

DALYMOUNT STADIUM REDEVELOPMENT

Dublin City Council

Floodlighting Design Report

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1.0 EXECUTIVE SUMMARY

This floodlighting study has been prepared to inform the development of Dalymount Stadium Redevelopment. The findings aim to steer the design decisions to achieve compliant lighting values and minimise lighting spillage to support a successful Planning Application.

2.0 BACKGROUND

The light spillage analysis intends to verify if the proposed pitch floodlighting will exceed the existing values. This is especially important in the north and south areas (back-side of Connaught Street and North Circular Road houses). The proposed floodlighting design is as illustrated in the following figure.

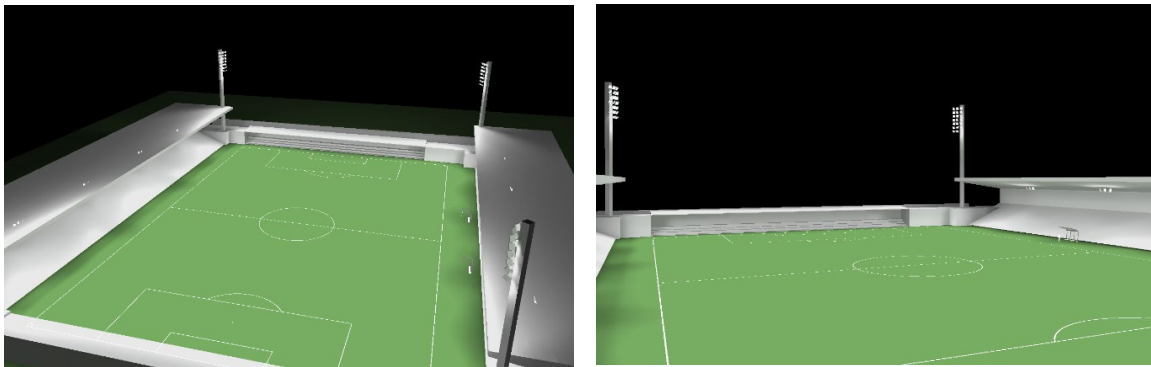


Figure 1 Proposed Floodlighting Design

The calculation has been performed by Signify® (former Philips), a reputed provider of lighting solutions for Stadiums. The calculation is based on their own products but is extensible to any other manufacturer of lightning fixtures.

3.0 ACRONYMS AND ABBREVIATIONS

DCC	Dublin City Council
Eh	Horizontal illuminance level (measured in lx)
Ev	Vertical illuminance level (measured in lx)
FAI	Football Association of Ireland
ILP	Institution of Lighting Professionals (from UK)
LX	Illuminance level unit (lux)
UEFA	Union of European Football Associations

4.0 BRIEF AND TARGETS

Dalymount Park is a football stadium located in Phibsborough, Dublin, recognised at both local and national levels for its contribution to Irish Football. Dublin City Council (DCC), the owner of the stadium since 2015, have appointed a team of specialised professionals to develop a proposal for the redevelopment of the site.

The existing floodlighting system will be demolished and improved according to the Football Association of Ireland's lighting requirement.

The document reference to be used for the development of the project are:

- Football Association of Ireland Stadium Infrastructure Criteria 2011, available online
- FAI, Floodlighting, Guidance notes on the installation and maintenance of floodlights, 2008, available online.
- UEFA Guide to Quality Stadiums 2011, available online.
- UEFA Stadium Infrastructure Regulations 2018, available online

The following paragraphs analyse the lighting requirements as per the documents listed above.

Firstly, as per the FAI Stadium Infrastructure Criteria document, 2011, the lighting requirements are as follows:

FAI - LIGHTING REQUIREMENTS (lx)	
Type of Use	(lx)
Training (Eh)	-
Preliminary category (Ev)	250
Category 1 (Ev)	350
Category 2 (Ev fix cameras, / Ev mobile cameras)	800 / 500
Category 3 (Ev fix cameras / Ev mobile cameras)	1,200 / 800

To complement this table, the document *Floodlighting - Guidance notes on the installation and maintenance of floodlights (July 2008)* issued by the Facility Development Unit (FAI), indicates:

Competition and training Lighting Recommendations				
Televised Events		Non Televised Events		
UEFA (Preliminary Rounds)	Eircom League & Competitive non- senior Internationals	Regional Development & non-senior international friendlies	Senior, intermediate, junior and schoolboy Football	Training
1200 – 1400 (E _v)	800 (E _v)	500(E _v)	250 (E _v)	150 (E _v)

This table provides additional information for non-televised events and training sessions.

Secondly, according to the UEFA requirements, the lighting levels to be met are as follows:

UEFA - LIGHTING REQUIREMENTS (lx)	
Type of Use	(lx)
Training (Eh)	-
Non-televised UEFA (Eh)	350
Televised Events Eircom League & competitive non-senior internationals (Ev)	-
UEFA Level D (Eh/Ev)	800/350
UEFA Level C (Eh/Ev)	1200/750
UEFA Level B (Eh/Ev)	1400/1000

Also, for the case of the UEFA, the document includes a description of the events and their associated illuminance level, as summarized in the following table:

Type of match	UEFA illuminance level
UEFA EURO	Elite level A
UEFA Champions League final	Elite level A
UEFA Europa League final	Elite level A
UEFA Champions League: group stage to semi-finals	Level A
UEFA Super Cup final	Level A
UEFA Women's EURO	Level B
UEFA European Under-21 Championship: Final tournament	Level B
UEFA Champions League: Play-offs	Level B
UEFA Europa League: group stage to semi-finals	Level B
UEFA European Football Championship: qualifying matches	Level B
UEFA Champions League: third qualifying round	Level C
UEFA Europa League: third qualifying round and play-offs	Level C
UEFA Champions League: second qualifying round	Level C
UEFA European Under-21 Championship: qualifying matches	Level C
UEFA Champions League: first and second qualifying rounds	Level D
UEFA Europa League: First and second qualifying rounds	Level D
Youth and Women's Competitions: Qualifying rounds, group-stage and knock-out rounds (excluding final(s))	Level D
Non-broadcast matches	➤ 350 lux

5.0 ANALYSIS

The analysis has been carried out by *Signify Commercial Ireland Ltd.* using the software *Calculux Area 7.9*, in cooperation with IDT.

The existing floodlighting installation has 15 No fittings on each Mast = 60 No fittings.

5.1. FAI TELEVISED MATCH/ UEFA C (EH 1200 LUX/EV 800 LUX)

The proposed new floodlighting system will have, 4 No 32m high masts exist to centre of headframe. Illuminance requirement is achieved with 19 fittings of Arena Vision LED BVP428 (1505.0 W) with symmetrical optics + Louvre on each mast.

12 No lower output LED BVP418 fittings (1006W) are added under roofs of east and west stands at 15m height.

Required light level is achieved with 19 No fittings per mast (76 No on Masts, plus 24 No setback under main stand roofs = 100 No in total.)

This floodlighting design meets the following requirements:

- (1) FAI Category 2, FAI Category 3 Ev mobile camera
- (2) UEFA Level C

According to this lighting level, Eircom League, the televised matches are suitable to play.

The following figures illustrate the result of the calculation for Eircom League.

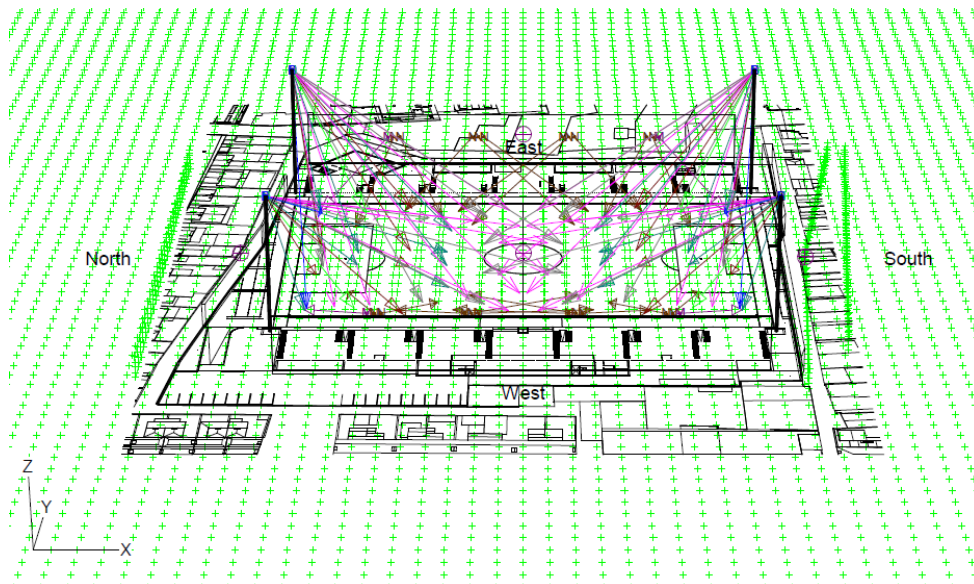


Figure 2 Location and pointing of fixtures.

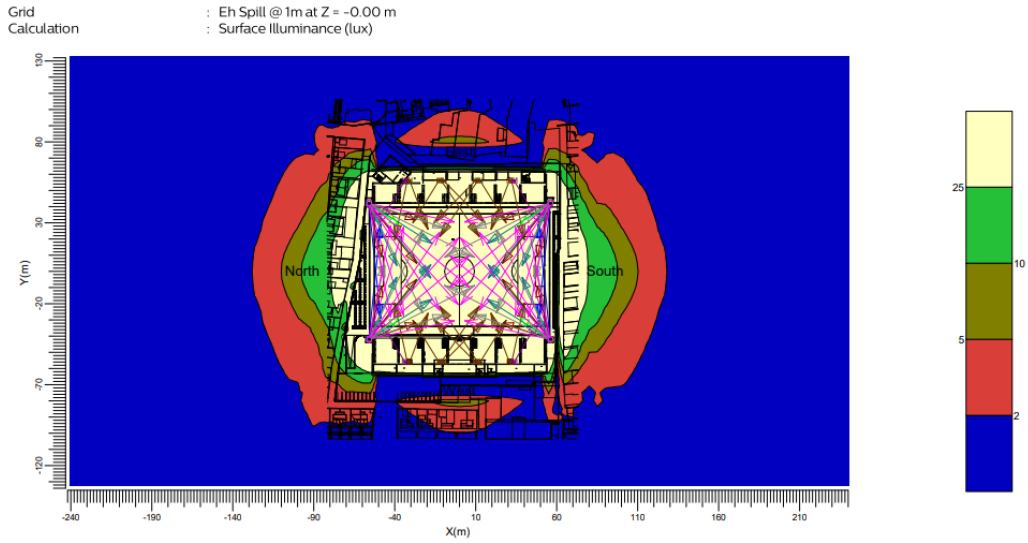


Figure 3 Illuminance Eh levels in false colours

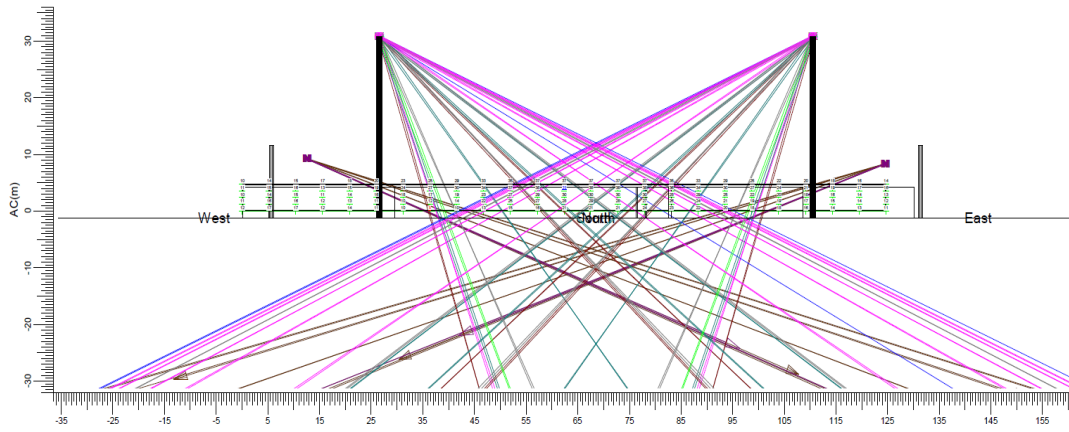


Figure 4 Illuminance Ev houses west

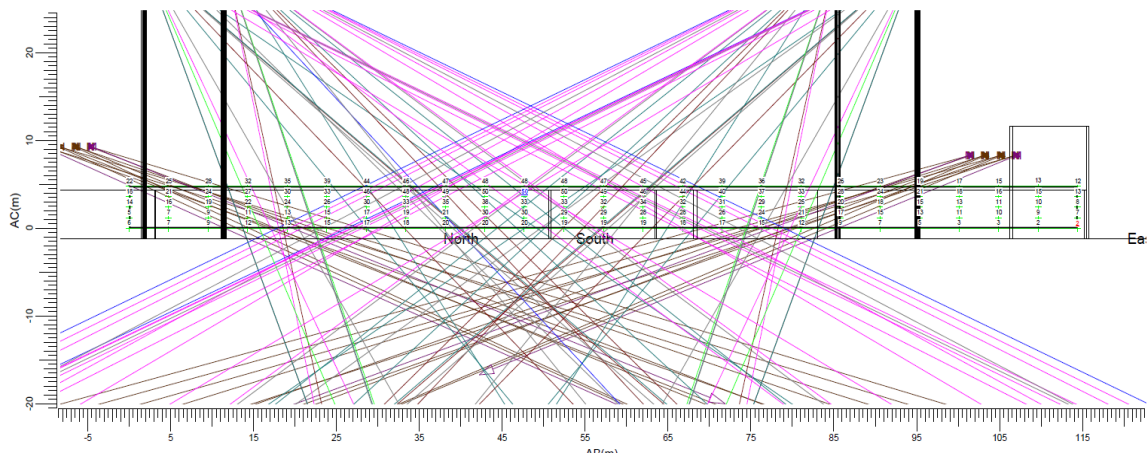


Figure 5 Illuminance Ev houses east

5.2. NON-TELEVISED MATCH (EH 800 LUX)

The 800-lux scheme design calculation is simulated by dimming each fitting of 1200 lux design by approximately 30%.

This lighting level is suitable for non-televised event, regional development & non-senior international friendlies according to FAI flood lighting guidance.

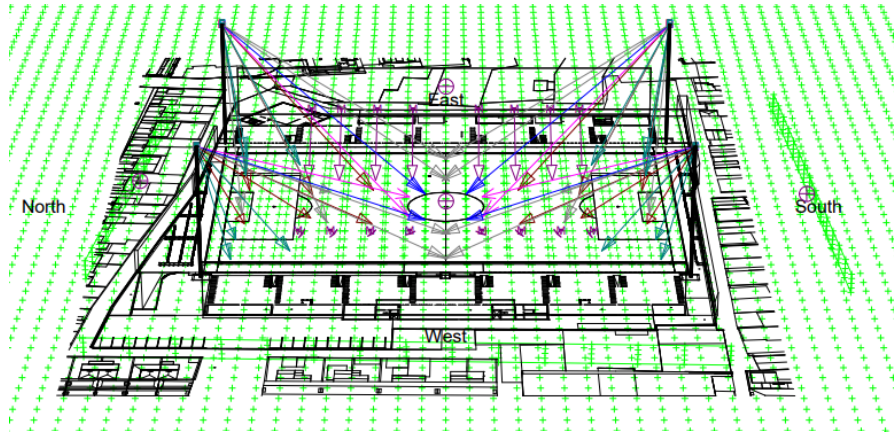


Figure 6 Location and pointing of fixtures

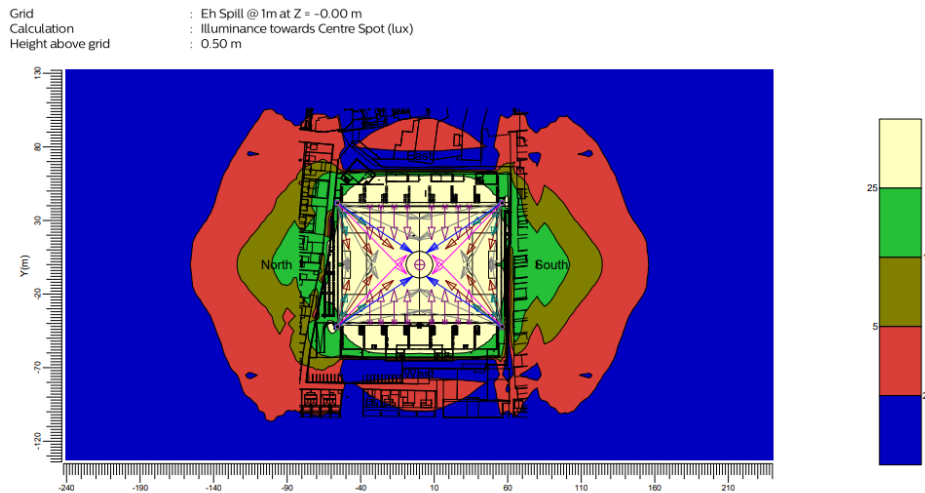


Figure 7 Illuminance Eh levels in false colours

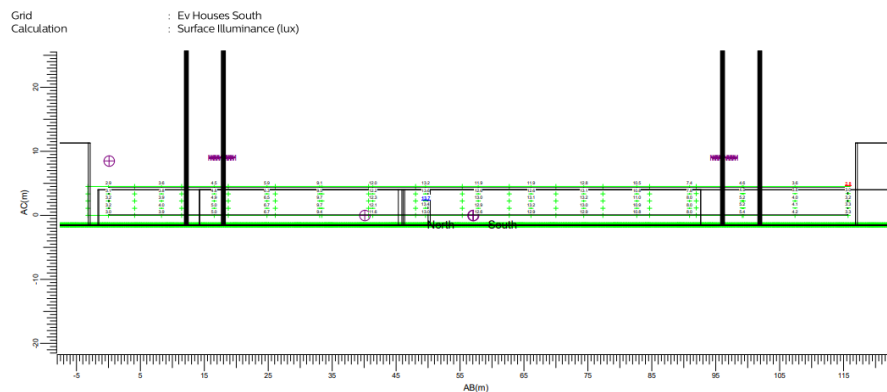


Figure 8 Illuminance Ev houses south

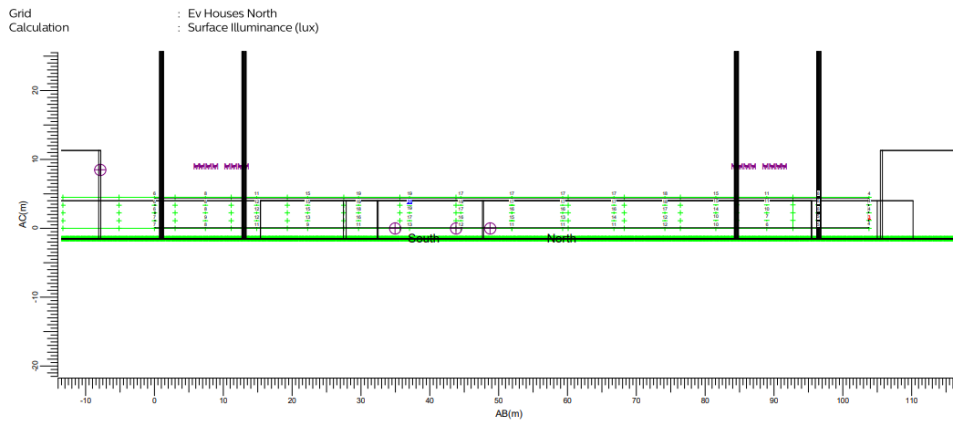


Figure 9 Illuminance Ev houses north

6.0 RESULTS

The analyses have been performed to meet the lighting requirement of Eh 1200 lux/ Ev 800 lux (Televised Match) and Eh 800 lux (Non-televised Match).

The performed analyses show that the highest light spillage occurs behind the goals, at the midpoint of the lighting masts.

The results have been assessed using the *Guidance notes for the reduction of obtrusive light – Guidance Note 01/20* (ILP – Institution of Lighting Professionals www.theilp.org.uk). The ILP Guidance recommended values for Urban areas are:

Zone	Surrounding	Lighting environment	Examples
E0	Protected	Dark (SQM 20.5+)	Astronomical Observable dark skies, UNESCO starlight reserves, IDA dark sky places
E1	Natural	Dark (SQM 20 to 20.5)	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, IDA buffer zones etc.
E2	Rural	Low district brightness (SQM ~15 to 20)	Sparsely inhabited rural areas, village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Well inhabited rural and urban settlements, small town centres of suburban locations
E4	Urban	High district brightness	Town/city centres with high levels of night-time activity

Light technical parameter	Application conditions	Environmental zone				
		E0	E1	E2	E3	E4
Illuminance in the vertical plane (E_v)	Pre-curfew	n/a	2 lx	5 lx	10 lx	25 lx
	Post-curfew	n/a	<0.1 lx*	1 lx	2 lx	5 lx

According to the performed analysis, the max. lighting level (E_v) is c. 50.4 lx, which is **above the max. 25 lx recommended by the ILP Guidance** for Eh 1200lux/ Ev 800 lux scheme (Televised Match). The calculation result for Eh 1200 lux/ Ev 800 lux is as follows:

Switching Modes:

Code	Switching Mode	Maintenance factor
1	Performance	0.95
2	All On Spill	1.00

(Il)luminance Calculations:

Calculation	Switching Mode	Type	Unit	Ave	Min	Max	Min/Ave	Max/Min
Eh Pitch 5m	1	Horizontal Illuminance	lux	1253	995	1657	0.79	0.60
Eh Pitch 10m	1	Horizontal Illuminance	lux	1239	995	1583	0.80	0.63
Ev + Y 90d 10m	1	Vertical Illuminance	lux	904	522	1480	0.58	0.35
Ev - Y 270d 10m	1	Vertical Illuminance	lux	889	518	1417	0.58	0.37
Ev Houses West	2	Surface Illuminance	lux			38.6		
Ev Houses East	1	Surface Illuminance	lux			50.4		
Eh Spill @ 1m	2	Surface Illuminance	lux					
Ev Spill @ 1.5m	2	Illuminance -> Dd	lux					

Glare Rating for Grid of Observers:

Calculation	Switching Mode	Observer Grid	Reference Grid	Reflectance	GR-Max
GR Max !0m Grid	2	Eh 10m	Eh 10m	0.25	46.1

Obtrusive Light Calculations:

Switching Mode	Observer Code	Luminaire Code	Position			Aiming Angles			Maximum Intensity (cd)
			X (m)	Y (m)	Z (m)	Rot.	Tilt90	Tilt0	
1	Aa	B	56.00	42.00	32.00	-95.84	65.89	0.00	27966
1	Bb	D	-56.00	-42.00	32.00	78.37	56.04	0.00	23239
Switching Mode	ULR								
1	0.01								
2	0.01								

However, for Eh 800 lux (non-televised match), the max. lighting spillage (Ev) is 19.6 lux, which is within the limit of 25 lux. The calculation result for Eh 800 lux is as follows:

Switching Modes:

Code	Switching Mode	Maintenance factor
1	Performance	0.95
2	All On Spill	1.00

(II) Illuminance Calculations:

Calculation	Switching Mode	Type	Unit	Ave	Min	Max	Min/Ave	Min/Max
Eh Pitch 5m	1	Horizontal Illuminance	lux	897	789	1072	0.88	0.74
Eh Pitch 10m	1	Horizontal Illuminance	lux	881	795	1055	0.90	0.75
Ev Houses South	2	Surface Illuminance	lux			13.69		
Ev Houses North	2	Surface Illuminance	lux			19.6		
Ev Houses West	2	Surface Illuminance	lux			3.13		
Eh Spill @ 1m	2	Surface Illuminance	lux					
Ev Spill @ 1.5m	2	Illuminance -> Dd	lux					

Glare Rating for Grid of Observers:

Calculation	Switching Mode	Observer Grid	Reference Grid	Reflectance	GR-Max
GR Max 10m Grid	2	Eh 10m	Eh 10m	0.25	42.9

Obtrusive Light Calculations:

Switching Mode	Observer Code	Luminaire Code	Position			Aiming Angles			Maximum Intensity (cd)
			X (m)	Y (m)	Z (m)	Rot.	Tilt90	Tilt0	
1	Aa	D	-56.00	-42.00	32.00	23.83	62.78	0.00	11350
1	Bb	D	-56.00	-42.00	32.00	81.31	55.88	0.00	12525

Switching Mode	ULR
1	0.00
2	0.00

For FAI Category 1 (Eh 350lux) or regional matches (Eh 500 lux), the fittings are dimmed to the lower level and the lighting spillage will be less.

Compared to the existing lighting provided by 15No. fittings per mast mounted on 4No. masts, the floodlighting design is enhanced. It is foreseen that the existing light spillage to be lower than the calculated values for FAI televised events. These provide a mean illuminance not higher than 500lx in the pitch which is insufficient to meet the desired FAI and UEFA requirements.

7.0 CONCLUSION

According to the results of two floodlighting design, for FAI televised event, there is a significant risk of light spillage. However, it is important to note that the events with the highest spillage are to occur very sporadically throughout the year, and each will have a short duration (≈ 4 hours).

For non-televised events and training, the light spillage value is acceptable.