ASSIST Application Design Guide: Retail Lighting

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Introduction

Lighting is a key component to successful store design. Through the understanding of a store's design goals, retail lighting can be planned to maximize its impact on the main operations in the store, from attracting customers to facilitating product evaluation to completing sales. Each one of these store functions has specific lighting requirements but in the end, all areas in a store should present a cohesive image – and lighting can be one of the most effective design elements at providing a unified message of the store's identity. Generally speaking, stores are categorized with respect to the type of products for sale, their price point, and the method to display and sell the products. Common examples include bulk sale warehouses, discount stores, general merchandise stores, and upscale or specialty stores. While these store types may have lighting solutions that could seem diametrically opposed, all have common retail lighting objectives that include attracting attention, create a comfortable and inviting atmosphere, integrate the store's identity, and be flexible to accommodate for seasonal or special occasions. As in other lighting applications, a layered approach is the best way to ensure that the multiple objectives of retail lighting are met. The main lighting layers in retail applications include ambient illumination (generally uniform, with the light level depending on the type of store), perimeter illumination (which provides customers a clear and bright impression of the expanse of the store), accent illumination (which highlights items to which it is desired to draw attention), and shelf illumination (which provides local illumination to items on display).

While not at the top of the priorities in most retail applications, maintenance costs and energy use of lighting should be minimized.

This *ASSIST Application Design Guide* is meant to assist lighting designers and specifiers in identifying appropriate metrics for quantifying the benefits of lighting relative to their costs, and in doing so, maximize the value of the specified lighting system in retail applications.

Application Issues

Visual merchandising

The ability to impact consumer traffic patterns is one of the major goals of visual merchandising. This is often achieved by means of accent lighting on selected objects or displays. Storefront window displays usually require the highest accent ratio to create drama and visual impact to attract customers into the store. Areas with higher traffic volume or more exclusive products on display can demand an even greater contrast ratio. It is not uncommon for shopping mall retail display windows to attempt to capture attention using high light levels, but this translates into high energy costs. As an alternative, research has shown the effectiveness of using colored light backgrounds in displays at attracting attention of potential customers. By having **color contrast** instead of luminance contrast between the background and the subject, it is possible to reduce the accent illumination on

the subject with a corresponding reduction in energy use for display windows. Field demonstrations of this technique showed that, compared to a white background, displays with colored backgrounds were rated higher in preference, attention capture, and visual appeal, at the same time that the accent illumination can be decreased by 50 percent.

Color Quality

The color of illumination and the color rendering abilities of the light sources used in retail lighting are the top considerations for store and lighting designers. These color qualities are critical in the creation of a certain store atmosphere and in rendering objects in display as intended. Helping ensure that the color of lighting does not appear unnatural or unpleasant is an important design concern as well. Research has shown consistently that a two-metric approach to characterizing the color rendering properties of light sources helps reduce the uncertainty in specifications when the task is not fully specified or can vary. ASSIST recommends using the general **color rendering index** (CRI, R_a) and the **gamut area index** (GAI) as the two metrics to specify good color rendering for industrial tasks. Research also shows that the **correlated color temperature** (CCT) of light sources is not an unequivocal descriptor of the color of illumination. To be precise in the specification of a light source's color appearance, the CIE chromaticity values should be included.

Benefit Metrics

The **photopic illuminance** on the task is the primary basis for current recommendations for retail lighting. Light level and spectrum are important for good color appearance in retail applications. While traditionally higher light levels have been recommended to increase the visual appeal and attention grabbing of displays, **color contrast** (as opposed to the illuminance contrast) between the background and the display can provide the same or better attractiveness and visual appeal with reduced photopic illuminances.

The use of **Class A color** sources, that is, sources with a general color rendering index of at least 80 and a gamut area index between 80 and 100 will provide optimal ability to distinguish among colors and provide high overall acceptability ratings. Class A color sources are those that, in addition, have minimum tint. The use of light sources with Class A color characteristics will provide illumination that is likely to be judged as natural and pleasant in appearance.

Reducing Costs to Optimize Lighting Value

As in other applications, reducing the costs of lighting is a reasonable goal of store designers and facility managers. An effective way of reducing costs of retail display lighting is to maximize the effectiveness of the lighting system at delivering light where it is needed. This minimizes losses, which also results in a reduction of the number of luminaires needed and a consequent reduction in energy use. Determining the **application efficacy** of alternative lighting solutions facilitates the selection of those that are more energy- and cost-effective at providing the illumination needed for the task. Additionally, strategies such as using colored luminous backgrounds on display windows can help to reduce significantly the electric load needed for accent lighting.

Summary

The following criteria and metrics should be considered for retail lighting:

- **Photopic illuminance** at the plane of the objects on display to attract attention and create visual interest. **Color contrast** between the background and the object on display is an effective technique that allows the reduction of the accent illumination with a corresponding reduction in the system's electric input power.
- **Class A color** for good color appearance of products on display and for detailed evaluation of products that can lead to a sale. The two-metric approach (CRI+GAI) in the Class A color definition reduces the uncertainty in choosing light sources that provide good overall color rendering, whereas the chromaticity specification in the Class A color definition results in light with minimum tint. Color consistency between sources is also an important criterion for retail lighting and is also included in the Class A color definition.
- **Application efficacy** for task lighting to maximize energy and cost effectiveness while meeting all target illumination requirements.

Resources

This short design guide is meant to assist specifiers with a few preliminary considerations for general retail lighting applications and is not meant to provide comprehensive guidance. Many companies and organizations have specific requirements for different industries that must be considered in the lighting design. The following resources describe the application metrics discussed here and point the reader to additional information.

ASSIST. 2010. *ASSIST recommends: Guide to Light and Color in Retail Merchandising.* Volume 8, Issue 1. Troy, NY: Lighting Research Center.

ASSIST. 2010. *ASSIST recommends: Recommendations for Specifying Color Properties of Light Sources for Retail Merchandising.* Volume 8, Issue 2. Troy, NY: Lighting Research Center.

Freyssinier, J.P., D. Frering, J. Taylor, N. Narendran, and P. Rizzo. 2006. Reducing lighting energy use in retail display windows. *Sixth International Conference on Solid State Lighting, Proceedings of SPIE* 6337: 63371L.

Illuminating Engineering Society. 2001. Recommended *Practice for Lighting Merchandise Areas (A Store Lighting Guide), RP-2.* New York: Illuminating Engineering Society.

Narendran, N., J.P. Freyssinier, J. Taylor, T. Dong, and R. Capó. 2010. Application efficacy for comparing energy demand in lighting applications. *Tenth International Conference on Solid State Lighting, August 1- 5, 2010, San Diego, CA, Proceedings of SPIE* 7784: 77840L.

Rea MS (ed). 2000. *Illuminating Engineering Society of North America Lighting Handbook: Reference and Application*. 9th edition, New York: IESNA.

Rea MS. 2013. *Value Metrics for Better Lighting.* Bellingham, WA: SPIE Press.

About ASSIST: The Alliance for Solid-State Illumination Systems and Technologies (ASSIST) was established in 2002 by the Lighting Research Center as a collaboration among researchers, manufacturers, and government organizations. ASSIST's mission is to enable the broad adoption of solid-state lighting by providing factual information based on applied research and by visualizing future applications. ASSIST members include: 3M; Acuity Brands Lighting; Amerlux; BAE Systems; Bridgelux; Cree; Crouse-Hinds by Eaton; Dow Corning; Federal Aviation Administration; GE Lighting Solutions; Hubbell Lighting; Legrand; Lumileds; New York State Energy Research and Development Authority (NYSERDA); OSRAM SYLVANIA/OSRAM Opto Semiconductors; Philips Lighting; Samsung Electronics Co.; Seoul Semiconductor; United States Environmental Protection Agency.