Proposed Development of an All-Weather Pitch at Coláiste Eoin/Íosagain
PC/PKS/01/18

Appendix 1 – Floodlighting Design & Report
Proposed Floodlighting at Colaiste Eoin
Blackrock, Co. Dublin

Sports Lighting Proposal
Compiled by Neil McSherry BEng MIET
16th March 2018

Eoin O’Brien
Senior Executive Parks Superintendent, Landscape Architect, MILI
Parks and Landscape Services,
Municipal Services Department
Dún Laoghaire Rathdown County Council,
Marine Road, Dún Laoghaire, Co. Dublin, Ireland

RE: Proposed Floodlighting at Colaiste Eoin

Dear Mr O’Brien,
As instructed, Musco Lighting Europe has undertaken the sports lighting design for the proposed GAA Pitch. Our design is prepared in compliance with:

- Chartered Institute of Building Services Engineers Lighting Guide 4: Sports Lighting (CIBSE LG4)
- Institute of Lighting Professionals (ILP) Guidance Notes for the Reduction of Obtrusive Light GN01:2011

Terminology
In order to ensure clarity and understanding, some typical floodlighting and project specific terms have been defined/explained to assist in the reading and evaluation of this document and the design documents:

- **Horizontal Illuminance** - the level of light at a given point measured on a horizontal plane, such as the sports pitch, footpath, or a desk. Often used in sports applications as a visual and playability evaluation of light. Measured by holding the light meter horizontal to the ground, facing toward the sky.
- **Vertical Illuminance (E_v)** - the level of light at a given point measured on a vertical plane, such as a wall, the side of a building, or window. Measured by holding the light meter vertically towards the light source.
- **Lux** - unit of measure for illumination.
  - Sunny Day = 50,000 - 150,000 lux
  - Overcast Day = 5,000 - 10,000 lux
  - Major sports stadium = 2,000 - 3,000 lux
  - Office lighting = 300 - 500 lux
  - Roadway lighting = 15 - 30 lux
  - Sunset = 10 lux
- **Luminaire** - Light fitting/floodlight
- **Uniformity (E_{min}/E_{av})** - Evaluation of how well distributed the light is across a given area. Expressed as a ratio of minimum point divided by the average of all points.
- **Metal Halide (HID)** - Traditional lamp technology used in sports lighting. Combines specific gases and electricity to produce light.
- **LED** - (Light Emitting Diode) - Light is produced electronically using a semiconductor
The objective of the design was to produce a system compliant with CIBSE LG4 as follows:

**Class I GAA - 500 lux Horizontal average, 0.7 Emin/Eav uniformity**

In accordance with the *ILP Guidance Notes for the Reduction of Obtrusive Light GN01:2011* the local area can be classified as a suburban environment and therefore Environmental Zone ‘E3’ applies. E3 areas are defined for lighting purposes as ‘Medium District Brightness Areas’ (Table 1) and typically include suburban locations.

In accordance with Table 2, Light Intrusion into Windows is limited to 10 lux vertical ($E_v$). Musco’s design is compliant with this requirement with a maximum Light Intrusion into Windows of 8.73 lux vertical ($E_v$) as demonstrated on page 7 of the lighting design document 190498D.

The developed design is optimised for compliance with *ILP Guidance Notes for the Reduction of Obtrusive Light GN01:2011* by minimising obtrusive light; Spill, sky glow and glare. This is achieved in the following ways:

1. **Column height, number of columns and aiming angles**
   Choosing appropriate number of columns and column heights is key to the overall quality of the lighting design. Based on the size of the pitch, the sport being played, the competition level, and the use of the floodlighting system (televised or non-televised); column number and height requirements must be accurately assessed to ensure the aiming angle of the floodlight onto the pitch is at an appropriate degree to maintain good playability, control glare, and reduce spill light on adjoining landscape or properties. See the diagram below:
GAA is by its nature an aerial sport, in particular the *sliotar* is a fast moving small object, which requires adequate levels of light both at pitch level and at height. In order to provide adequate light levels for this type of sport, correct height of column needs to be carefully considered. Shorter columns with shallow aiming angles, will not provide light for the ball in flight, will cause unplayable levels of glare and will increase spill to the adjacent roads and residences. Choosing columns at an adequate height - proposed to be 18m for the Musco design will allow the aiming of the floodlights to be at a more downward angle to the pitch, thus minimising spill and glare. This height will also facilitate the ball in flight in accordance with the ILP Guidance Notes on the Reduction of Obtrusive Light GN01:2011 (page 5). This will ensure good playability and consideration for the health and safety of the players.

2. **Class Leading Light Control**

The proposal uses Musco’s Light Structure Green TLC-LED-1150 system. The Musco LED system luminaire is markedly different in design than Musco’s metal halide system. While the traditional metal halide luminaire was efficient and provided class leading light control, the Musco LED luminaire has advanced light control even further. Note the two images below.

Musco is a leading international sports lighting company with thousands of installations worldwide. We are leaders in the development of LED technology for sports lighting applications. Some high profile installations in the UK include:

- Twickenham Stadium
- Emirates Stadium
- Wimbledon Centre Court
- Tottenham Hotspur – New Stadium Development

To following images of completed projects illustrate the enhanced spill control of the LED system over traditional metal halide technologies.
Installation of Musco LED system on two hockey pitches. Light levels are 350 lux & 500 lux.
3. **Patented Technological Advancements**

The Musco LED system is designed to perform for more than ten times as long as traditional metal halide system (L90 51,000 hours). This means less maintenance required, thus less disturbance on the surrounding area. Musco offers a fully inclusive 10 year warranty with the entire system, so it will never fall into disrepair.

The environmental impact with regard to energy consumption and CO2 emissions is significantly reduced with the proposed LED system. Analysis of both technologies shows the LED system will reduce energy and CO2 emissions by around 66% over 2kW metal halide systems.

In addition metal halide systems apply a maintenance factor, typically of 0.8 to counteract light depreciation. It should be noted that this will result in initial light levels including spill being 25% higher than the average designed lighting level on metal halide solutions.

**Attachments**

1. 18599D Lighting Design
2. TLC-LED-1150W Luminaire Data Sheet
**Lighting System**

<table>
<thead>
<tr>
<th>Pole ID</th>
<th>Pole Height</th>
<th>Mtg Height</th>
<th>Fixture Qty</th>
<th>Luminaire Type</th>
<th>Load</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1, P3-P4, P6</td>
<td>18.0</td>
<td>18.0</td>
<td>7</td>
<td>TLC-LED-1150</td>
<td>8.05 kW</td>
<td>A</td>
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<tr>
<td>P2, P5</td>
<td>18.0</td>
<td>18.0</td>
<td>6</td>
<td>TLC-LED-1150</td>
<td>6.90 kW</td>
<td>A</td>
</tr>
</tbody>
</table>

**Group Summary**

<table>
<thead>
<tr>
<th>Group</th>
<th>Description</th>
<th>Load</th>
<th>Fixture Qty</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>GAA Pitch</td>
<td>46.0 kW</td>
<td>40</td>
</tr>
</tbody>
</table>

**Fixture Type Summary**

<table>
<thead>
<tr>
<th>Type</th>
<th>Source</th>
<th>Wattage</th>
<th>Lumen</th>
<th>L90</th>
<th>L80</th>
<th>L70</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLC-LED-1150</td>
<td>LED 5700K - 75 CRI</td>
<td>11500</td>
<td>121,000</td>
<td>&gt;51,000</td>
<td>&gt;51,000</td>
<td>&gt;51,000</td>
<td>40</td>
</tr>
</tbody>
</table>

**Light Level Summary**

<table>
<thead>
<tr>
<th>Grid Name</th>
<th>Calculation Metric</th>
<th>Avg</th>
<th>Min</th>
<th>Max</th>
<th>Min/Max</th>
<th>Min/Ave</th>
<th>Groups</th>
<th>Fixture Qty</th>
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</thead>
<tbody>
<tr>
<td>100m Spill Blanket</td>
<td>Horizontal</td>
<td>3.22</td>
<td>0</td>
<td>106</td>
<td>0.00</td>
<td>0.00</td>
<td>A</td>
<td>40</td>
</tr>
<tr>
<td>100m Spill Blanket</td>
<td>Max Vertical Buminess (by Light Bank)</td>
<td>4.48</td>
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<td>186</td>
<td>0.00</td>
<td>0.00</td>
<td>A</td>
<td>40</td>
</tr>
<tr>
<td>GAA Pitch</td>
<td>Horizontal Buminess</td>
<td>0.16</td>
<td>0</td>
<td>8.72</td>
<td>0.00</td>
<td>0.00</td>
<td>A</td>
<td>40</td>
</tr>
<tr>
<td>LTW 1</td>
<td>Max Vertical Buminess Metric</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>A</td>
<td>40</td>
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<tr>
<td>LTW 2</td>
<td>Max Vertical Buminess Metric</td>
<td>0.14</td>
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<td>0.85</td>
<td>0.00</td>
<td>0.00</td>
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<td>40</td>
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<tr>
<td>LTW 3</td>
<td>Max Vertical Buminess Metric</td>
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<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>A</td>
<td>40</td>
</tr>
<tr>
<td>LTW 4</td>
<td>Max Vertical Buminess Metric</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>A</td>
<td>40</td>
</tr>
<tr>
<td>Soccer</td>
<td>Horizontal Buminess</td>
<td>512</td>
<td>436</td>
<td>676</td>
<td>0.65</td>
<td>0.85</td>
<td>A</td>
<td>40</td>
</tr>
</tbody>
</table>
ILLUMINATION SUMMARY

Colaiste Eoin School

Blackrock, LEINSTER

GRID SUMMARY

Name: 100m Spill Blanket
Size: 100.0m x 64.0m
Spacing: 10.0m x 10.0m
Height: 1.0m above grade

ILLUMINATION SUMMARY

Scan Average: 3.32
Minimum: 0
No. of Points: 800

LUMINARIES INFORMATION

Reported per TM-21-11. See luminaire datasheet for details.

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with ESMA RP 6-13.

Electrical System Requirements: Refer to Amperage Datasheet and/or the “Musco Control System Summary” for electrical sizing.

Installation Requirements: Results assume a 3% nominal voltage drop on line side of the driver and structures located within 3 feet (0.9m) of design locations.

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Colaiste Eoin School
Blackrock, LEINSTER

GRID SUMMARY
Name: LTW 1
Spacing: 5.0m
Height: 1.5m above grade

ILLUMINATION SUMMARY
MAINTAINED MAX VERTICAL LUX
Scan Average: 0.0000
Maximum: 0.00
Minimum: 0.00
No. of Points: 23

LUMINAIRE INFORMATION
Color / CRI: 5700K - 75 CRI
Luminaire Output: 121,000 lumens
No. of Luminaires: 40
Total Load: 46.0 kW

Lumen Maintenance
Luminaire Type L90 hrs L80 hrs L70 hrs
TLC-LED-1150 >51,000 >51,000 >51,000
Reported per TM-21-11. See luminaire datasheet for details.

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the “Musco Control System Summary” for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.
Colaiste Eoin School
Blackrock, LEINSTER
GRID SUMMARY
Name: LTW 2
Spacing: 5.0m
Height: 1.5m above grade

ILLUMINATION SUMMARY
MAINTAINED MAX VERTICAL LUX
Scan Average: 0.1422
Maximum: 0.85
Minimum: 0.00
No. of Points: 18

LUMINAIRE INFORMATION
Color / CRI: 5700K - 75 CRI
Luminaire Output: 121,000 lumens
No. of Luminaires: 40
Total Load: 46.0 kW

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.
Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.
Electrical System Requirements: Refer to Amperage Draw Chart and/or the "Musco Control System Summary" for electrical sizing.
Installation Requirements: Results assume ±3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

Reported per TM-21-11; see luminaire datasheet for details.
Guaranteed Performance:

Pole location(s) are relative to 0,0 reference point(s).
EQUIPMENT LIST FOR AREAS SHOWN

<table>
<thead>
<tr>
<th>Pole</th>
<th>Location</th>
<th>Min Elevation</th>
<th>Max Elevation</th>
<th>Luminaires</th>
<th>Qty</th>
<th>Poles</th>
<th>Overhead</th>
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<tbody>
<tr>
<td>P1</td>
<td>P1, P3-P4</td>
<td>18m</td>
<td>-</td>
<td>TLC-LED-1150</td>
<td>7</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>P2</td>
<td>P2, P5</td>
<td>18m</td>
<td>-</td>
<td>TLC-LED-1150</td>
<td>6</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

TOTALS: 40 Luminaires

Pole locations are relative to grid reference points.

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the "Musco Control System Summary" for electrical sizing.

Installation Requirements: Results assume ±3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

ISLUMINATION SUMMARY

Name: LTW 3
Spacing: 5.0m
Height: 1.5m above grade

Scan Average: 1.2238
Maximum: 8.73
Minimum: 0.00
No. of Points: 26

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the "Musco Control System Summary" for electrical sizing.

Installation Requirements: Results assume ±3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

Colaiste Eoin School
Blackrock, LEINSTER

GRID SUMMARY

Name: LTW 3
Spacing: 5.0m
Height: 1.5m above grade

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

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Colaiste Eoin School
Blackrock, LEINSTER

GRID SUMMARY

Name: LTW 3
Spacing: 5.0m
Height: 1.5m above grade

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

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Installation Requirements: Results assume ±3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.
EQUIPMENT LIST FOR AREAS SHOWN

<table>
<thead>
<tr>
<th>Location</th>
<th>Size</th>
<th>Grade</th>
<th>Elevation</th>
<th>Mounting Height</th>
<th>Pole No.</th>
<th>Pole Location</th>
<th>Luminaires</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1, P3-P4</td>
<td>18m</td>
<td>-</td>
<td>0</td>
<td>18m</td>
<td>T16-155</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>P2, P5</td>
<td>18m</td>
<td>-</td>
<td>0</td>
<td>18m</td>
<td>T16-155</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

**GRID SUMMARY**

Name: LTW 4
Spacing: 5.0m
Height: 1.5m above grade

**ILLUMINATION SUMMARY**

**MAINTAINED MAX VERTICAL LUX**

Scan Average: 0.0000
Maximum: 0.00
Minimum: 0.00
No. of Points: 41

**LUMINAIRE INFORMATION**

Color / CRI: 5700K - 75 CRI
Luminaire Output: 121,000 lumens
No. of Luminaires: 40
Total Load: 46.0 kW

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the "Musco Control System Summary" for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.
Colaiste Eoin School
Blackrock, LEINSTER

EQUIPMENT LAYOUT

INCLUDES:
· GAA Pitch
· Soccer

Electrical System Requirements: Refer to Amperage Draw Chart and/or the "Musco Control System Summary" for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

EQUIPMENT LIST FOR AREAS SHOWN

<table>
<thead>
<tr>
<th>Pole P1, P3-P4</th>
<th>Location</th>
<th>Size</th>
<th>Grade</th>
<th>Elevation</th>
<th>Mounting Height (m)</th>
<th>Luminaires Type</th>
<th>QTY P/L</th>
<th>P6</th>
<th>TLC-LED-1150</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2, P5</td>
<td>Location</td>
<td>Size</td>
<td>Grade</td>
<td>Elevation</td>
<td>Mounting Height (m)</td>
<td>Luminaires Type</td>
<td>QTY P/L</td>
<td>TLC-LED-1150</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

SINGLE LUMINAIRE AMPERAGE DRAW CHART

<table>
<thead>
<tr>
<th>Ballast Specified</th>
<th>Single Phase Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLC-LED-1150</td>
<td>208 (60)</td>
</tr>
<tr>
<td></td>
<td>220 (60)</td>
</tr>
<tr>
<td></td>
<td>240 (60)</td>
</tr>
<tr>
<td></td>
<td>277 (60)</td>
</tr>
<tr>
<td></td>
<td>347 (60)</td>
</tr>
<tr>
<td></td>
<td>380 (60)</td>
</tr>
<tr>
<td></td>
<td>480 (60)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Single Phase Voltage</th>
<th>Line Amperage Per Lumenante</th>
</tr>
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<tbody>
<tr>
<td>208 (60)</td>
<td>0.6</td>
</tr>
<tr>
<td>220 (60)</td>
<td>0.6</td>
</tr>
<tr>
<td>240 (60)</td>
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<tr>
<td>277 (60)</td>
<td>0.6</td>
</tr>
<tr>
<td>347 (60)</td>
<td>0.6</td>
</tr>
<tr>
<td>380 (60)</td>
<td>0.6</td>
</tr>
<tr>
<td>480 (60)</td>
<td>0.6</td>
</tr>
</tbody>
</table>

Pole location(s) [Dimensions are relative to EQ reference point(s)]
Galvanized steel pole
Precast concrete base
10 ft (3 m)

POLE(S): P1, P3, P4, P6
Musco 60FT Light-Structure System™ pole
TLC for LED™ luminaires

Scale: 1:100
Galvanized steel pole
Precast concrete base
Electrical components enclosure
Pole-top luminaire assembly

POLE(S): P2, P5
Musco 60FT Light-Structure System™ pole
TLC for LED™ luminaires

Ground level

0 2m 4m
SCALE: 1:100