THE FUTURE OF INDOOR LIGHTING STANDARDS (AND HOW TO GET THERE)

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Abstract

Over the last two decades, lighting practice has changed dramatically. LEDs have become the dominant light source. Lighting controls have become easier to apply and more sophisticated. Knowledge of the non-visual effects of exposure to light has exploded. New metrics for describing colour perception have been developed. In this changing world one aspect of lighting practice has remained largely unchanged – indoor lighting standards.

Indoor lighting standards were first introduced in the first half of the 20th century as a means to ensure enough light was provided for the efficient performance of visual tasks in workplaces. Their scope soon expanded to cover a broad range of lighting applications, and other aspects of visual response to lighting such as discomfort, and thus became a means to eliminate bad lighting. In this they have been successful but today they can be a restriction on the freedom of lighting practitioners to produce good lighting. This is partly because standards have been issued for applications without critical visual tasks. Attempts have been made to ameliorate the fixation on the task by adding illuminance recommendations for walls and ceiling to give some emphasis to the lighting of the space. This is a move in the right direction but it leaves another problem unresolved. This is the design method usually used to ensure compliance with lighting standards, the lumen method. This assumes a regular array of luminaires and puts technology before perception. Essentially, the lumen method asks the practitioner to choose the technology first and then determines what illuminance will be achieved. Fortunately, there is now an alternative, the lighting design objectives procedure.

This differs from conventional lighting practice in that:

- At the outset, the practitioner identifies the lighting needs and opportunities presented by the application to form a list of lighting design objectives to be achieved.
- The criterion for maintained illuminance is spatial brightness, which is related to ambient illuminance. A spatial brightness lighting design objective is specified by a mean room surface exitance value.
- Wherever practical, other objectives are specified in terms of other lighting metrics.
- Lighting design objectives that involve illumination diversity, which may include a creation of visual emphasis or ensuring efficient flux utilance, are achieved by selecting target surfaces to receive direct flux and specifying values of target/ambient illuminance ratio.
- These specified values are related to the photometric properties of the space to determine an optimal direct flux distribution to achieve those lighting design objectives that relate to ambient illuminance or illuminance distribution.
- The selection of luminaires and the planning of the layout and controls are then directed to providing the required direct flux distribution, as well as achieving any of the practitioner's other chosen objectives.

In this way, the lighting design objectives procedure provides the practitioner with options that range from ensuring compliance with lighting standards, to designing unique solutions which exploit the needs and opportunities presented by the space, its contents, and the activities it houses. Its general adoption would provide a shared basis for architects, interior designers, and building services engineers to describe, specify, and verify lighting design objectives for specific applications.

Why should any of this be of interest to the CIE? The answer to this question depends on the aspirations of the CIE. If its aspirations are limited to eliminating bad lighting, then the lighting design objectives procedure will be of little interest. However, if the CIE aspires to promote good lighting then

the lighting design objective procedure offers a route to achieve this aim but not without a major change to indoor lighting standards. For a start, indoor lighting standards would need to be based on spatial brightness due to ambient illuminance, expressed as mean room surface exitance, rather than task illuminance in lux. Then, illumination diversity would need to be expressed as target / ambient illuminance ratio. There would also need to be major changes in the facilities available to lighting practitioners. Design software would need to be substantially revised. Full-field measurement devices would have to become commercially available to allow compliance with revised standards to be checked. Lighting equipment manufacturers would need to provide appropriate technical support.

To justify such an upheaval in general lighting practice, some research will be needed. The CIE itself does not undertake research but it knows people who can. Among the questions that would need to be addressed are:

- Is mean room surface exitance a stable metric for ambient illuminance in spaces that vary in size, shape and surface reflectances, with and without daylighting?
- How does light received directly at the eye from luminaires influence spatial brightness?
- How will the colour properties of light sources be expressed in indoor lighting standards?
- Is there a case for using ambient illuminance as a means for assessing the impact of light exposure on the human circadian system?
- Should indoor lighting standards be separated into a base case, legally applicable to all installations to ensure safety and consequential aspects such a limits on lighting energy consumption, and advisory guidance for specific applications?

Such a change in the basis of indoor lighting standards is not to be undertaken without careful thought but the question certainly deserves the attention of the CIE.