

RESEARCH ON LIGHTING FOR PEDESTRIANS

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One aim of lighting design for residential roads is to make a trade-off between lamp type and illuminance: using a light source of particular spectral characteristics may allow a lower illuminance to be used whilst maintaining the same level of visual benefits, and this may lead to a reduction in energy consumption. This presentation will give a summary of recent research on the relationship between lamp spectrum and brightness in the context of residential roads where lighting design considers primarily the needs of pedestrians rather than drivers.

Lighting in residential roads is needed to provide a road which is safe for people to use and which is also perceived to be safe. The factors contributing to safe movement include the ability to detect obstacles on the pavement which may otherwise be a trip hazard, and the ability to make judgements regarding the intent and or identity of other people at a distance sufficient to take avoiding action if necessary. Perceived safety is influenced by factors such as a general feeling of safety, which may result from a brightly lit street, and a perceived ability to recognise the identity and intent of other road users. There are of course many other environmental factors such as familiarity, prospect and refuge, and regardless of lighting some areas will still feel unsafe. The only thing that lighting can do for certain is to allow you to see better, but if what can be seen is disturbing then this will not alleviate the fear of crime.

Studies of brightness for lamps with different spectral power distributions at illuminances representative of those used for residential road lighting have been made using controlled laboratory conditions and field surveys and the findings from these two approaches are in good agreement. In the mesopic region (the lighting levels found on roads at night time) lamps with a higher scotopic / photopic (S/P) ratio appear brighter at the same illuminance than lamps with lower S/P ratios. This means that lamps with a high S/P ratio can be used either at the same illuminance to create a higher brightness or at a lower illuminance but the same brightness, the latter leading to a reduction in energy consumption. The recently established CIE system of mesopic photometry, which involves S/P ratio, can be used to predict the illuminance reduction that will ensure the same level of brightness for a range of lamps with different spectra.

Other studies have shown that the ability to detect obstacles is influenced by lamp spectrum in a similar manner to brightness, that is, a higher S/P ratio improves obstacle detection. As for the acceptability of the appearance of the environment, this is more consistently related to the colour rendering of the light source than the S/P ratio. How light spectrum affects the ability to recognise the intent of other people is still uncertain.

Given these findings it is possible to modify the illuminances used in residential roads when using different light sources. These illuminances should be chosen based on two characteristic of the light source, S/P ratio and colour rendering index. Reducing illuminance from the levels recommended in the S-series of lighting classes can be considered when using lamps which have a CIE general colour rendering index greater than or equal to 60. Where lamps with a colour rendering index greater than or equal to 60 are to be used, the illuminance reduction allowed can be calculated using the CIE system of mesopic photometry. In the UK it is assumed that the low pressure sodium lamp is the benchmark for the standard illuminances reported in guidance.