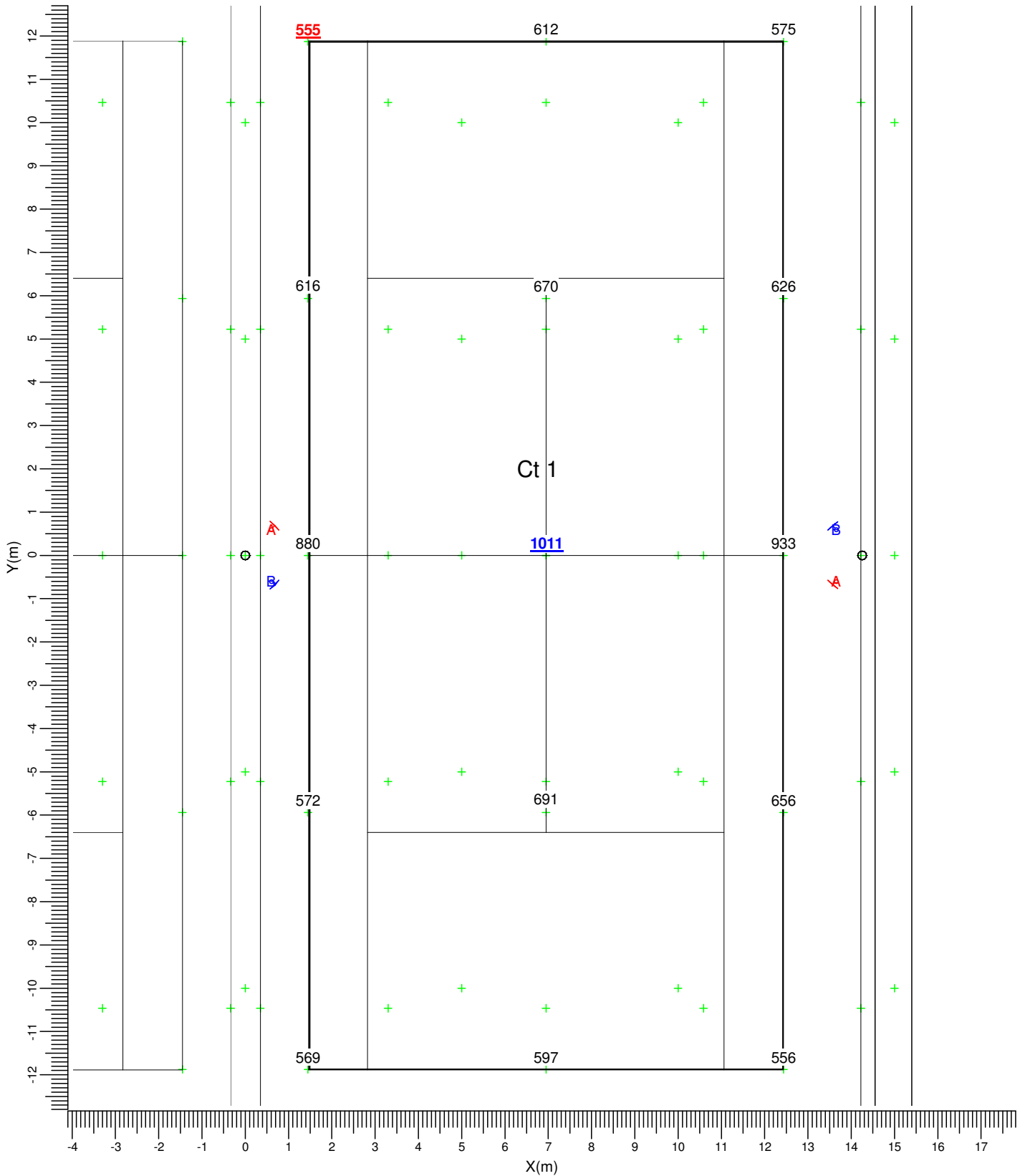
Calculation	Switching Mode	Type	Unit	Ave	Min	Max	Min/Ave
PPA Ct1	1	Surface Illuminance	lux	675			0.82
PPA Ct2	2	Surface Illuminance	lux	683			0.81
TPA Ct1	1	Surface Illuminance	lux	653			0.60
TPA Ct2	2	Surface Illuminance	lux	658			0.60
Spillage	3	Surface Illuminance	lux		0	1532	

3. Calculation Results

3.1 PPA Ct1: Graphical Table

Ct 1 only

Grid : PPA Ct1 at Z = -0.00 m
Calculation : Surface Illuminance (lux)



A Type A ADV-1000MH

B Type B ADV-1000MH

Average
675

Min/Ave
0.82

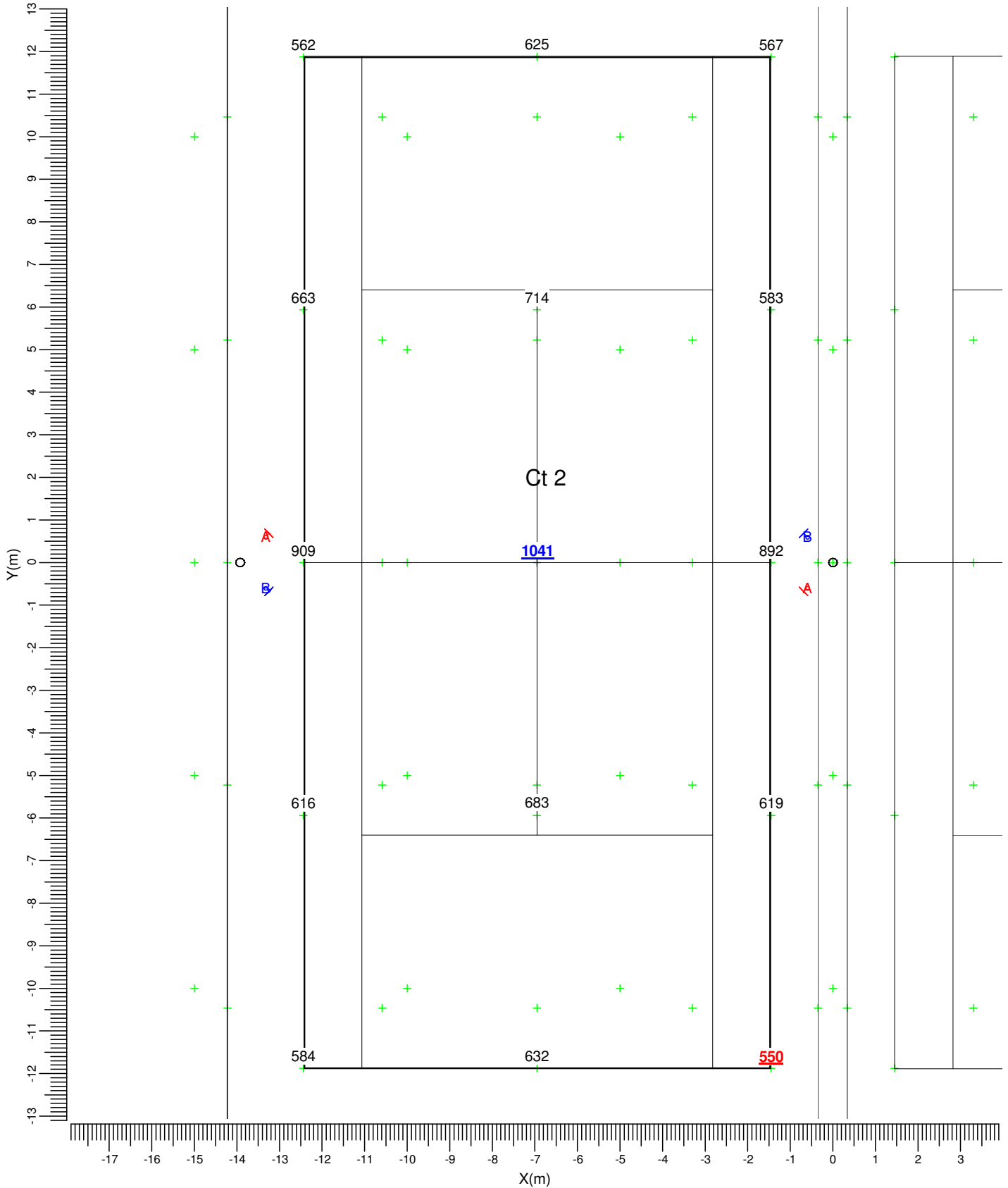
Project maintenance factor
1.00

Scale
1:125

3.2 PPA Ct2: Graphical Table

Ct 2 only

Grid : PPA Ct2 at Z = -0.00 m
Calculation : Surface Illuminance (lux)



A → Type AADV-1000MH

B → Type B ADV-1000MH

Average
683

Min/Ave
0.81

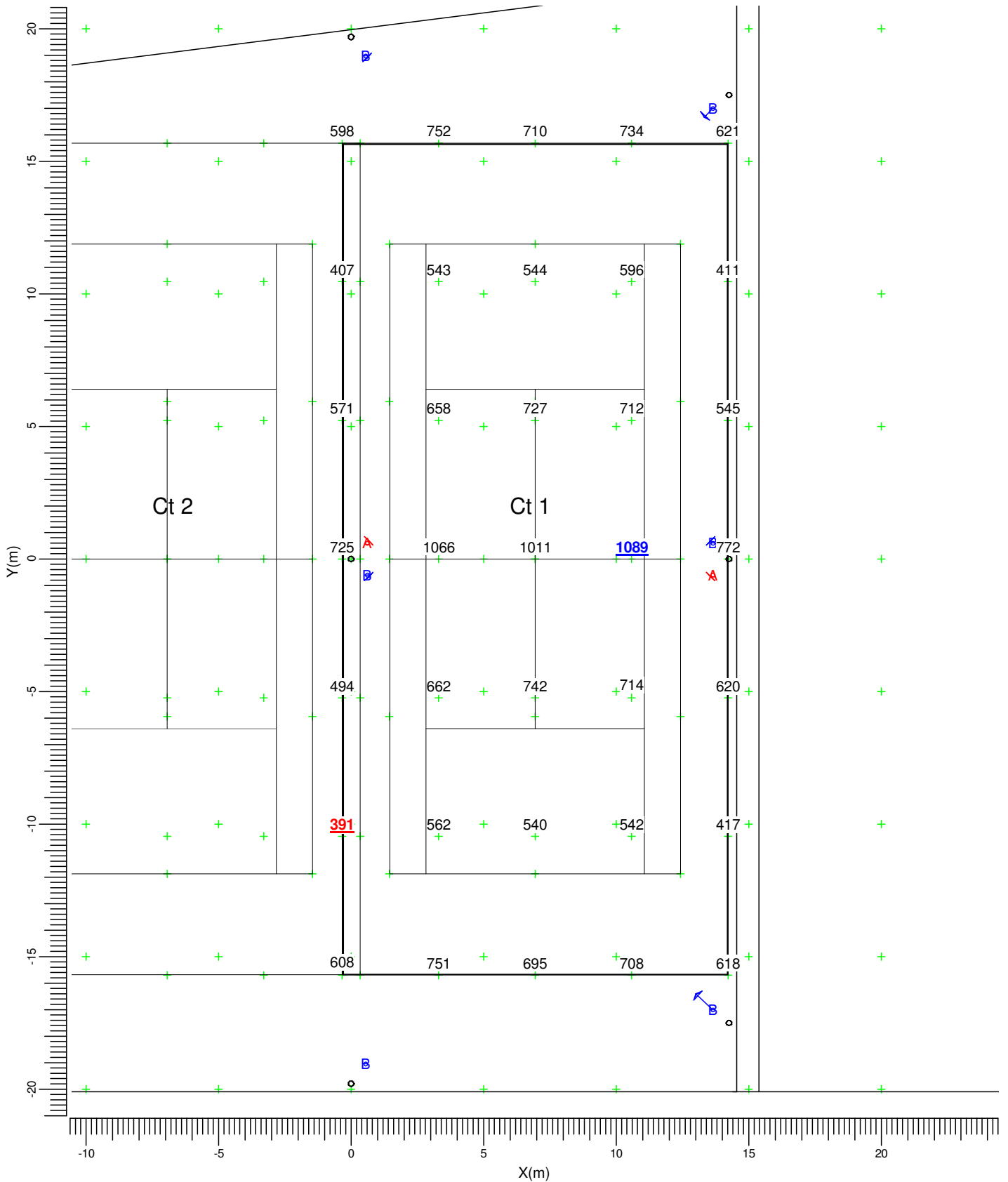
Project maintenance factor
1.00

Scale
1:125

3.3 TPA Ct1: Graphical Table

Ct 1 only

Grid : TPA Ct1 at Z = -0.00 m
Calculation : Surface Illuminance (lux)



A → Type AADV-1000MH

B → Type B ADV-1000MH

Average
653

Min/Ave
0.60

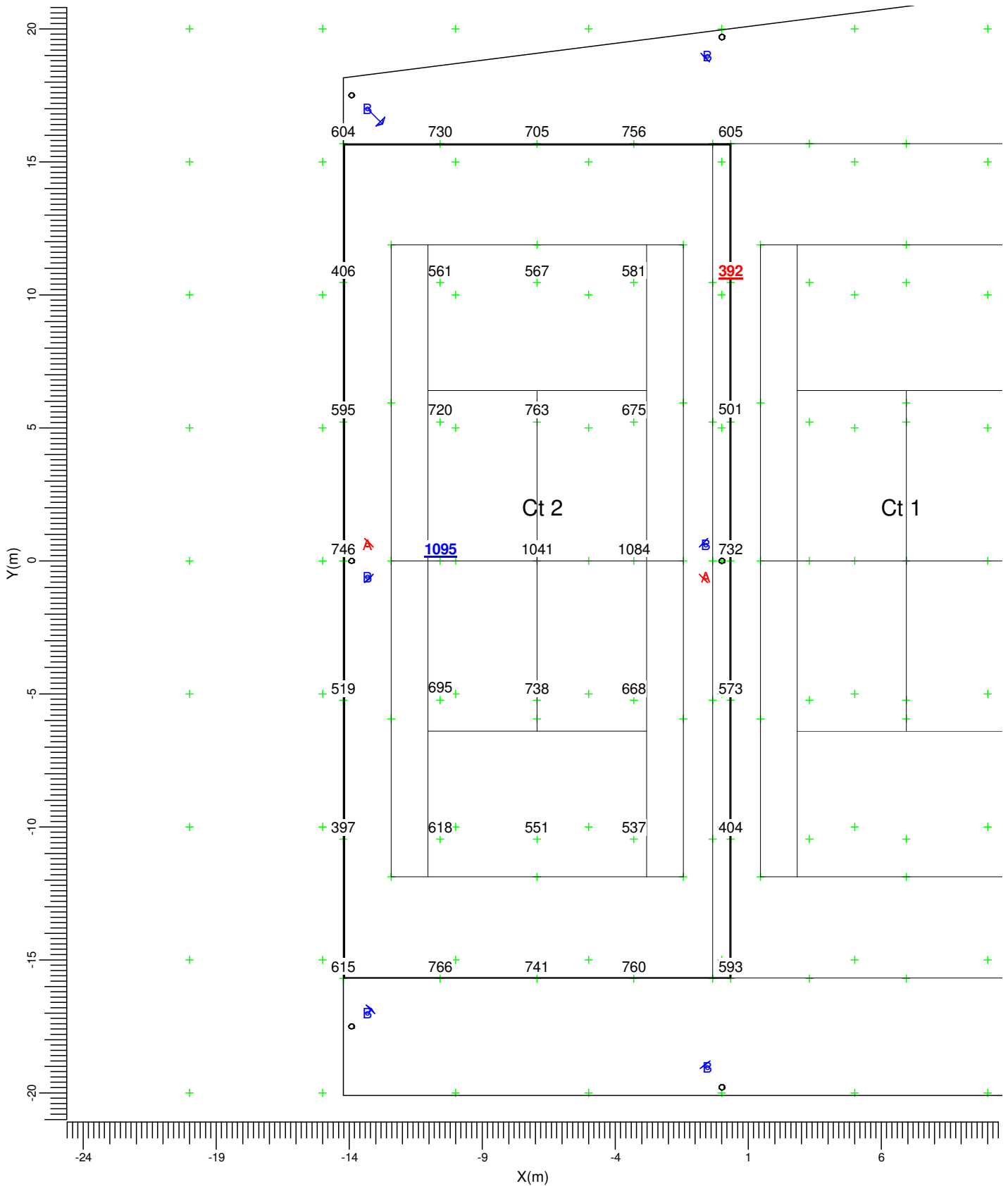
Project maintenance factor
1.00

Scale
1:200

3.4 TPA Ct2: Graphical Table

Ct 2 only

Grid : TPA Ct2 at Z = -0.00 m
Calculation : Surface Illuminance (lux)



A Type A ADV-1000MH

B Type B ADV-1000MH

Average
658

Min/Ave
0.60

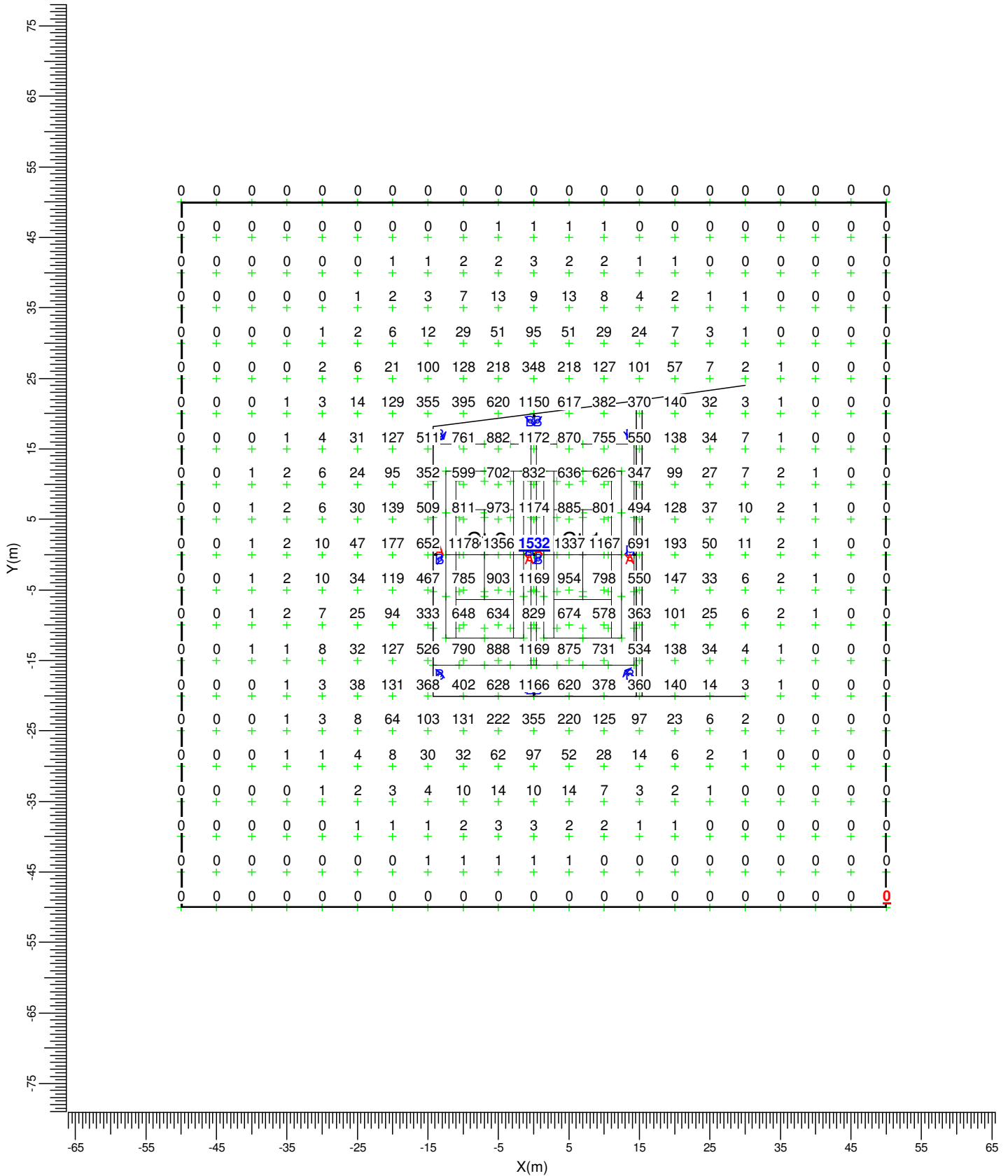
Project maintenance factor
1.00

Scale
1:200

3.5 Spillage: Graphical Table

All lights on

Grid : Spillage at Z = -0.00 m
Calculation : Surface Illuminance (lux)



A  Type AADV-1000MH

B  Type B ADV-1000MH

Minimum
0

Maximum
1532

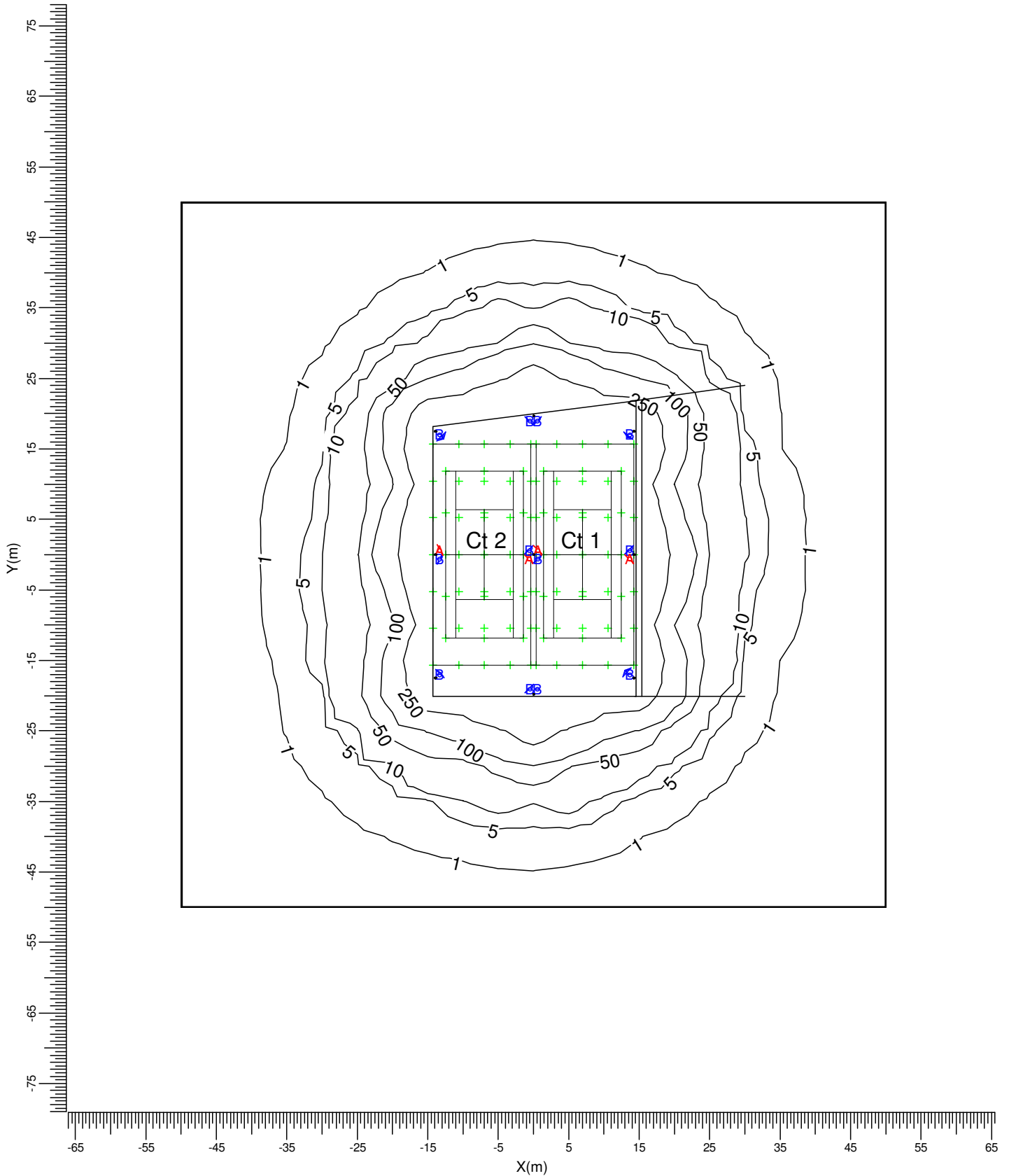
Project maintenance factor
1.00

Scale
1:750

3.6 Spillage: Iso Contour

All lights on

Grid : Spillage at Z = -0.00 m
Calculation : Surface Illuminance (lux)



A  Type A ADV-1000MH

B  Type B ADV-1000MH

Minimum
0

Maximum
1532

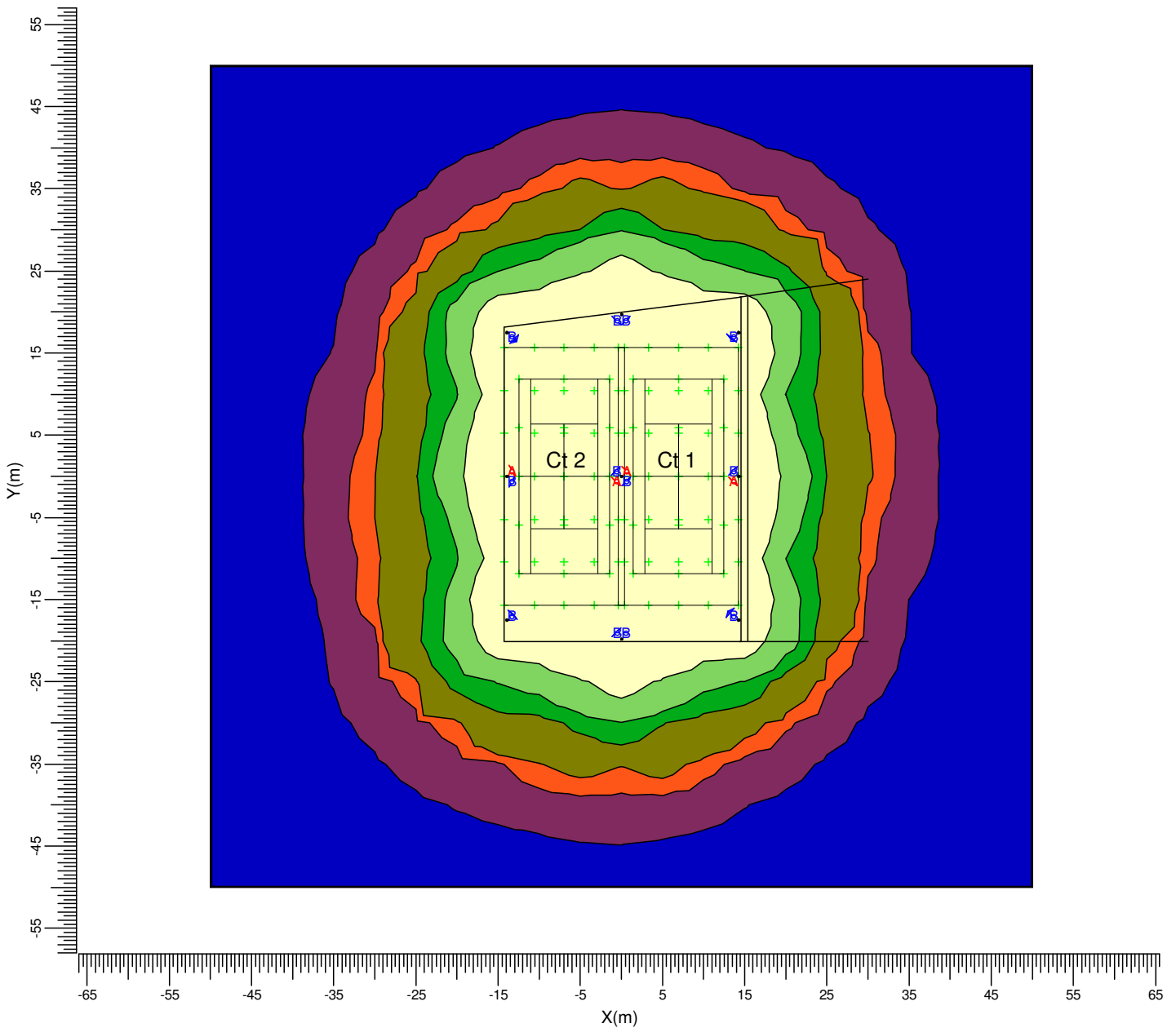
Project maintenance factor
1.00

Scale
1:750

3.7 Spillage: Filled Iso Contour

All lights on

Grid : Spillage at Z = -0.00 m
Calculation : Surface Illuminance (lux)



A Type AADV-1000MH

B Type B ADV-1000MH

Minimum
0

Maximum
1532

Project maintenance factor
1.00

Scale
1:750

4. Luminaire Details

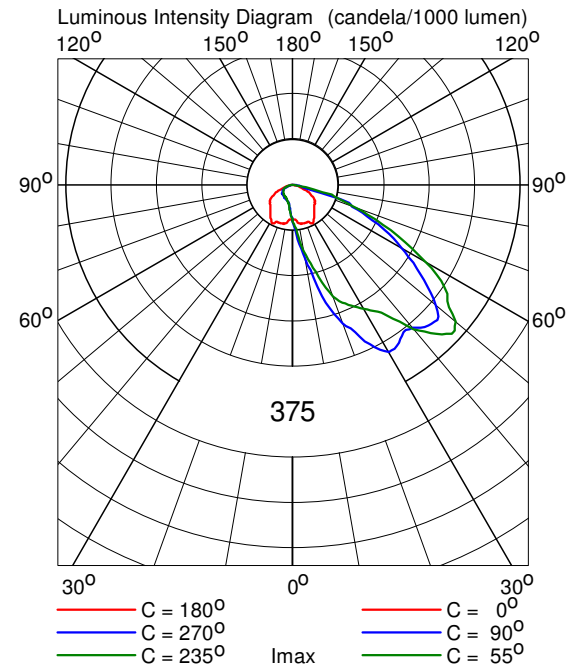
4.1 Project Luminaires

Type A ADV-1000MH 1x1000 WATT METAL HALIDE MAGNETIC

Light output ratios

DLOR	: 0.46
ULOR	: 0.00
TLOR	: 0.46
Ballast	: MAGNETIC
Lamp flux	: 110000 lm
Measurement code	: LSI- 4710V

Note: Luminaire data not from database.

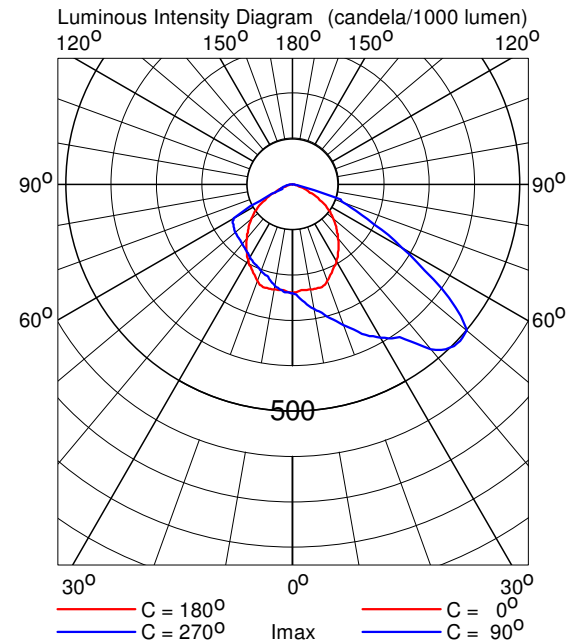


Type B ADV-1000MH 1x1000 WATT METAL HALIDE MAGNETIC

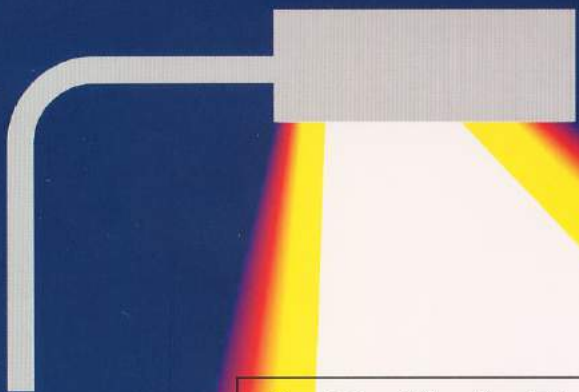
Light output ratios

DLOR	: 0.85
ULOR	: 0.00
TLOR	: 0.85
Ballast	: MAGNETIC
Lamp flux	: 110000 lm
Measurement code	: LSI- 4723V

Note: Luminaire data not from database.







A D V A N T A G E
L O W P R O F I L E
L I G H T I N G

from  **EL** EXCLUSIVE
LEISURE LTD

WHY ADVANTAGE WAS DEVELOPED

In the past, outdoor tennis courts have been illuminated using traditional floodlights, adapted for the game of tennis. These consisted of tungsten halogen, high pressure sodium and mercury halide lamps in fittings which are pointed in various directions to obtain an even spread of light over the court. The problem is that in directing the light, the lamp itself is visible and therefore produces glare and light spillage outside the court itself. This is not only distracting to the players, it is also a wasteful use of light. These floodlights need to be mounted at a height of 8-10 metres to enable an even distribution of light. This causes further problems to surrounding properties and highways, which in turn leads to difficulties in obtaining planning permission.

Traditional floodlights may also be very expensive to run, difficult and expensive to maintain and in the case of sodium lamps, produce a yellow/orange light.

In 1987, the **Advantage** system was developed with the aim of producing a lighting system specifically for tennis whilst at the same time, suiting the environment as a large proportion of clubs are situated in urban areas.

Low level lighting is not just a question of attaching floodlights onto a 6 metre high column, and saying it is a low level system. It is also a misconception to think that just because different lighting systems have metal halide lamps, they are the same. This is not so. It is only the type of lamp that is the same, not the floodlight luminaire. Low level lighting with minimal glare and light spillage is achieved by the design of the luminaire itself and not just by the height of the column, or the lamp. **Advantage** luminaires were designed to produce this low level lighting system.

THE ADVANTAGES OF ADVANTAGE:

1. High illuminance levels and uniformity

Advantage produces exceptional levels of illuminance from a minimal number of luminaires. For example, 4 No. columns and 4 No. luminaires on a single court will produce approximately 400 lux which is Club Standard. 6 No. columns and 6 No. luminaires will achieve approximately 500 lux, which is County/Tournament Standard. It is possible with variations to exceed in excess of 750 lux.

The accepted method of assessing minimum uniformity is

$$\frac{\text{minimum}}{\text{average}} = 0.60$$

Advantage will achieve uniformity factors in excess of this minimum requirement.

2. Individual court lighting

The **Advantage** system is designed to provide individual lighting to each court. There is therefore no waste of electricity by having all your courts lit when only one is in use. We can install simple on/off switching or coin/token/card meter control.

3. Low silhouette mounting

Advantage produces maximum lighting levels and uniformity when mounted on 6 metre high columns and at a mounting height of 6.7 metres. This low mounting height combined with the compact clean appearance of the luminaire produces an unobtrusive design. It is therefore perfectly suited to club and residential tennis and most planning authorities will find it an acceptable solution to the environmental pollution of traditional floodlights.

4. Efficient design with minimal glare and spillage

Advantage is an individually designed luminaire which distributes the light evenly in a downward direction by means of multi-sided reflectors rather than aiming a number of floodlights



The photographs below were taken from the same position during daytime and evening and shows the minimal glare and light spillage achieved.





SPECIFICATIONS

HOUSING

Extruded Aluminium - Mitred, Welded and Silicone Sealed.

DOORFRAME

Extruded Aluminium - Gasketed - Positive Lock-Aluminium Plano Hinge.

LENS

Tempered Clear Glass - Rear Aluminium Light Baffle - Gasketed.

REFLECTOR

Specular aluminium multi-sided, with minimum 0.55 m of reflecting surface-swing down and latch design.

BALLAST

Regulated Auto Transformer - High Power Factor.

LAMP TYPE

1000 Watt Metal Halide. Average rated lamp life 12000 hours (10 hours per start).

SIZE

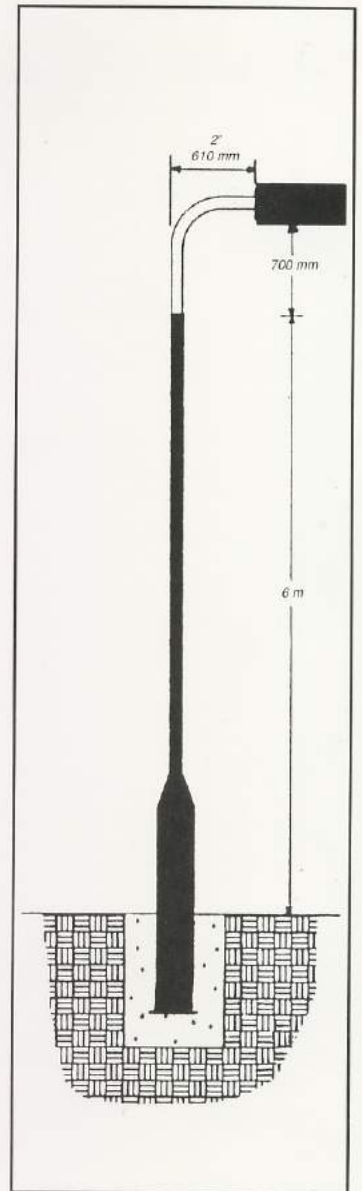
635 x 635 x 305mm.

WEIGHT

28kg.

FINISH

Chemically cleaned, primed, painted and baked enamel: Hollybush Green.



in different directions. The result is that the light is directed into the critical playing zones, and produces maximum cut off with very little glare and spillage outside the court.

Advantage utilises a 1,000 Watt metal halide lamp which is widely recognised as the most efficient light source with excellent colour rendition.

This design combined with the low column height, ensures there is little effect on adjacent properties or highways, and will prove beneficial in any planning application.

5. Low Running Costs

The efficiency of the system ensures low running costs. In achieving 400 lux illuminance the electricity used will be approximately 4Kw per hour per court. For 500 lux it will be approximately 6Kw per hour per court. For clubs, this will mean maximum profit from court hiring charges.

6. Low maintenance

The efficiency of the metal halide lamp gives a lamp life of approximately 12,000 hours at 10 hours per start. This life is reduced each time the lamp is switched on and off. In practical terms however, a period of eight to ten years use should be obtained before replacement lamps are necessary. The glass lens will collect dirt and dust and will require occasional cleaning to maintain maximum illuminance.

Due to the low column height, both these tasks can be undertaken using a simple scaffold tower and can be carried out by yourselves without having to call in outside contractors.

7. Quality manufacture

The **Advantage** luminaire is manufactured from extruded aluminium, chemically cleaned, primed, painted and baked enamel in a hollybush green colour. Columns and extension arms are tubular steel and also finished in hollybush green paint.

The system therefore uses the best materials to ensure strength, durability and weather resistance and provides an installation whose painted finish allows it to blend in naturally with its setting unlike obtrusive galvanised alternatives.

8. Costs

Whilst **Advantage** may appear slightly more expensive initially against traditional floodlighting, it is advised to compare the illuminance levels achieved. You will probably find that the traditional system with equal illuminance will have a similar cost. When considering the low running costs and future expenditure on lamps, maintenance etc., **Advantage** will prove to be a good investment.

9. Warranty

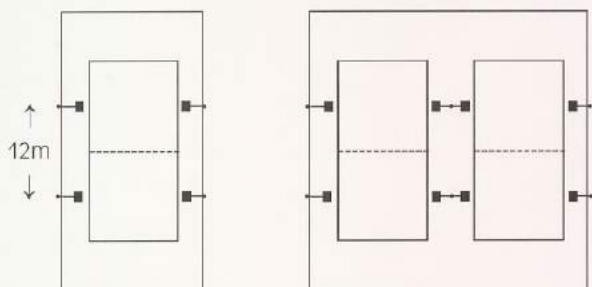
We warrant that products are free from defects in materials and workmanship for a period of twelve months from the date of purchase.

As it is easy to make misleading claims, we also provide a computer grid print out of the illuminance levels we expect to achieve from any design we suggest, including light spillage.

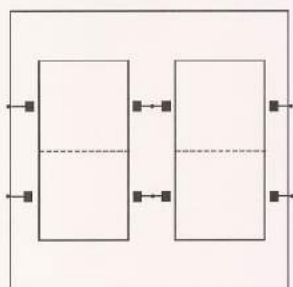
Please Note: The information on this page is based on all luminaires switched on and all lux values initial (i.e. when first switched on). The LTA recommended illuminance levels are based on each court being lit independently with an 80% maintenance factor applied.

STANDARD ADVANTAGE LAYOUTS FOR TENNIS

Single Four Layout

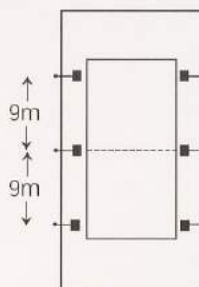


6m Cols 4 No
Adv. Lum 4 No
Approx 400 Lux Tennis

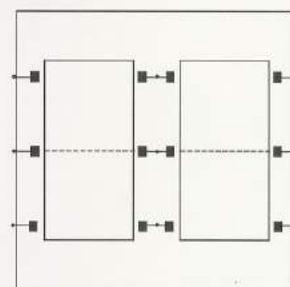


6m Cols 6 No
Adv. Lum 8 No
Approx 420 Lux Tennis

Single Six Layout



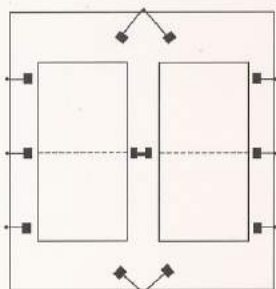
6m Cols 6 No
Adv. Lum 6 No
Approx 520 Lux Tennis



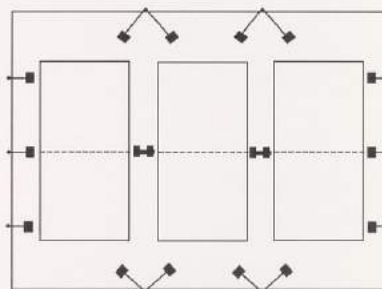
6m Cols 9 No
Adv. Lum 12 No
Approx 550 Lux Tennis

These are the ideal column positions but for safety reasons blocks of two or more courts should have at least 5.5m between the playing lines of adjacent courts.

Adjacent Court Layouts



6m Cols 9 No
Adv. Lum 12 No
Approx 500 Lux Tennis

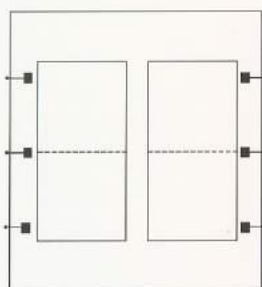


6m Cols 12 No
Adv. Lum 18 No
Approx 500 Lux Tennis

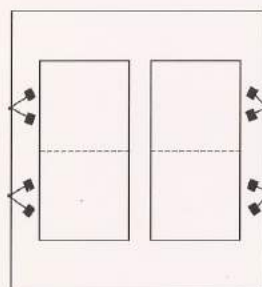
These are column positions for two or more courts where the distance between the playing lines of adjacent courts in is less than 5.5m.

LTA recommended illuminance levels. Recreational 300 Lux. - Club 400 Lux. - County 500 Lux.
Illuminance levels are an average taken over the principal playing area of the Tennis Court.

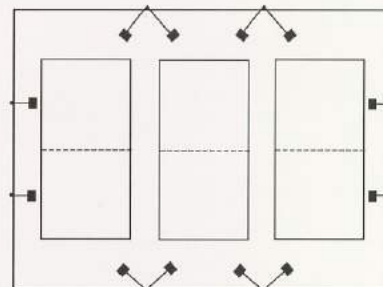
PERIMETER ADVANTAGE LAYOUTS FOR TENNIS AND MULTI-USE AREAS



8m Cols 6 No
Adv. Lum 6 No
Approx 250 Lux Tennis
Approx 200 Lux Multi use



8m Cols 4 No
Adv. Lum 8 No
Approx 300 Lux Tennis
Approx 250 Lux Multi use



8m Cols 8 No
Adv. Lum 12 No
Approx 300 Lux Tennis
Approx 250 Lux Multi use

Note: The approximate average illuminance levels are taken over the playing area only for tennis and the whole area for multi-use.



EXCLUSIVE LEISURE LTD

28 CANNOCK STREET, LEICESTER LE4 9HR

Telephone: 0116 233 2255 Fax: 0116 246 1561



A GUIDE TO TENNIS COURT FLOODLIGHTING

INTRODUCTION

When contemplating the installation of a floodlighting scheme for tennis there are a number of questions you will need to ask yourself to determine which scheme will suit your requirements.

1. **The first will be the standard of play which will take place on the courts** i.e. recreational, club, county or tournament standard. This will determine the illuminance level you require as the higher the standard of play the greater the level of illuminance necessary. As a guide, the following are the Lawn Tennis Association recommended levels.

Recreational 300 Lux

Club 400 Lux

County 500 Lux

These illuminance levels should be an average over the principal playing area of the tennis court and not just a maximum in one area of the court. It is important that the light is uniformly distributed over the area. This can be measured by the following calculation:- $\frac{\text{min}}{\text{avg}} = 0.6$ or above.

The illuminance levels are dictated by the number of floodlights per court, the number of columns and how they are situated to obtain an even spread.

As it is easy to make misleading claims, ask for a computer grid print out of the illuminance levels expected. These should always be available.

ADVANTAGE WILL ACHIEVE ILLUMINANCE LEVELS UP TO 750 LUX WITH UNIFORMITY FACTORS IN EXCESS OF THE MINIMUM REQUIREMENTS

2. **If you have more than one tennis court**, it will be necessary to decide whether you require courts lit individually or if it does not matter, whether they are lit in twos or threes. In other words, systems can be installed which do not have floodlights between the actual tennis courts but are situated around the perimeter of the blocks only. This will produce a less expensive system but may mean that all courts have to be lit at the same time even though only one is in use. This obviously adds to the running costs. It is also worth asking whether you wish the lights to be operated by just a main

switch or whether you need coin/token/card operated meters. These can be provided at an extra cost.

ADVANTAGE SYSTEMS CAN PROVIDE INDIVIDUAL COURT LIGHTING

3. **Column heights and positions are an important aspect of your scheme.** Traditional floodlighting with Tungsten or Sodium lamps are mounted on columns between 8-10 metres high. The Advantage system can be mounted on 5m to 8m high columns. The column height can be an important factor when planning permission is being sought. Generally columns over 6m will prove difficult to obtain planning permission, particularly if the courts are bounded by properties or highways. 8-10 metre high columns are usually required where lighting is from the perimeter of the courts only. The ideal situation is to have three columns situated on either side of a tennis court. These columns should be positioned between the base and service lines of the tennis court and in the centre adjacent to the net. This is not always possible, when considering blocks of tennis courts which only have a nominal 3-4m of space between courts. In such situations the columns between the courts would have to be taken back to the fence lines. A minimum of 5.5 metres is necessary between the tramlines of two adjacent courts to enable columns to be situated in the ideal positions.

ADVANTAGE LUMINAIRES CAN BE MOUNTED ON 5-8 METRE HIGH COLUMNS.

4. **Will you have problems in obtaining planning permission?** If so, it is important to know how the light is distributed over the area. Does it minimise glare and light spillage?

Generally an exposed lamp in the floodlight is likely to produce glare and light spillage. If your court is in an urban area with houses or highways

adjacent, you may have difficulty in obtaining planning permission with this type of floodlight.

If the floodlight distributes the light by means of reflectors it will provide minimal glare and spillage.

As mentioned previously column height will also play an important part.

ADVANTAGE DISTRIBUTES THE LIGHT EVENLY OVER THE AREA BY MEANS OF REFLECTORS.

4a. Do you prefer a white light? If you do, then do not use Sodium floodlights which emit a yellow/orange light.

ADVANTAGE GIVES A WHITE LIGHT FROM A METAL HALIDE LAMP

5. The next choice is one of expense. Do you require an inexpensive installation, with high running costs, or a more expensive installation with lower running costs? These variations can be quite considerable as two schemes with different floodlights but giving the same illuminance can vary considerably in costs per hour per court. You will therefore see that on a profit making basis, the less the running costs, the greater the profit for the Club. This is particularly relevant if a grant can be obtained for the initial installation. This will result in reduced capital expenditure for the Club on a more expensive installation but at the same time have a scheme which will provide them with larger profits when in operation.

ADVANTAGE SYSTEMS PROVIDE LOW RUNNING COSTS

6. Do you require low maintenance costs?

Different lamps have varying life spans from 2000-12000 hours. You will need to know what type of lamp is being used and how long it will last before replacement. Also the present day cost of the lamp. This will enable you to calculate the costs over the years to come. You will be surprised at the difference. The initial installation costs may look attractive but the running and maintenance costs

may make the system expensive over the long term.

ADVANTAGE UTILISES A METAL HALIDE LAMP WITH A LIFE OF APPROX. 12000 HOURS ON A 10 HOUR START

7. Is the installation aesthetically pleasing?

Columns and floodlights can be manufactured using different methods and materials. Columns can be tubular, octagonal or lattice type and can be galvanised or painted. Floodlights can be mounted directly onto the column or on an extension arm. Ask if you have a preference.

ADVANTAGE COLUMNS ARE TUBULAR WITH EXTENSION ARMS AND ALONG WITH THE LUMINAIRES ARE FINISHED IN HOLLYBUSH GREEN.

8. You must also find out whether you have sufficient electricity supply to cater for the system. We, like most contractors will normally assume that sufficient supply is available within fifteen metres of the tennis court. The supply can be checked by the local Electricity Board, who will also supply a new one if it is needed. For a single court a single phase supply would be adequate but for two or more courts you will probably require a three phase supply.

9. What is low level lighting? Low level lighting is not just a question of attaching floodlights onto a 6m high column and saying it is a low level system. It is the design of the floodlight luminaire which determines the height.

It is also a misconception to think that just because different lighting systems have metal halide lamps they are the same. This is not so. It is only the type of lamp that is the same, not the floodlight luminaire.

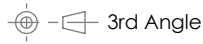
ADVANTAGE IS LOW LEVEL LIGHTING

We hope this information will assist you in deciding the type of floodlighting scheme which will suit your requirements.



EXCLUSIVE LEISURE LTD
28 CANNOCK STREET, LEICESTER LE4 9HR
Telephone: 0116 233 2255 Fax: 0116 246 1561

Technical Information



Design

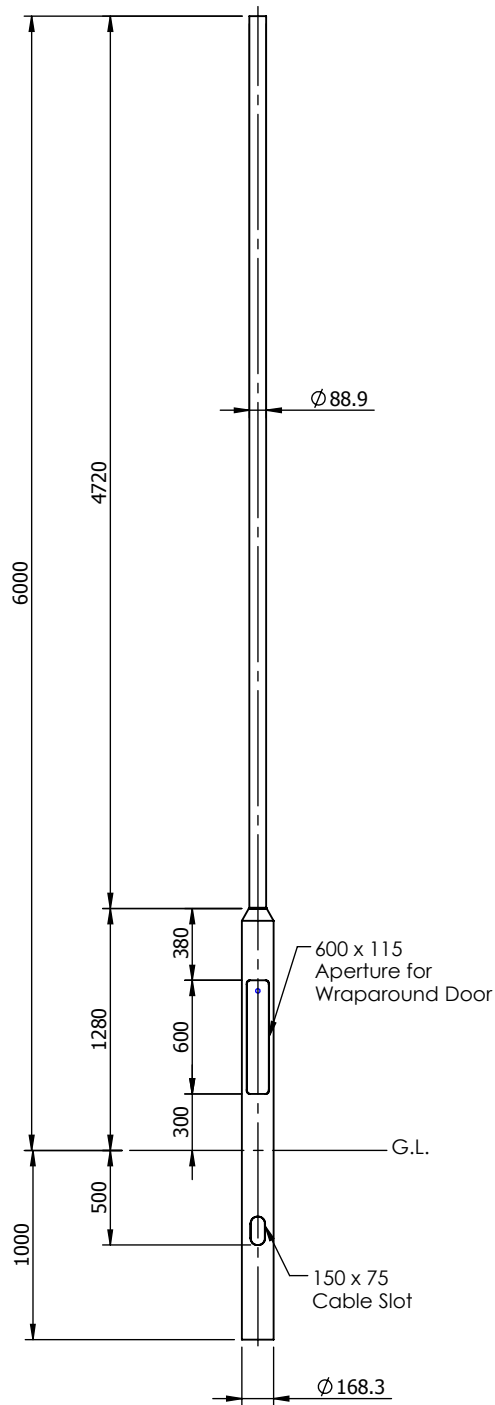
BSEN40

Finish

Galvanised to BSEN 1461:2009

Welding

In accordance with BSEN1011
 Procedures to BSEN ISO 15614-1:2004
 Welders qualified to BSEN 287-1:2011



2014 © Copyright

BEI | lighting
 lighting from the ground up

Wyndham Way, Brackla Industrial Estate, Bridgend,
 Mid Glamorgan, CF31 2AN

Tel.01656 645414
 Fax.01656 669231 / 01656 766395

Notes

All dimensions in millimetres unless stated otherwise.

When Multiple views are shown 3rd Angle Projection is assumed.

Revisions		
Rev.	Description	Date

Title

6metre tubular post top column

(As CU W2606027)

Drg No. 33167-0

Scale:1:40
 Sheet 1 of 1

Drawn By: MJB

Chk'd: MB

Ref. 6M01B(89)

Contract:

Customer:

Date: 26/03/2014

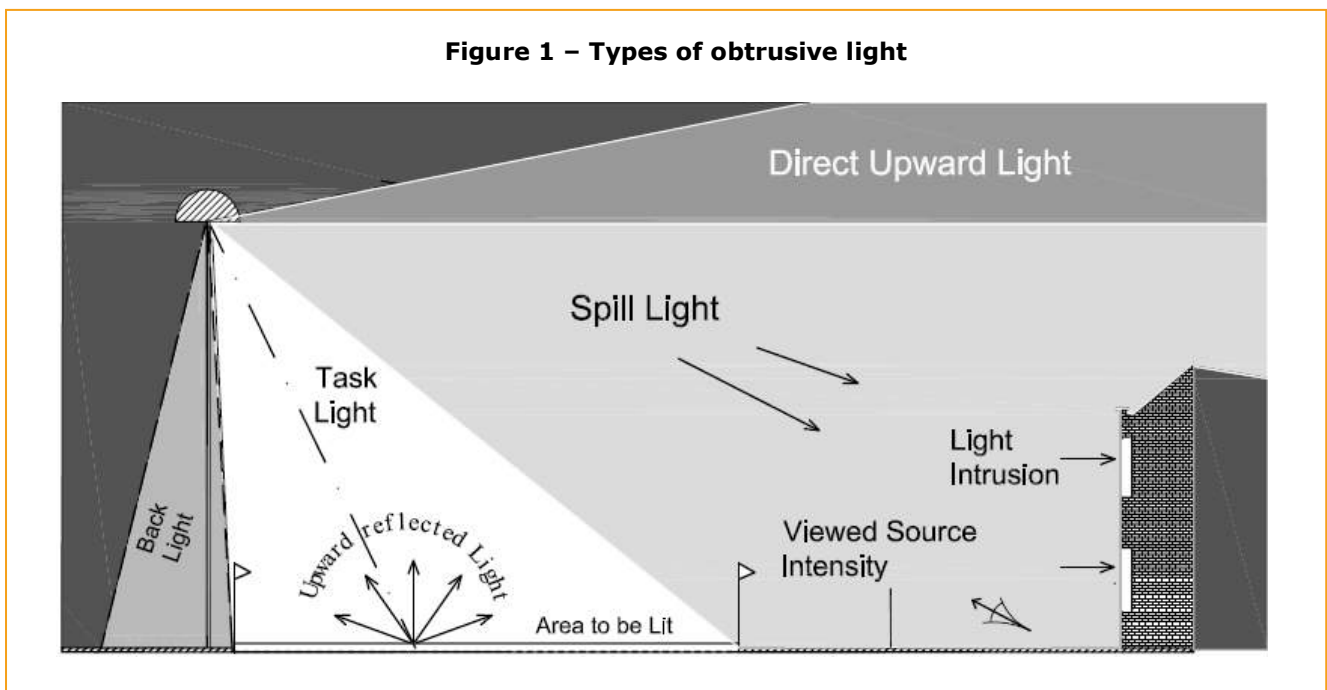
GUIDANCE NOTES FOR THE REDUCTION OF OBTRUSIVE LIGHT

“Think before you light - The right amount of light, where wanted, when wanted.”

Man's invention of artificial light has done much to safeguard and enhance our night-time environment but, if not properly controlled, **obtrusive light** (sometimes referred to as light pollution) can present serious physiological and ecological problems.

Obtrusive Light, whether it keeps you awake through a bedroom window or impedes your view of the night sky, is a form of pollution, which may also be a nuisance in law and which can be substantially reduced without detriment to the lighting task.

Sky glow, the brightening of the night sky, **Glare** the uncomfortable brightness of a light source when viewed against a darker background, and **Light Intrusion (“Trespass”)**, the spilling of light beyond the boundary of the property or area being lit, are all forms of obtrusive light which may cause nuisance to others and waste money and energy. Think before you light. Is it necessary? What effect will it have on others? Will it cause a nuisance? How can you minimise the problem?



Do not "over" light. This is a major cause of obtrusive light and is a waste of energy. There are published standards for most lighting tasks, adherence to which will help minimise upward reflected light. Organisations from which full details of these standards can be obtained are given on the last page of this leaflet.

Dim or switch off lights when the task is finished. Generally a lower level of lighting will suffice to enhance the night time scene than that required for safety and security.

“Good Design equals Good Lighting”

Any lighting scheme will consist of three basic elements: a light source, a luminaire and a method of installation.

Light sources (Lamps)

Remember that the light source output in LUMENS is not the same as the wattage and that it is the former that is important in combating the problems of obtrusive light.

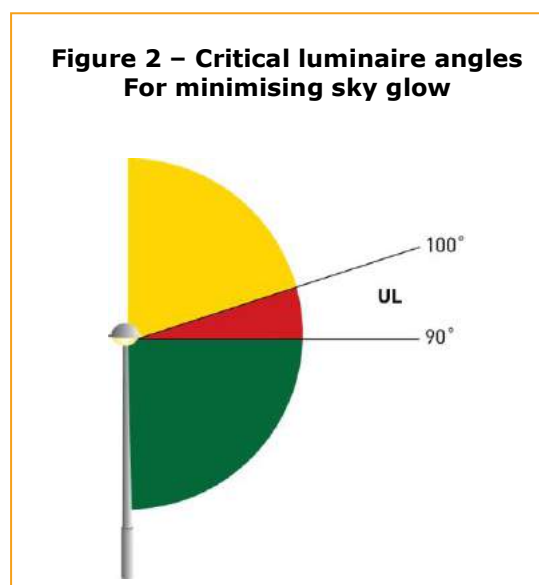
Most nighttime visual tasks are only dependant on light radiated within the visual spectrum. It is therefore NOT necessary for light sources to emit either ultra-violet or infra-red radiation unless specifically designed to do so. It is also understood that light from the shorter wavelengths of the spectrum has important effects on both flora and fauna that should be considered.

Research indicates that light from the blue end of the spectrum has important non-visual effects on the health of the human body, in particular in our sleep/wake patterns. It is therefore important to appreciate that while in obtrusive light terms the use of blue light should be minimised, there are many night-time tasks such as driving and sports where to be fully awake is an important aid to safety.

Luminaires

Care should always be taken when selecting luminaires to ensure that appropriate products are chosen and that their location will reduce spill light and glare to a minimum.

Use specifically designed lighting equipment that minimises the upward spread of light near to and above the horizontal. The most sensitive/critical zones for minimising sky glow are those between 90° and 100° as shown in Figure 2 and referred to as the lower, upward light output zone (UL).



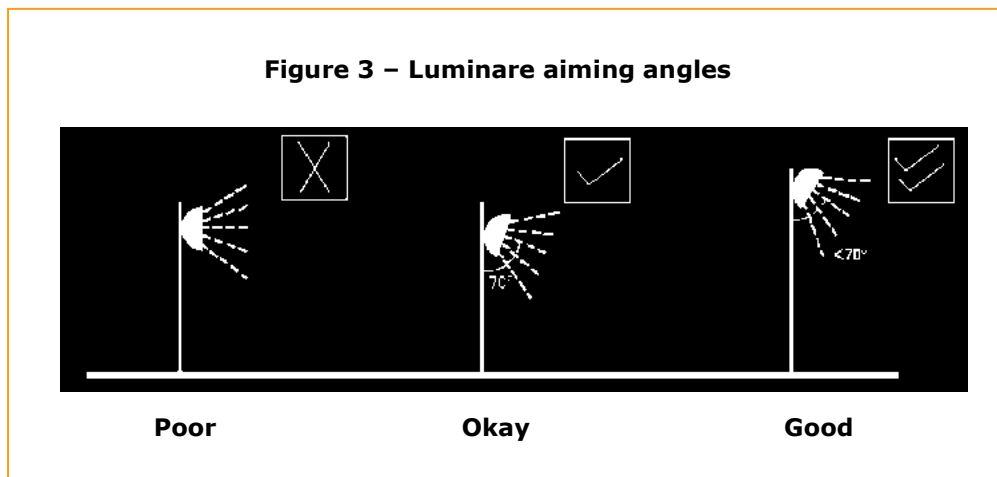
For most sports and area lighting installations the use of luminaires with double-asymmetric beams designed so that the front glazing is kept at or near parallel to the surface being lit should, if correctly aimed, ensures minimum obtrusive light.

Appendices 1 and 2 to these notes gives more details of how to choose and if necessary modify luminaires.

Installation

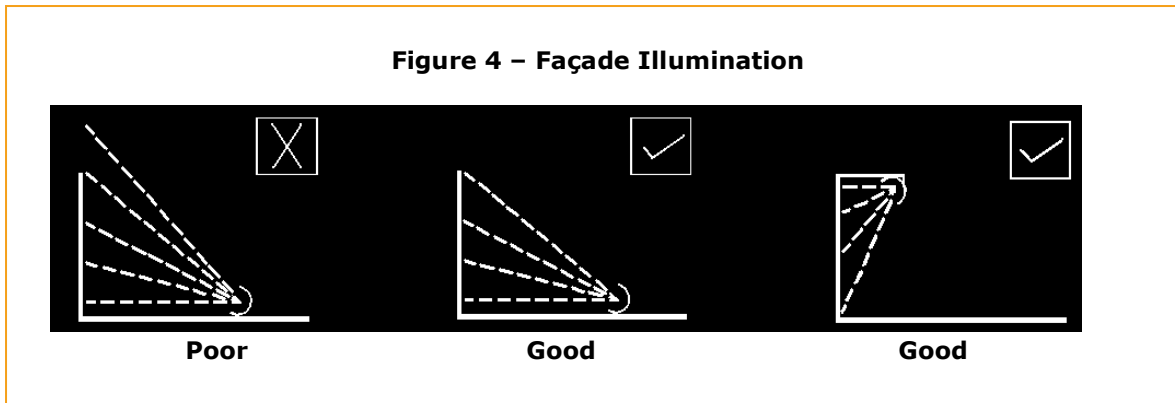
In most cases it will be beneficial to use as high a mounting height as possible, giving due regard to the daytime appearance of the installation. The requirements to control glare for the safety of road users are given in Table 3.

Keep glare to a minimum by ensuring that the main beam angle of all lights directed towards any potential observer is not more than 70°. Higher mounting heights allow lower main beam angles, which can assist in reducing glare. In areas with low ambient lighting levels, glare can be very obtrusive and extra care should be taken when positioning and aiming lighting equipment. With regard to domestic security lighting the ILP produces an information leaflet GN02:2009 that is freely available from its website.



When lighting vertical structures such as advertising signs, direct light downwards wherever possible. If there is no alternative to up-lighting, as with much decorative lighting of buildings, then the use of shields, baffles and louvres will help reduce spill light around and over the structure to a minimum.

For road and amenity lighting installations, (see also design standards listed on Page 5) light near to and above the horizontal should normally be minimised to reduce glare and sky glow (Note ULR's in Table 2). In rural areas the use of full horizontal cut off luminaires installed at 0° uplift will, in addition to reducing sky glow, also help to minimise visual intrusion within the open landscape. However in some urban locations, luminaires fitted with a more decorative bowl and good optical control of light should be acceptable and may be more appropriate.



Since 2006 “Artificial Light” has been added to the list of possible Statutory Nuisances in England, Wales and Scotland. The monitoring of such nuisances will be the responsibility of Environmental Health Officers (EHOs) for which separate guidance is being produced.

With regard to the planning aspect, many Local Planning Authorities (LPAs) have already produced, or are producing, policies that within the planning system will become part of their local development framework. For new developments there is an opportunity for LPAs to impose planning conditions related to external lighting, including curfew hours.

The Scottish Executive has published a design methodology document (March 2007) entitled [“Controlling Light Pollution and Reducing Energy Consumption”](#) to further assist in mitigating obtrusive light elements at the design stage.

ENVIRONMENTAL ZONES

It is recommended that Local Planning Authorities specify the following environmental zones for exterior lighting control within their Development Plans.

Table 1 – Environmental Zones			
Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark	UNESCO Starlight Reserves, IDA Dark Sky Parks
E1	Natural	Intrinsically dark	National Parks, Areas of Outstanding Natural Beauty etc
E2	Rural	Low district brightness	Village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Small town centres or suburban locations
E4	Urban	High district brightness	Town/city centres with high levels of night-time activity

Where an area to be lit lies on the boundary of two zones the obtrusive light limitation values used should be those applicable to the most rigorous zone.

NB: Zone E0 must always be surrounded by an E1 Zone.

DESIGN GUIDANCE

The following limitations may be supplemented or replaced by a LPA's own planning guidance for exterior lighting installations. As lighting design is not as simple as it may seem, you are advised to consult and/or work with a professional lighting designer before installing any exterior lighting.

Table 2 – Obtrusive Light Limitations for Exterior Lighting Installations – General Observers

Environmental Zone	Sky Glow ULR [Max %] ⁽¹⁾	Light Intrusion (into Windows) E _v [lux] ⁽²⁾		Luminaire Intensity I [candelas] ⁽³⁾		Building Luminance Pre-curfew ⁽⁴⁾
		Pre-curfew	Post-curfew	Pre-curfew	Post-curfew	Average, L [cd/m ²]
E0	0	0	0	0	0	0
E1	0	2	0 (1*)	2,500	0	0
E2	2.5	5	1	7,500	500	5
E3	5.0	10	2	10,000	1,000	10
E4	15	25	5	25,000	2,500	25

ULR = **Upward Light Ratio of the Installation** is the maximum permitted percentage of luminaire flux that goes directly into the sky.

E_v = **Vertical Illuminance in Lux** - measured flat on the glazing at the centre of the window.

I = **Light Intensity in Candelas (cd)**

L = **Luminance in Candelas per Square Metre (cd/m²)**

Curfew = **the time after which stricter requirements (for the control of obtrusive light) will apply**; often a condition of use of lighting applied by the local planning authority. If not otherwise stated - 23.00hrs is suggested.

***** = **Permitted only from** Public road lighting installations

(1) Upward Light Ratio – Some lighting schemes will require the deliberate and careful use of upward light, e.g. ground recessed luminaires, ground mounted floodlights, festive lighting, to which these limits cannot apply. However, care should always be taken to minimise any upward waste light by the proper application of suitably directional luminaires and light controlling attachments.

(2) Light Intrusion (into Windows) – These values are suggested maxima and need to take account of existing light intrusion at the point of measurement. In the case of road lighting on public highways where building facades are adjacent to the lit highway, these levels may not be obtainable. In such cases where a specific complaint has been received, the Highway Authority should endeavour to reduce the light intrusion into the window down to the post curfew value by fitting a shield, replacing the luminaire, or by varying the lighting level.

(3) Luminaire Intensity – This applies to each luminaire in the potentially obtrusive direction, outside of the area being lit. The figures given are for general guidance only and for some sports lighting applications with limited mounting heights, may be difficult to achieve.

(4) Building Luminance – This should be limited to avoid over lighting, and related to the general district brightness. In this reference building luminance is applicable to buildings directly illuminated as a night-time feature as against the illumination of a building caused by spill light from adjacent luminaires or luminaires fixed to the building but used to light an adjacent area.

Table 3 – Obtrusive Light Limitations for Exterior Lighting Installations – Road Users		
Road Classification ⁽¹⁾	Threshold Increment (TI)	Veiling Luminance (Lv)
No road lighting	15% based on adaptation luminance of 0.1cd/m ²	0.04
ME6/ ME5	15% based on adaptation luminance of 1cd/m ²	0.25
ME4/ ME3	15% based on adaptation luminance of 2cd/m	0.40
ME2 / ME1	15% based on adaptation luminance of 5cd/m ²	0.84

TI = Threshold Increment is a measure of the loss of visibility caused by the disability glare from the obtrusive light installation

Lv = Veiling Luminance is a measure of the adaptation luminance caused by the disability glare from the obtrusive light installation

(1) = Road Classifications as given in BS EN 13201 - 2: 2003 Road lighting Performance requirements. Limits apply where users of transport systems are subject to a reduction in the ability to see essential information. Values given are for relevant positions and for viewing directions in path of travel. For a more detailed description and methods for determining, calculating and measuring the above parameters see CIE Publication 150:2003.



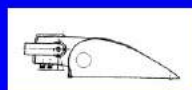
RELEVANT PUBLICATIONS AND STANDARDS:

British Standards: www.bsi.org.uk	BS 5489-1: 2003 Code of practice for the design of road lighting – Part 1: Lighting of roads and public amenity areas BS EN 13201-2:2003 Road lighting – Part 2: Performance requirements BS EN 13201-3:2003 Road lighting – Part 3: Calculation of performance BS EN 13201-4:2003 Road lighting – Part 4: Methods of measuring lighting performance. BS EN 12193: 1999 Light and lighting – Sports lighting BS EN 12464-2: 2007 Lighting of work places – Outdoor work places
Countryside Commission/ DOE	Lighting in the Countryside: Towards good practice (1997) (<i>Out of Print but available on www.communities.gov.uk/index.asp?id=1144823</i>)
UK Government / Defra www.defra.gov.uk	Statutory Nuisance from Insects and Artificial Light – Guidance on Sections 101 to 103 of the Clean Neighbourhoods and Environment Act 2005 Road Lighting and the Environment (1993) (Out of Print)
CIBSE/SLL Publications: www.cibse.org	CoL Code for Lighting (2002) LG1 The Industrial Environment (1989) LG4 Sports (1990+Addendum 2000) LG6 The Exterior Environment (1992) FF7 Environmental Considerations for Exterior Lighting (2003)
CIE Publications: www.cie.co.at	01 Guidelines for minimizing Urban Sky Glow near Astronomical Observatories (1980) 83 Guide for the lighting of sports events for colour television and film systems (1989) 92 Guide for floodlighting (1992) 115 Recommendations for the lighting of roads for motor and pedestrian traffic – Second Edition (2010) 126 Guidelines for minimizing Sky glow (1997) 129 Guide for lighting exterior work areas (1998) 136 Guide to the lighting of urban areas (2000) 150 Guide on the limitations of the effect of obtrusive light from outdoor lighting installations (2003) 154 The Maintenance of outdoor lighting systems (2003)
ILP Publications: www.theilp.org.uk	TR 5 Brightness of Illuminated Advertisements (2001) TR24 A Practical Guide to the Development of a Public Lighting Policy for Local Authorities (1999) GN02 Domestic Security Lighting, Friend or Foe
ILP/CIBSE Joint Publications	Lighting the Environment - A guide to good urban lighting (1995)
ILP/CSS Publications	Joint Code of Practice for the installation, maintenance and removal of seasonal decorations. (2005)
ILP/CfDS Joint Publication www.dark-skies.org	Towards Understanding Sky glow. 2007
IESNA www.iesna.org	TM-15-07 (R) Luminaire Classification System for Outdoor Luminaires

NB: These notes are intended as guidance only and the application of the values given in Tables 2 & 3 should be given due consideration along with all other factors in the lighting design. Lighting is a complex subject with both objective and subjective criteria to be considered. The notes are therefore no substitute for professionally assessed and designed lighting, where the various and maybe conflicting visual requirements need to be balanced.

APPENDIX 1 - PROPOSED OUTDOOR LUMINAIRE CLASSIFICATION SYSTEM

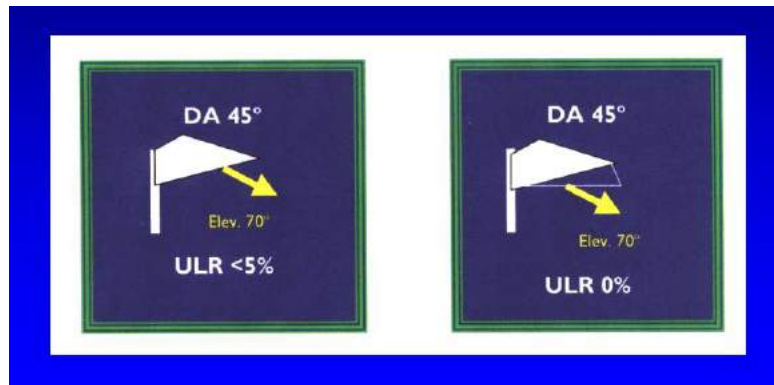
Variable Aim Luminaires – General Classifications:

➤ Type A	Symmetrical	
➤ Type B	Asymmetrical	
➤ Type C	Double-Asymmetrical	

Proposed labelling System:

Fixed Position luminaires

Variable Aim Luminaires
(Shown here for a 45° Double-Asymmetric luminaire aimed at 70° – with and without a cowl).



APPENDIX 2 - ILLUSTRATIONS OF LUMINAIRE ACCESSORIES FOR LIMITING OBTRUSIVE LIGHT (images provided by Philips and Thorn)

Cowl (or Hood)



External Louvre



SHIELD



SHIELD "Barn Doors"



Double Asymmetric Luminaire



Simple Hood



Circular Louvre



Cowl & Louvre



Internal Louvre (horizontal)



Internal Louvre (vertical)

