ANSI/IES LM-83-23

Illuminating ENGINEERING SOCIETY

APPROVED METHOD: IES SPATIAL DAYLIGHT AUTONOMY (sDA) AND ANNUAL SUNLIGHT EXPOSURE (ASE)

AN AMERICAN NATIONAL STANDARD

Approved American National Standard ANSI

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Prepared by
The IES Daylight Metrics Committee

Illuminating
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Preface

Assessing the dynamic qualities of a daylit space requires different methods of assessment than those that have been developed for a space that is electrically illuminated. With electric lighting, average illuminance is a significant and useful metric, especially in designs that aim to provide general illumination at a predetermined target illuminance. However, in a daylit space, average illuminance has less meaning and utility in practice. One reason is purely spatial; for example, sidelit environments inherently have non-uniform illuminance distributions due to the geometric relationship of room and aperture, as well as internal shading from furnishings. Typically, there are high illumination levels near a window, which quickly diminish with increased distance from these daylight apertures.

Other reasons are both spatial and temporal; the daylight sources of sun, sky, and clouds vary in luminous intensity and position each moment of the day and over the course of a year, and corresponding illumination within a space varies relative to the geometry of daylight apertures such as windows and skylights. In addition, it is well known that building occupants can have a profound impact on daylight availability through their operation of window management devices, such as blinds, shades, or variable transmission glass. These may be integral to an original design or, perhaps more frequently, are subsequently retrofitted onto existing windows to improve occupant comfort. Finally, interior daylight illumination can easily be an order of magnitude brighter than the illumination provided by electric lighting, thus shifting the adaptation levels of the eye. Therefore, human perception of illuminance sufficiency in spaces with daylight and/or direct sunlight is more complex than in spaces illuminated only by electric lighting.

Because daylight illumination levels are dynamic, the performance of daylight needs to be considered over time. Evaluation of annual daylight performance integrates these variations over one full year, including both daily and seasonal variations. Because the availability of daylight is highly dependent upon local climate conditions, especially the daily and seasonal balance of daylight provided from direct sunlight versus the sky and clouds, accounting for local climate conditions is also critical. The optimal design of a daylit system is likely to be very different for a foggy coastline location compared to an inland desert or mountaintop.

Over the last few decades, a variety of daylighting metrics have been proposed and implemented in simulation tools to overcome the inability of older metrics and earlier tools to assess these dynamic conditions. Most of these metrics require substantial computational power to process a large number of input variables, such as the geometry of building, site, and surround; climate data; occupancy schedules; and criteria for operating window management devices to control excessive sunlight. Because the accuracy, variability, and formatting of inputs and outputs can be quite challenging, interpretation of these metrics has become problematic. This document describes a standardized analysis methodology that results in a pair of daylight performance metrics that can be used to compare across designs, building types, and locations.

1.0 Introduction, Changes from Previous, Scope, Overview

1.1 Introduction

This document describes two annual daylight performance metrics, spatial Daylight Autonomy (sDA) and Annual Sunlight Exposure (ASE), which provide two useful dimensions for evaluating daylight performance. Both metrics are generated via a similar computer-based simulation methodology that uses a full year of hourly weather data to calculate illuminance values inside a given architectural space. The sDA metric is distinguished from many others in that it explicitly accounts for the movement of operable shading devices at daylight apertures, which hereafter in this document will be collectively referred to as blinds.

Spatial Daylight Autonomy reports on the level and prevalence of daylight in a space over the course of a year, after the operation of any daylight management devices at the aperture. Thus, sDA addresses the