Effect of Colored Luminous Surrounds on LED Discomfort Glare

Anecdotal reports suggest that outdoor LED lighting produces more discomfort glare than typical high-pressure sodium lighting. This perception may result from differences between new and traditional outdoor light sources, including spectral power distribution (SPD), source luminance, beam intensity distribution, size and the number of sources in the visual field. Past studies have shown a relationship between glare and SPD, suggesting that SPDs with greater short wavelength content have an increased likelihood of producing discomfort glare. Previous research also has shown that the presence of a luminous field surrounding a bright light source can reduce the viewer's perception of discomfort glare.

The LRC investigated the connection between discomfort glare perception and the SPD of a luminous area surrounding a white LED array, taking into consideration the luminous surround spectrum, brightness perception, and the effect of a luminous surround on an LED array glare stimulus.

Experiment

In the LRC laboratory, subjects were shown a white LED array against a luminous surround with one of three different SPDs (blue, white, or yellow). Different intensities of light from the array and from the luminous surround were presented.

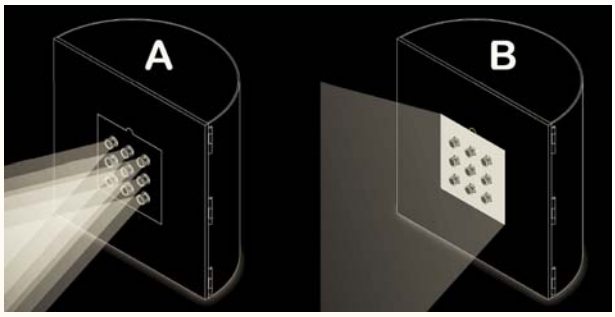
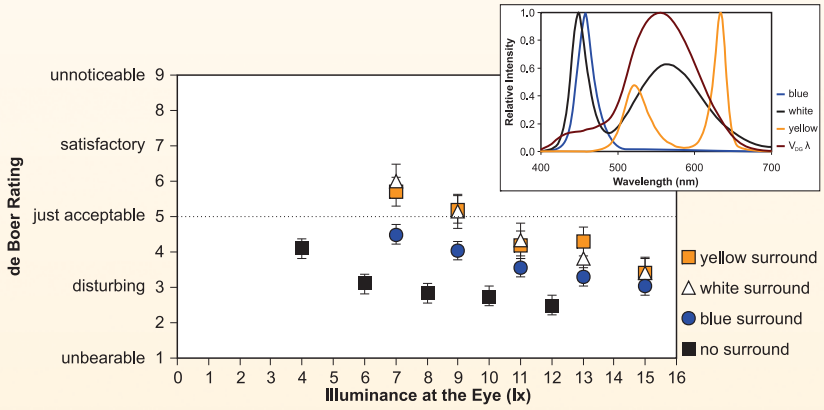


Illustration of the LED apparatus showing the LED array glare source (A) and the luminous surround mode (B).



Mean de Boer discomfort glare ratings (± standard error of the mean) for the different experimental conditions. Inset shows relative SPDs for the three luminous surround conditions plotted over the $V_{DG}(\lambda)$ luminous efficiency functions for a 5° extrafoveal stimulus.

Results

For the range of conditions evaluated:

- The presence of any luminous surround significantly reduced the perception of discomfort glare from the LED array.
- The blue luminous surround reduced discomfort glare perception significantly less than the white or the yellow luminous surrounds.
- A spectral sensitivity function incorporating short-wavelength cone sensitivity ($V_{DG}\lambda$), in addition to current discomfort glare formulas, can more accurately predict discomfort glare from a source and its immediate surround.

In application, adding a colored luminous surround to a white LED luminaire could help mitigate perceptions of discomfort glare when looking directly at the LED array source.

Publication

Sweater Hickcox K, N Narendran, J D Bullough, and J P Freyssinier. Effect of different coloured luminous surrounds on LED discomfort glare perception. *Lighting Research and Technology*, first published online February 20, 2013; doi:10.1177/1477153512474450.

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Lighting Research Center, Rensselaer Polytechnic Institute • 21 Union Street • Troy, NY 12180 • (518) 687-7100 • www.lrc.rpi.edu