



Parameters for Indirect Viewing of Visual Signals Used in Emergency Notification Project Summary

Background

LEDs and other innovative energy saving lighting technologies (e.g. fluorescents) are rapidly entering the marketplace and present themselves for application to emergency notification appliances. The existing requirements for the performance and application of visible notification appliances are based on relatively short duration, high peak intensity flashing lights – strobe lights. The National Fire Alarm Code and referenced listing standards define a method for calculating the effective intensity of a flashing light source, which is used to characterize the photometric performance. However, the calculation method is subjective, does not produce an exact comparison, and is intended only to approximate the perceived brightness for direct viewing of the light source. It has worked because all of the lights approved using the standard have all had relatively similar and short pulse durations, so the peak intensities have been relatively similar.

A [review of research performed for the Fire Protection Research Foundation by the RPI Lighting Research Center](#) suggested that effective intensity may not be predictive of visual detection of signal lights when these are viewed indirectly or in the far-peripheral field of view. In particular, observers see the change in illuminance on room surfaces rather than the flashing light itself when it is not in the central field of view. Based on previous literature, the previous Foundation study suggested that a flashing light should increase the illuminance on the opposite wall by at least 7% in order for this increase to be detected reliably. For an ambient horizontal illumination level of 100 footcandles (fc) on the work plane in a space such as an office, it was estimated that the vertical illuminance on the wall should increase by at least 2 fc to be reliably detected. This estimate has not been tested empirically.

Objective: The objective of this project is to conduct a human factors laboratory study to identify whether the 7% increase in light level can be reliably detected by observers with normal vision. The study will be conducted in several discrete phases in order to provide decision points at which progress could be assessed and decisions regarding next phases of work made.

Tasks:

- 1 Develop Experimental Test Source: The initial step will be to develop a test light source that can be used in a large classroom or auditorium space, to produce a range of vertical illuminance levels onto the wall at one end of the test room. The source will also be able to produce light for durations ranging from <1 ms (to simulate the very short flash duration of xenon strobe lamps used in many visual signals) to 200 ms (the maximum permissible in present requirements for flash duration), at frequencies of 1 to 2 Hz.

- 2 Empirical Study of Indirect Detection: A number of conditions corresponding to a high level of ambient illuminance (e.g., 1000 lx) and different light source flash durations (e.g., 1 ms to 100 ms), maximum illuminances produced on the opposite wall (e.g., from 0.1 fc to 10 fc), and spatial distributions of the illuminance increase (e.g., the entire wall, the upper or lower portions, modified using partitions) will be selected. The basic experimental approach will be relatively simple: subjects will be seated in a laboratory illuminated to a specific ambient light level and at random intervals, the test light source will be flashed with a combination of maximum illuminance and flash duration.
- 3 Final Report: Summarize all activities in Task 1 and 2 into a written report describing the background, experimental approach and apparatus, results, analyses and discussion. The discussion will include a recommendation for quantifying the photometric performance of visual signals for reliable indirect detection, including a table for specifying maximum illuminance or intensity values for varying room dimensions and ambient light levels, if necessary.

REPORTING and DELIVERABLES:

The project will be conducted under the Foundation's auspices under the direction and guidance of a project technical panel. The final report will be issued in August 2013.