

Buckingham Group Contracting Ltd

**170248 Headbolt Lane New
Station**

Light Obtrusion Assessment
Amendment

170248-ARU-REP-EEN-000023

Issue 1 | 30 July 2021

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 276736

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1 Introduction

1.1 Background

Headbolt Lane is an infrastructure project that will extend the Merseyrail network from the existing terminating station at Kirkby to a new station to be constructed at Headbolt Lane.

Figure 1: Site Location (boundary in red)



Arup was instructed to survey and report on the existing and likely artificial lighting conditions due to the Headbolt Lane Project (HBL) in relation to current guidance for limiting the effects of light obtrusion and the design proposals for external lighting for the station platforms and car parks

The findings were published in report reference: 170248-ARU-REP-EEN-000023.

The key findings were:

- Existing lighting in the neighbourhood uses a mix of older lighting technologies and some modern LED sources.
- The GRIP4 lighting proposals use LED technology with enhanced optical control, reduced direct upward light potential and reduced blue wavelength light (i.e. less impactful on the nocturnal environment).
- Controls are also applied to the proposals to reduce lighting levels when the station is off-peak (e.g. post-curfew) and to respond to low usage with dimming in response to occupancy sensing.
- These measures will offer improved mitigation of light obtrusion effects versus the existing street lighting LED luminaires near the site.

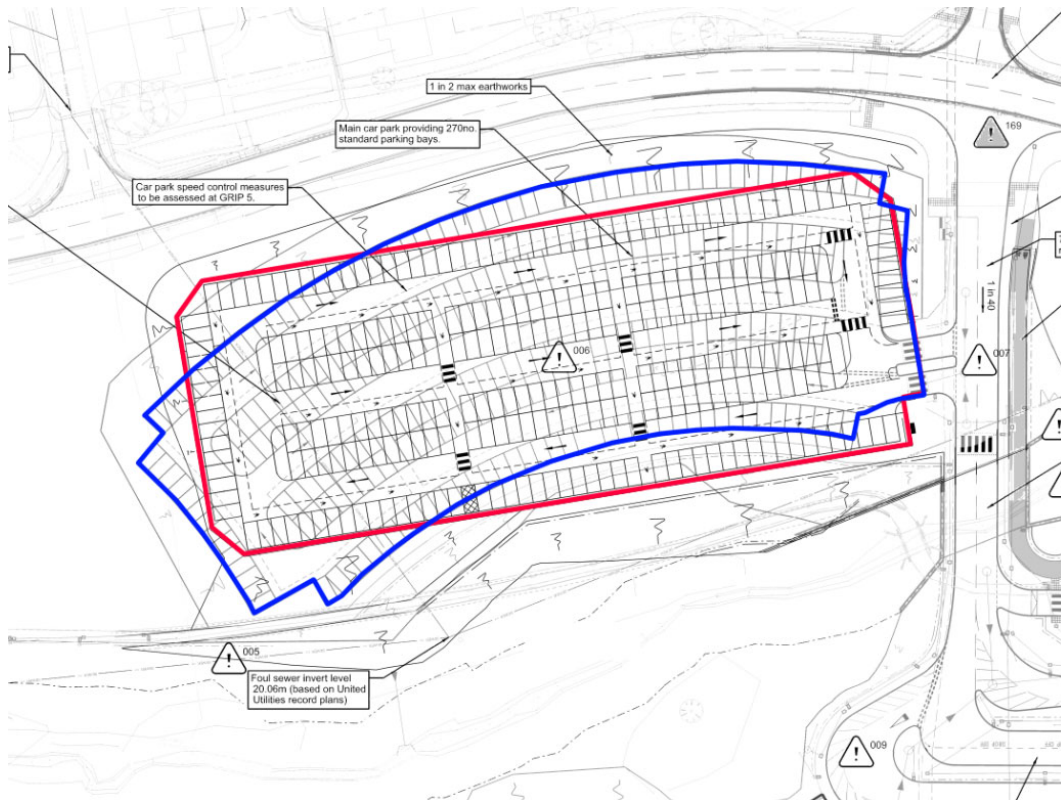
- Simulations demonstrated how the provision of external is deemed to satisfy the recommendations of ILP¹ Guidance Note GN01 (2020): Guidance Notes for the Reduction of Obtrusive Light for nearby dwellings.
- The footpath area will see an increase in light because it is presently unlit, however the design will seek to reduce light spill over the watercourse where possible.

The objective of this amendment is to compare an alternative car park configuration and consider whether this may affect the findings of the previous light obtrusion assessment.

2 Two Car Park Options

The car park layout assessed in 170248-ARU-REP-EEN-000023 is shown in red below in Figure 2. The alternative car park proposal is marked in blue.

Figure 2: Alternative car park proposals



At this stage in the design process, the final details of the external lighting scheme are not confirmed. This amendment is based around the GRIP4 proposals, the objectives and performance of which will form the basis of the GRIP5 proposals.

¹ Institute of Lighting Professionals

2.1 Appraisal

The following performance assessment metrics were set out in 170248-ARU-REP-EEN-000023 are considered in this amendment:

- Colour temperature, colour rendering and spectral performance.
- Upward Flux Ratio calculation
- Upward Light Ratio analysis
- Light source intensity visible from multiple observer locations beyond the site (Figure 3, red/orange/yellow)
- Light intrusion experienced by each dwelling (Figure 3, blue)
- Isolines to describe the illuminance conditions at ground level

Figure 3: Light obtrusion assessment points



2.2 Lighting Commentary

The following section considers the potential for the alternative car park scenario to adversely affect the findings of the assessment in 170248-ARU-REP-EEN-000023.

2.2.1 Colour temperature, colour rendering and spectral performance

It is not anticipated that the alternative car park proposal would require a change to the specified colour temperature, colour rendering and spectral performance characteristics.

Therefore, it is considered unlikely that the alternative car park proposal will adversely affect the conclusions of the lighting quality assessment in 170248-ARU-REP-EEN-000023.

2.2.2 Upward Flux Ratio (UFR)

Upward Flux Ratio considers the direct and reflected upward light resultant from the area being illuminated. The net area of the two car park options is similar and the arrangement of perimeter and island parking spaces is also comparable. Therefore, it is unlikely that the rationale behind the luminaire optics selected for either car park option will need to change. Under the assumption that the same road surface type will also be applied to either option, the reflectance coefficient for the indirect upward light will not be affected.

The assessment in 170248-ARU-REP-EEN-000023 concluded that the UFR was substantially lower than the required maximum for a suburban location.

Therefore it is considered unlikely that the alternative car park proposal will adversely affect conclusions of the UFR assessment.

2.2.3 Upward Light Ratio (ULR)

All luminaires selected were selected to have horizontal cut-off characteristics, i.e. zero direct upward light is emitted from the luminaires.

Under the assumption the luminaire optical performance will be the same for both car park options, it is unlikely that the alternative car park proposal will adversely affect the conclusions of the ULR assessment.

2.2.4 Light source intensity

Light source intensity connects the intensity of the source with the visible area of the luminaire and the distance of the observer from the luminaire.

The highest source intensity values were found to be attributable to the platform luminaires facing Fern Close. These will not be affected by either of the car park layouts due to the distance between Fern Close and the car park.

The next highest source intensity values were found on dwellings near Headbolt Lane/Ashburn Avenue (>20m from the car park) and the resultant source intensity was substantially lower (5.8cd) than the ILP maximum recommended intensity of 14.5cd at the same 20m distance. While some columns will move closer to Headbolt Lane (magenta zone in Figure 4), other columns will move further away (green zone in Figure 4). The key consideration is that the alternative proposal will not reduce the proximity of the lighting to these dwellings, maintaining a distance of at least 20m as noted in the previous assessment.

Figure 4: Column movement comparison, relative to Headbolt Lane (See Section 2.2.4)



Under the assumption the luminaire optical performance will be the same for both car park options, it is therefore considered unlikely that the alternative car park proposal will adversely affect the conclusions of the light source intensity assessment.

2.2.5 Illuminance into windows

The illuminance into dwelling windows resultant from the original proposal was found to be $<0.1\text{lux}$ (on the vertical plane at bedroom window height) whereas the maximum permitted illuminance recommended in ILP GN01 is 2.0lux .

Similar to the light source intensity commentary above, while the shape of the alternative car park will move some luminaires closer to Headbolt Lane at the north of the site and others further away, it is not considered that this will significantly increase the illuminance into windows because the light sources remain in excess of 20m from the windows and the intensity in the direction of the windows is predicted to be low. Therefore, it is highly unlikely that the 2.0lux maximum recommended limit will be exceeded.

It was also noted that illumination levels one order of magnitude higher than those predicted by the lighting assessment were recorded during the baseline survey on the pavements north of Headbolt Lane (average 6.0lux horizontal and 4.0lux vertical).

Therefore, under the assumption the luminaire optical performance will be the same for both car park options, it is considered unlikely that the alternative car park proposal will adversely affect the conclusions of the illuminance into windows assessment.

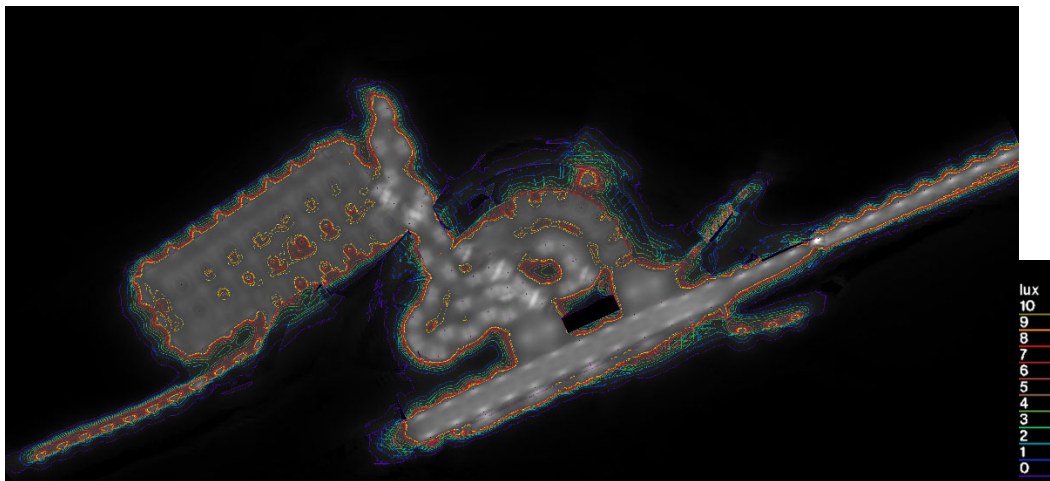
2.2.6 Simulated illuminance: survey points and isolines.

Similar to illuminance into windows commentary above, the orange and red routes (Figure 3) were also predicted to receive <0.2lux horizontal/vertical plan. Again, these values are substantially lower than the ILP recommended maximum for a suburban location.

The yellow route (Figure 3, footpath through the site) will receive a significant increase in artificial light, because it is presently unlit. A full dataset for comparison of the lighting conditions with the baseline is not possible in many cases because the footpath is significantly different in elevation and route, particularly through the centre of the site, in the new landscape scene.

However, by inspection of Figure 5 (a high resolution image was provided in 170248-ARU-REP-EEN-000023, Appendix C) it can be seen that the optical control of the luminaires constrains light close to the road/car-park and footpath areas boundaries; i.e. the 1lux contour does not extend significantly beyond the task areas or over the watercourse. Furthermore, it can also be seen in Figure 2 that the alternative car park does not move closer to the watercourse than the proposed illuminated footpath, the illumination of which can be seen in Figure 5, suggesting that the light spill towards the river will not be significantly different.

Figure 5: Illuminance contours – overhead view



Therefore, under the assumption the luminaire optical performance will be the same for both car park options, it is unlikely that the alternative car park proposal will adversely affect the conclusions of the illuminance assessment for survey points or light spill.

3 Conclusion

The findings of the light obtrusion assessment for the original car park proposal indicated that the lighting quality, source intensity, illuminance and upward light characteristics of the GRIP4 external lighting scheme would satisfy the recommendations in ILP GN01 for limiting the effects of obtrusive light.

The alternative car park proposal amends the shape of the parking area, but it is not considered that a change in the lighting design principles applied to the original scheme will be necessary.

The original assessment concluded the significance of the impact would be negligible and a minor change in column location (approximately 7m further at most) is unlikely to affect the conclusions of the previous study. Therefore, under the assumption that the same design principles are applied to the alternative car park layout, it is considered that the same findings of the original lighting assessment would be likely with alternative car park layout.

As the external lighting design is developed through the subsequent GRIP5 design stages, the performance of the finalised scheme must uphold the findings of the initial study (170248-ARU-REP-EEN-000023) and apply the same principles to design, minimise and assess potential effects of obtrusive light in order to satisfy the recommendations of ILP GN01.