

C874 Castletreasure Residential Development LIGHTING ANALYSIS



Planning Stage
Rev 02

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DOCUMENT CONTROL & HISTORY

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1.0 EXECUTIVE SUMMARY

The report considers the lighting design as developed by O'Connor Sutton Cronin (OCSC) and outlines the design intent and considerations with regards to transport, cyclists, pedestrians whilst also taking into account bats and other wildlife (e.g. birds) within the Castletreasure residential development. The lighting design complies with the regulations services such as ETCI National Rules for Electrical Installations ET101:2008, Bat Conservation Ireland 2010. Bats and Lighting: Guidance Notes for Planners, Engineers, Architects and Developers. Bat Conservation Ireland, BCT (Bat Conservation Trust) and ILP (Institution of Lighting Professionals). 2018. Bats and Artificial Lighting in the UK. Bats and the Built Environment Series. Guidance Note 08/18. England, UK. Cork County Council Public Lighting Installations and British Standards Institution 5489-1:2013 Code of practice for the design of road lighting Part 1: Lighting of roads and public amenity areas lighting regarding illumination levels. The design criteria is outlined in Section 3.0.

The report has been developed with the following principal considerations:

- Provide adequate illumination to contribute towards the safe use of the roadways, footpaths and pedestrian walkways.
- Contain the lighting within the site.
- Minimise light pollution and visual glare for pedestrians and neighbouring areas.
- Enhance security.
- Minimise the impact of lighting on bats and birds use of the site.

The predicted performance of the external lighting installations has been assessed in detail using Lighting Simulation software. The Lighting Simulation software used was Lighting Reality; which includes isoline contour capabilities.

Our design intent comprising of column lighting for the roadways and footpaths are described in Section 4.0. An indicative example of the type of proposed luminaires (light fitting) and associated lamp specification have been included, with accompanying images, photometric and dimensional data.

Section 5.0 provides analysis of the predicted illumination results for the roadways, footpaths and pedestrian walkways.

2.0 INTRODUCTION

The proposed strategic housing development will consist of the construction of a strategic housing development comprising 472 residential units, a crèche and all associated ancillary development works.

The proposed 472 no. residential units are broken down as follows:

- 234 no. semi-detached and terraced houses comprising 67 no. 4 bed units and 167 no. 3 bed units;
- 93 no. duplexes/apartments and 145 no. apartments (in Blocks A, B, C & D) comprising 76 no. 1 bed units, 123 no. 2 bed units and 39 no. 3 bed units.

The development also includes a number of play areas, active amenity spaces and circa 4.4 hectares of landscaped parkland which runs northwest to southeast through the site. A section of the Ballybrack Greenway is also provided within the parkland which will connect to the existing Cork County Council cycle network at the site's western boundary via the existing Irish Water Pumping Station compound, and to the future expansion of the Greenway towards Maryborough at the site's eastern boundary.

Primary access to the proposed development will be from a new signalised junction on to Carr's Hill/Carrigaline Road (R609), which will also serve a 24 classroom Primary School (permitted under Cork County Council planning application ref. 18/5369 / An Bord Pleanála, ref. ABP-302924-18) and which is located on land within the ownership of the applicant. Upgrades are also proposed to the Carr's Hill/Carrigaline Road (R609) including road widening, traffic calming and footpath connections. A second access point and footpath connections will be provided onto the Carr's Hill/Carrigaline Road (R609) (serving 98 apartments in Blocks B, C & D only) and access will also be provided via the adjoining Temple Grove residential area.

Provision is also made for the diversion of the existing 300mm Irish Water watermain, the construction of an underground wastewater pumping station and rising main to serve Apartment Blocks B, C and D, and all other associated ancillary site development works including ground works and retaining structures, foul drainage, stormwater drainage, water supply, 7 no. electrical substation kiosks, service ducting and cabling, boundary treatments, access roads including a vehicular and pedestrian bridge over the Moneygurney Stream, gateway treatment/signage on the Carr's Hill/Carrigaline Road (R609), bicycle and car parking and landscaping. A temporary single storey marketing suite, adjoining the Carr's Hill/Carrigaline Road (R609), and signage (including hoarding) will be provided during the construction phases.

A lighting class of P3 is required within the residential development with results outlined in Section 5 of this report. A lighting class of P2 on the proposed Carrs Hill Road entrance and a lighting conflict class C3 at the development entrance from the proposed Carrs Hill Road is required with results outlined in Section 5 of this report.

The site was surveyed by Kelleher Ecology Services Ltd. and they note in Chapter 8 Biodiversity of the EIAR, Section 8.5.4.2 Operational Phase Impacts, that operational stage disturbance effects also include disturbance to bats arising from artificial light spillage into the environment from the associated lighting scheme. Lighting types that emit a narrow spectrum with no UV (*e.g.* low pressure sodium) attract relatively less insects than broad spectrum types with high or low UV (*e.g.* high pressure sodium, Metal halide and mercury; see Bat Conservation Ireland 2010, Stone 2013). Therefore, the narrow spectrum types with no UV have a relatively lower impact on bats by not attracting their insect prey base away from the nearby habitats where bats will be searching for prey (see Bat Conservation Ireland 2010, Stone 2013). The use of directional lighting and luminaire accessories (shield, louvre) are also very successful approaches to reducing light spillage nuisance into the surrounding environment (see Bat Conservation Ireland 2010, Stone 2013, BCT & ILP 2018) in relation to bats. Of course, minimising light spillage nuisance also benefits other fauna that are active/resting at night. In this case, areas of the study site that are considered sensitive to artificial lighting in relation to bats coincide with linear woody habitats or wildlife corridors.

3.0 DESIGN CRITERIA

The design criteria applied to the proposed roadways, footpaths and bat 'conscious' lighting installation shall be in accordance with ETCI National Rules for Electrical Installations ET101:2008 as well as Cork County Council Public Lighting Installations, British Standards Institution 5489-1:2013 Code of practice for the design of road lighting & Bat Conservation Ireland 2010. Bats and Lighting: Guidance Notes for Planners, Engineers, Architects and Developers. Bat Conservation Ireland, BCT (Bat Conservation Trust) and ILP (Institution of Lighting Professionals). 2018. Bats and Artificial Lighting in the UK. Bats and the Built Environment Series. Guidance Note 08/18. England, UK.

It is noted that an ecological study was conducted by Kelleher Ecology Services Ltd. at the Castletreasure site.

The key items in focusing the design are as described below:

1. Compliance with lighting regulations for the roadways, footpaths and pedestrian walkways functionality
2. Mitigate light spill onto adjoining trees, hedgerows and watercourses
3. Requirement to safeguard bat & birds against light emission

To address these points the following measures were put in place:

1. Consciously positioned, so as to limit negative spill and light pollution whilst also maintaining the required lux levels uniformly across the roadways, footpaths and pedestrian walkways.
2. Narrow beam optics are employed to physically contain unnecessary light spillage and light pollution.
3. The use of backlight shielding plates on luminaires positioned in proximity of light sensitive habitat features such as hedgerows, treelines and woodland to maintain a light level of 1 lux or less.

3.1 GUIDELINES TO ROADWAYS AND FOOTPATHS LIGHTING DESIGN

The points below were used as guidelines where practical in the design of the external lighting.

- Cool white light (4000K) LED luminaire.
- Minimum lux levels shall be used as required by Cork County Council Public Lighting (Classification P3)
- Cork County Council public lighting guidance document for roadways and footpaths are to be designed to conform with required lux levels with an average of 7.5 lux

	\bar{E}	E_{min}
P1 or S1	15.0	3.0
P2 or S2	10.0	2.0
P3 or S3	7.5	1.5
P4 or S4	5.0	1.0
P5 or S5	3.0	0.6
P6 or S6	2.0	0.4

Table 3.1 - P Classification BS 5489-1:2013

- Roadways and footpaths at the Castletreasure site will be designed to classification P3.
- To comply with P3 lighting classification the following parameters must be adhered to;
 1. Average Horizontal Illuminance (\bar{E}) must be an average of 7.5 lux.
 2. Minimum Horizontal Illuminance (E_{min}) must be a minimum of 1.5 lux.
 3. It is recommended that the actual overall uniformity of illuminance (U_o) be as high as reasonably practicable.

3.2 GUIDELINES TO MAIN ROAD LIGHTING DESIGN

The points below were used as guidelines where practical in the design of the external lighting.

- Cool white light (4000K) LED luminaire.
- Minimum lux levels shall be used as required by Cork County Council Public Lighting (Classification P2)
- Cork County Council public lighting guidance document for Main Roads are to be designed to conform with required lux levels with an average of 10 lux

	\bar{E}	E_{min}
P1 or S1	15.0	3.0
P2 or S2	10.0	2.0
P3 or S3	7.5	1.5
P4 or S4	5.0	1.0
P5 or S5	3.0	0.6
P6 or S6	2.0	0.4

Table 3.2 - P Classification BS 5489-1:2013

- Main Road at the Castletreasure site will be designed to classification P2.
- To comply with P2 lighting classification the following parameters must be adhered to;
 1. Average Horizontal Illuminance (\bar{E}) must be an average of 10 lux.
 2. Minimum Horizontal Illuminance (E_{min}) must be a minimum of 2.0 lux.
 3. It is recommended that the actual overall uniformity of illuminance (U_o) be as high as reasonably practicable.

4.0 PROPOSED INSTALLATIONS

The proposed residential development roadways, footpaths and pedestrian walkways will require illumination and shall for the purposes of this report comprise of the lighting installation of the Castletreasure Residential Development.

It is proposed that the development roadways and footpaths will accommodate 6 metre high columns and it is proposed that the Carrs Hill Main Road will accommodate 8 metre high columns. To ensure compliance with guidelines and standards Cork County Council do not permit the use of bollard lighting. Two of the main reasons for this are:

- Inefficiency - using bollards is an inefficient way of lighting an area.
- Safety

4.1 Column Lighting for Development Roadways and Footpaths

It is proposed to provide 6m high column type light fittings for the roadways and footpaths in order to achieve average illumination levels.

The proposed column light fittings are indicatively displayed in the accompanying images.

Proposed Light Fitting A (Wide Optic) as per Lighting Reality Report

The indicative luminaires selected would be provided with 1 x 21 Watt LED lamp module, with a lamp output of 3320 lumens and colour temperature 4000K.

The photometric curve displayed indicates how all light output is directed downwards (0-90° angle); i.e. no risk of sky glow.

Fig 4.1.1
Dimensions - Light Fitting no1

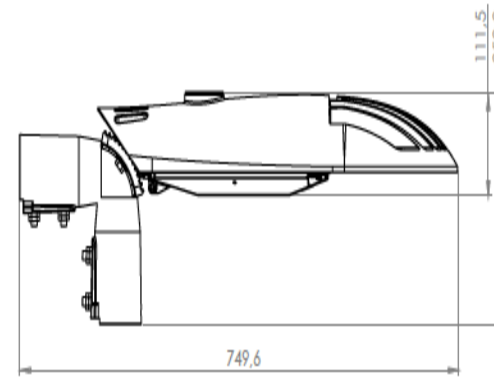
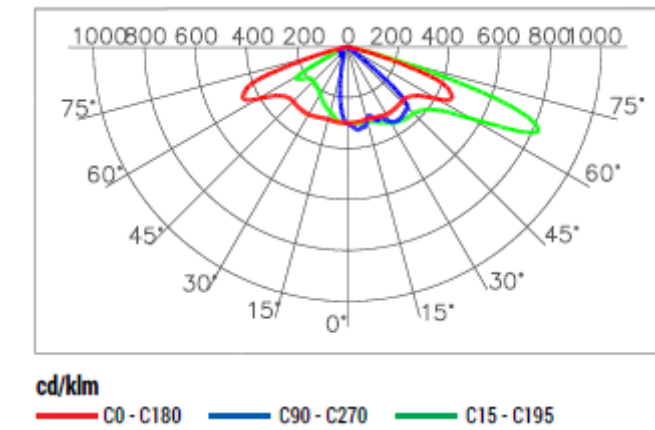


Figure 4.1.2 - Luminaire Mounted on Column- Image



Figure 4.1.3 - Floodlight Luminaire - Photometric Curve



Column Lighting for Development Roadways and Footpaths

It is proposed to provide 6m high column-type light fittings to the roadways and footpaths in order to achieve average illumination levels.

The proposed column light fittings are indicatively displayed in the accompanying images.

Proposed Light Fitting B (Narrow Optic) as per Lighting Reality Report

The indicative luminaires selected would be provided with 1 x 21 Watt LED lamp module, with a lamp output of 3320 lumens and colour temperature 4000K.

The photometric curve displayed indicates how all light output is directed downwards (0-90° angle); i.e. no risk of sky glow

Fig 4.1.4
Dimensions - Light Fitting no2

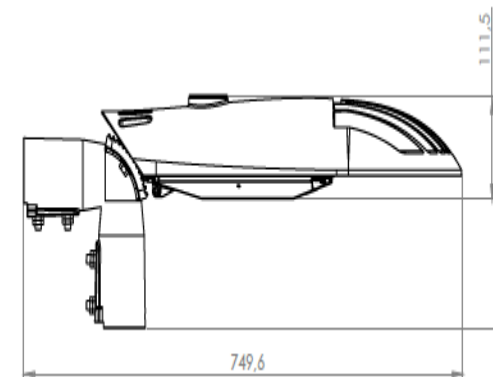
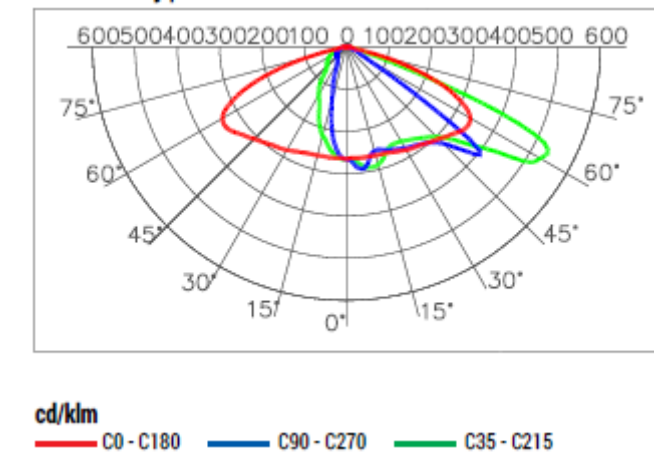


Figure 4.1.5 - Luminaire Mounted on Column- Image



Figure 4.1.6 - Floodlight Luminaire - Photometric Curve



Column Lighting along Main Road (Carrs Hill Road)

It is proposed to provide 8m high column-type light fittings to the Main Road in order to achieve average illumination levels.

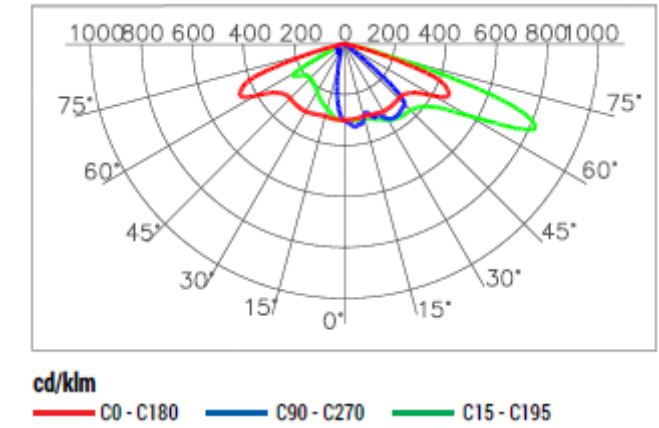
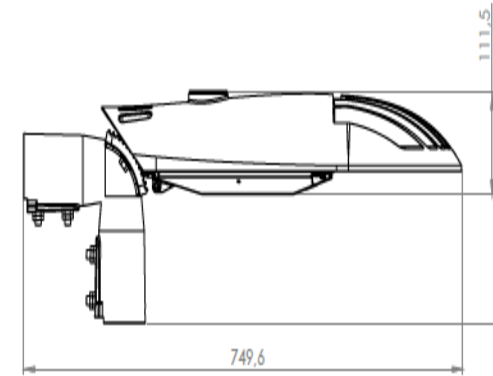
The proposed column light fittings are indicatively displayed in the accompanying image.

Proposed Light Fitting C as per Lighting Reality Report

The indicative luminaires selected would be provided with 1 x 41 Watt LED lamp module, with a lamp output of 5807 lumens and colour temperature 4000K.

The photometric curve displayed indicates how all light output is directed downwards (0-90° angle); i.e. no risk of sky glow

<p>Fig 4.1.7 Dimensions - Light Fitting no2</p>	<p>Figure 4.1.8 - Luminaire Mounted on Column- Image</p>	<p>Figure 4.1.9 - Floodlight Luminaire - Photometric Curve</p>
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4.2 Column Lighting Functionality

4.2.1 Pre-programming Ability / Dimmable Functionality & Telemetry

All lanterns shall be fitted with smart electronic ballasts suitable for use with the Cork City Council proposed method of lighting control with programmable DALI drivers. The drivers shall have dimming capability of 75% full light output between mid-night and 6am, have a 90% CLO (Constant Light Output) type, have a segment controller at street level for the onward forwarding of data and control signalling to / from a server.

The Public Lighting system of Cork City Council shall also incorporate a facility for remote monitoring and diagnostics.

The installation will be directly compatible with lighting control management software in use by Cork City Council.

4.2.2 Photocells

Switching control of the lighting columns will be achieved by means of miniature photocell control. Each individual lantern shall be capable of being switched "ON" from dusk to dawn, unless otherwise requested by Cork City Council.

An individual solid-state one-part Photo-Electric Control Unit (PECU) which will include a "fail safe" circuit that switches the lantern on in the event of photocell failure will control each lantern.

The PECU will incorporate a phototransistor complying with I.S.428: 1991 as the light sensor; e.g. SELC 84 by Solar Enterprises Ltd., or equivalent approved by the Council.

The PECU will be designed to fit the 6 pin NEMA socket provided on each lantern.

Each lantern will be fitted with a miniature photocell unless otherwise directed by the Engineer. The miniature photocell shall have a minimum IP65 rating.

The lanterns will have an integrated miniature photocell, switching at 35/18 lux levels. A control cable shall be installed from the miniature photocell to the column door to allow for future programming.



5.0 RESULTS

5.1 Ground Illumination for Development Estate 1

Figure 5.1.1 indicates results of the predicted illumination levels on Ground for the proposed installation. Refer to drawing KE/CRC/01.

The results indicate:

- These levels are based upon a 6 metre high pole with pole top lanterns.
- The Average Horizontal Illuminance is 8.01 Lux P3 compliant.
- The Minimum Horizontal Illuminance is 1.57 Lux P3 compliant.
- The Overall Uniformity U_o of 0.20 is achieved.

The results from the lighting simulation software, Lighting Reality produced a layout displaying the horizontal illuminance (lux).

Results

Eav	8.01
Emin	1.57
E _{max}	22.78
E _{min} /E _{max}	0.07
E _{min} /E _{av}	0.20

Fig 5.1.1
Illuminance Levels



Fig 5.1.2
Horizontal Illuminance (lux)

Ground Illumination for Development Estate 2 (As per Lighting Reality Report)

Figure 5.1.3 indicates results of the predicted illumination levels on Ground for the proposed installation. Refer to drawing KE/CRC/02.

The results indicate:

- These levels are based upon a 6 metre high pole with pole top lanterns.
- The Average Horizontal Illuminance is 8.69 Lux **P3 compliant**.
- The Minimum Horizontal Illuminance is 1.72 Lux **P3 compliant**.
- The Overall Uniformity U_o of 0.20 is achieved.

The results from the lighting simulation software, Lighting Reality produced a layout displaying the horizontal illuminance (lux).

Results

Eav	8.69
Emin	1.72
E _{max}	22.21
E _{min} /E _{max}	0.08
E _{min} /E _{av}	0.20

Fig 5.1.3
Illuminance Levels



Fig 5.1.4
Horizontal Illuminance (lux)

Ground Illumination for Main Road 1 (As per Lighting Reality Report)

Figure 5.1.5 indicates results of the predicted illumination levels on Ground for the proposed installation. Refer to drawing KE/CRC/03.

The results indicate:

- These levels are based upon an 8 metre high pole with pole top lanterns.
- The Average Horizontal Illuminance is 12.27 Lux **P2 compliant**.
- The Minimum Horizontal Illuminance is 2.90 Lux **P2 compliant**.
- The Overall Uniformity U_0 of 0.24 is achieved.

The results from the lighting simulation software, Lighting Reality produced a layout displaying the horizontal illuminance (lux).

Results

Eav	12.27
Emin	2.90
E _{max}	31.27
E _{min} /E _{max}	0.09
E _{min} /E _{av}	0.24

Fig 5.1.5
Illuminance Levels

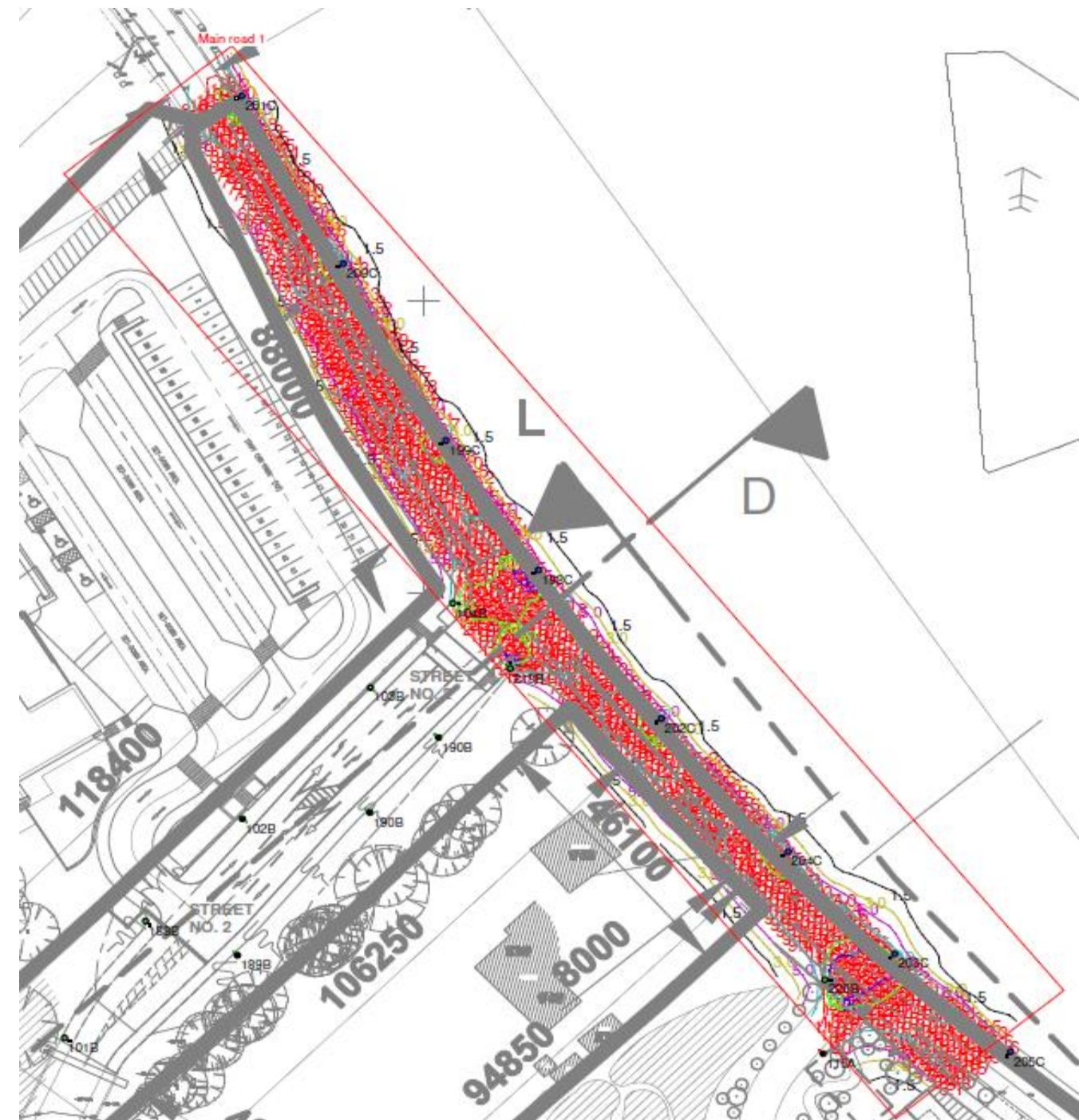


Fig 5.1.6
Horizontal Illuminance (lux)

Ground Illumination for Main Road 2 (As per Lighting Reality Report)

Figure 5.1.7 indicates results of the predicted illumination levels on Ground for the proposed installation. Refer to drawing KE/CRC/03.

The results indicate:

- These levels are based upon an 8 metre high pole with pole top lanterns.
- The Average Horizontal Illuminance is 10.92 Lux **P2 compliant**.
- The Minimum Horizontal Illuminance is 2.45 Lux **P2 compliant**.
- The Overall Uniformity U_o of 0.22 is achieved.

The results from the lighting simulation software, Lighting Reality produced a layout displaying the horizontal illuminance (lux).

Results

Eav	10.92
Emin	2.45
Emax	24.27
Emin/Emax	0.10
Emin/Eav	0.22

Fig 5.1.7
Illuminance Levels

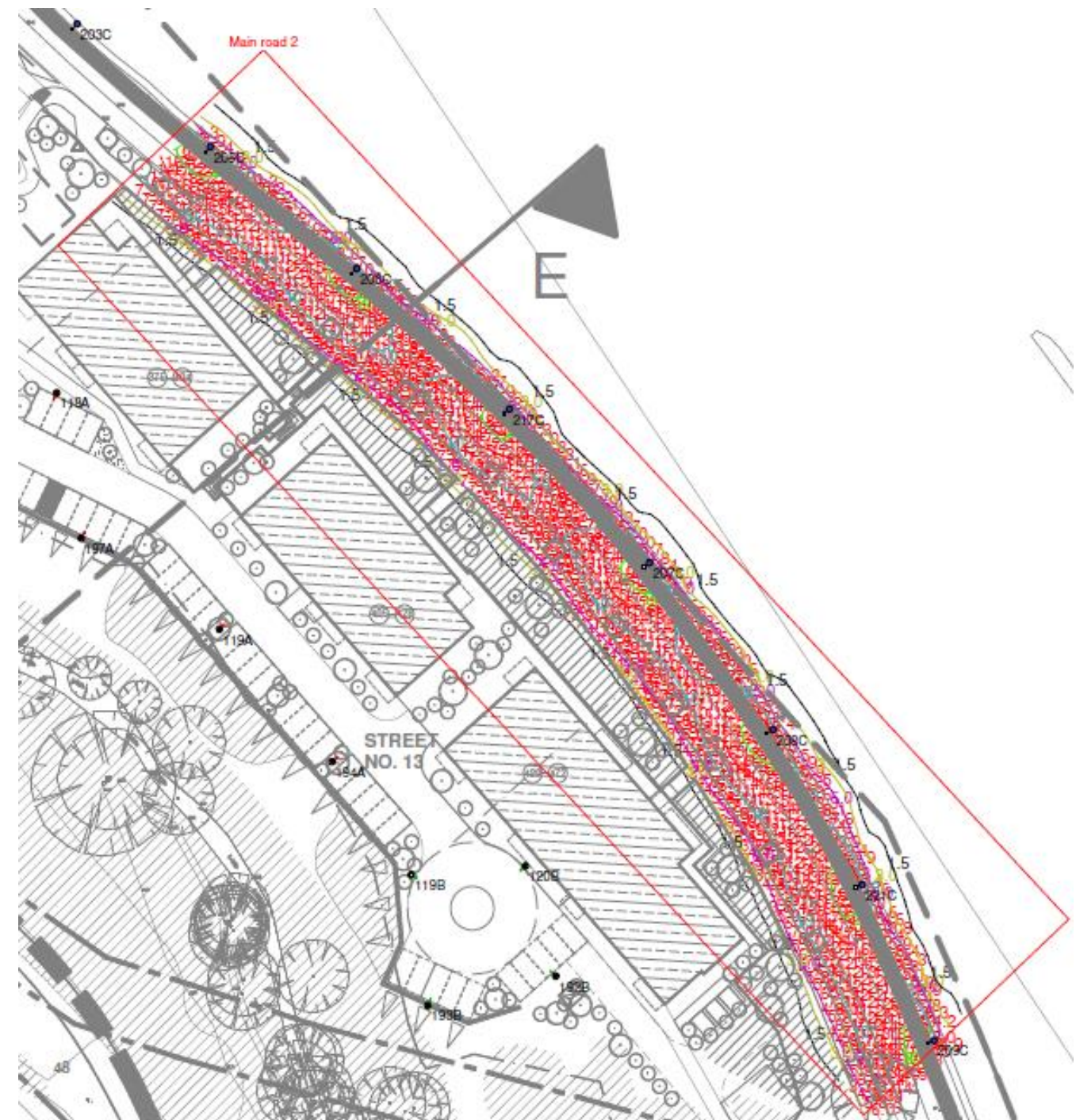


Fig 5.1.8
Horizontal Illuminance (lux)

6.0 CONCLUSION

As shown in Figure 5.1.2, Figure 5.1.4, Figure 5.1.6 and Figure 5.1.8 the illumination throughout the Castletreasure Development meets the lighting design requirements.

It should be noted that the results in Figure 5.1.2, Figure 5.1.4, Figure 5.1.6 and Figure 5.1.8 show the design intent only. Additional lamp standards may be required during the course of detailed design to ensure P2 and P3 Classification is adhered to ensuring lux level requirements are maintained throughout.

This report should be read in conjunction with the Lighting Reality Output Report KE/RE/CRC/01 and Lighting Layouts KE/CRC/01, KE/CRC/02 and KE/CRC/03.