

The Impact of Lighting and Reflectivity in Retail Settings

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With growing competition from online shopping, brick-and-mortar retailers are recognizing the need to transform their stores into refreshed settings where shoppers can more fully experience their brands and connect with their products. As part of their rejuvenated merchandising strategies, retailers are turning to improved lighting as one of the most effective ways to distinguish themselves and call attention to their entire merchandise offering. Lighting is becoming part of what makes brands what they are.

Successful retail lighting will create a unique shopping environment – one that attracts consumers, draws them into the store and showcases the personality of the brand. It can give an impression about product price range, provide a sense of trust and comfort for the customer and create an aesthetically pleasing shopping environment. A customer that enjoys their shopping experience will browse longer, spend more money and be more likely to return.

Influencing the Purchasing Decision

The impact lighting has in a retail environment and the way it renders colors are crucial factors in how a store's image is perceived. With effective lighting in place, all merchandise is well lit, colors are accurately viewed and it is less likely items residing on lower shelves are overlooked.

Before making a purchasing decision, customers need an opportunity to evaluate merchandise and determine its specific attributes, such as color, texture and quality. Illumination must be sufficient for customers to read price tags and product labeling. In facilities such as clothing stores, lighting must be adequate in sales areas and dressing rooms so customers can see how items look before purchasing them.

Good lighting will enhance the appearance and appeal of merchandise and help minimize returns since customers can fully evaluate products in the store and are less likely to be disappointed with their purchases later.

Improving Illumination through Flooring Reflectivity

Retail environments not only need to feature important merchandise and highlight store areas, but they also must provide a setting in which shoppers feel comfortable. Brightening a store by adding lighting increases electricity consumption and is not always effective. It can result in a setting with a lot of glare, which makes customers uncomfortable and negatively influences their shopping behavior. The key to maximizing brightness is layering different types of light; using flooring, ceiling and wall materials with high-reflectance values; and achieving contrast throughout the space by using increased illumination within the different types of light.

Reflectance value, or reflectivity, is the measure of visible and usable light that bounces off a surface when illuminated by a light source.¹ Amy Costello, the Sustainability Manager at Armstrong, notes that “glare from flooring is not related to reflectance; it is a characteristic of flooring materials that have a glossy finish. Flooring is available in lighter colors with a matte finish that has high light-reflectance values, yet does not create a glare.”

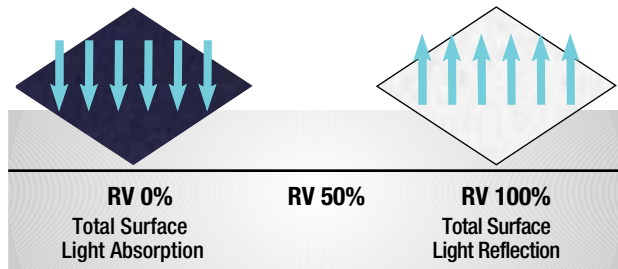
But reflectance isn't just about brighter stores without the glare. The use of high-reflectance flooring increases operational efficiencies in a store by working with all of the artificial and natural lighting sources to increase illumination in the space without the use of additional energy. In fact, the use of high-reflectance flooring can decrease artificial lighting needs resulting in energy cost savings.

It has traditionally been believed that wall and ceiling reflectivity is more significant to the luminance of a space than flooring, but research shows flooring is a very valuable contributor.

While displays and furniture do cover areas of the floor, they do not provide complete coverage and do not interfere with the floor's ability to reflect light any more than shelving and racks interfere with the reflectivity of walls against which they are placed.

Reflectance values from flooring, and other surfaces within the space, significantly impact both natural light and artificial lighting performance and should be kept as high as possible. Light reflectance is measured on a scale of 0% to 100% with 0 representing total surface light absorption and 100 indicating total light reflection. (See Figure 1.) When higher reflectance flooring is used, more light, from all sources, is reflected back into the space, and luminance levels are increased. White and light-reflective surfaces not only increase brightness, they help reduce shadows from racks and stacked products as well. This is particularly helpful for merchandise that is displayed on lower shelves. Rather than adding more lighting assemblies or increasing the intensity of existing units, utilizing light-reflective surfaces is a cost-effective way to improve illumination. Having high ceilings allows available light to bounce off more surfaces and provides even more reflected illumination.

Figure 1: Light Reflectance Value Ranges



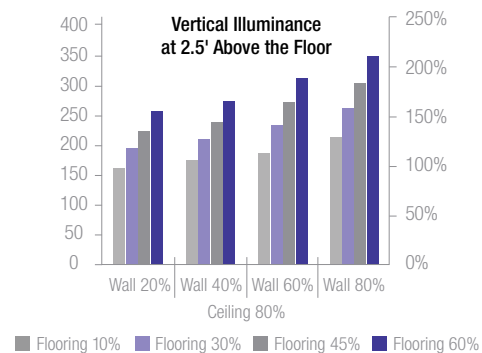
The Illumination Engineering Society of North America recommends light reflectance values for flooring from 20 to 50% depending on the market segment. Flooring products that have at least a 25% surface light reflectance value can contribute to LEED® v4 IEQ Interior Lighting Credit.²

A recent study completed at Pennsylvania State University, "The Impacts of High Reflectance Flooring Materials in Retail Applications," reported by Richard G. Mistrick, Associate Professor of Architectural Engineering, and Ling Chen, a Graduate Research Assistant, looks at the impact of high-reflectance flooring on the illuminance delivered by a general overhead lighting source in three retail settings: a specialty store with a spine layout (a store with a single main aisle that runs from the front to the back of the store with displays branching off to the right and the left), a specialty store with a free-flow layout (a store layout in which fixtures and merchandise are grouped into free-flowing patterns on the sales floor) and a grocery store. In each of these settings, researchers assessed the horizontal and vertical illuminance levels of a representative area of the space at 2.5 ft. and 5 ft. above the floor with an assessment also done at 7 ft. above the floor in the grocery store setting.

Horizontal illumination is the amount of light falling onto a horizontal surface. It is not a good indicator of the brightness of an environment, as people generally judge the adequacy of the lighting by the luminance, or relative brightness, of the vertical surfaces.³

For the study, researchers looked at two specialty retail stores, similar in size, and a larger grocery store setting. Conditions were measured for floor reflectance values of 10, 30, 45 and 60%; wall reflectance values of 20, 40, 60 and 80%; and ceiling reflectance values of 60 and 80%. Differences in the average values were evaluated to determine the potential for energy savings as the floor reflectance is changed, relative to the expected performance with a 20% reflectance floor.⁴ The study found that illumination of the spaces improves with an increase in the reflectance of the flooring. (See Figure 2.)

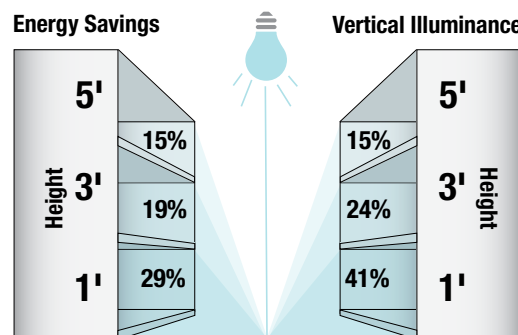
Figure 2: Vertical Illuminance in a Specialty Retail Setting



In settings where the floor reflectance is changed from 30% to 60%, the luminance levels' increase in a grocery store could be as high as 21%, at 2.5 ft. above the floor, while the magnitude in a specialty store space could be as high as 30% at 2.5 ft. above the floor.

In grocery shopping aisles, for a shelf that is 1 ft. above the floor, which is a relatively difficult area to illuminate from above, the increase in vertical illuminance, when the floor reflectance is increased from 20% to 60%, is 41% with an assumed reflectance of 30% for items on the shelf. The increase is 24% at 3 ft. and 15% at 5 ft. above the floor.⁴ (See Figure 3.)

Figure 3: Improved Illuminance from Higher Reflectance Flooring Results in Energy Savings



The findings conclude that installing higher-reflectance flooring material can achieve a measurable level of increased horizontal illuminance and a significant level of increased vertical illuminance. Relative increases in vertical illuminance are larger than those for horizontal illuminances, which can be expected.

If vertical illuminance is the dominant design criteria for the lighting system layout, high-reflectance flooring material can help deliver energy savings.

This can be attributed to the fact that a vertical illuminance meter receives light directly reflected from the floor, whereas a horizontal illuminance meter will only receive light from the floor after an additional reflection from either the ceiling or

vertical surfaces within the space. If vertical illuminance is the dominant design criteria for the lighting system layout, high-reflectance flooring material can help deliver energy savings.

The lighting improvement will be more substantial in spaces that have higher-reflectance ceilings and perimeter walls. As the study shows, illuminance increases steadily as illuminance of ceilings and walls increases. The greatest increases in luminance occurred in spaces where the ceiling and walls had reflectance values of 80%. It's not so much the lighting or the light source that effectively increases luminance but the amount of light available for the space. This can be increased from floor reflectivity.

Illuminating the Bottom Shelf

Consumers shop the way they read, at eye level and from left to right. For this reason, products placed at eye level will sell faster than products placed on higher or lower shelves. It is important to draw customer attention to lower shelves where merchandise is often overlooked. The lighting in the space may not reach the floor, resulting in minimal reflectance and making lower shelf products harder to see. When flooring with a high-reflectance value has been specified, it is easier for the available light to be projected onto merchandise displayed on lower level shelving. Accent lighting or integrated shelf lighting in these areas can be strategically placed to capture reflected light as well.

Effective lighting of the bottom shelves will enhance the appeal of merchandise, making it more likely to lead to purchase.

The Benefits of Daylighting

Daylighting has been shown to significantly increase retail sales, as consumers are better able to inspect merchandise and have a more accurate view of a product's colors, providing for a more satisfactory purchase. A study conducted by Pacific Gas & Electric (PG&E) evaluated a chain of 108 retail stores where two-thirds were lit with skylights and one-third were not. With all other things being equal, the results of the study showed stores that incorporated daylighting saw 40% higher sales than those that did not utilize daylighting.⁵

When daylighting is paired with high-reflectance flooring, luminance levels increase, allowing for enhanced representation of merchandise characteristics.

But daylighting isn't just about increasing sales. It's also an effective way to save on energy spending by reducing artificial lighting needs. In fact, in the state of California, spaces larger than 5,000 sq. ft. are required under Title 24, §140.3(c) to utilize daylighting as a means to reduce energy costs.

Reducing Energy Costs

Indoor lighting is one of the single largest consumers of energy in a typical retail setting, representing about 37% of annual electricity use. Specifying a high-reflectance floor provides opportunity to reduce energy costs by maximizing available light throughout the space.

Color is also a factor that comes into play. When selecting finish surfaces, opt for light colors – white being the best – to ensure light is sufficiently reflected throughout the space. Avoid extremely dark colored flooring materials, as these surfaces can require more installed lighting power to meet illuminance levels, resulting in higher costs. Reflectance differs based on the type and color of the surface. (See Figure 4.)

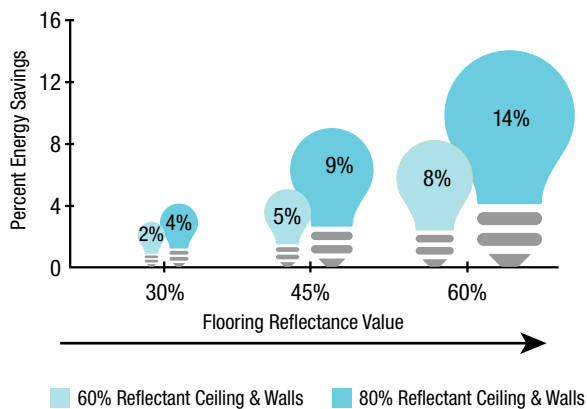
Figure 4: Luminance Differences in Space with 65% Reflectant Floor vs. 15% Reflectant Floor



As research shows, high-reflectance floor material can increase daylighting levels, and where daylighting is not a factor, can result in more efficient distribution of artificial light. Either outcome would enable retailers to create a brighter facility, use less electricity and reduce energy costs, saving money for the business. Spaces with high-reflectance ceilings and walls will result in higher luminance and yield even greater savings.

In a specialty retail environment with a free-flow layout, where the reflectance value of flooring material was raised from 20% to 30, 45 and 60%, the Penn State study showed electricity savings amounted to about 2% to 14% of the lighting energy that would otherwise be consumed depending upon the reflectance of the ceiling and the walls. (See Figure 5.)

Figure 5: Percent Energy Savings Relative to 20% Floor Reflectance for a Specialty Retail Floor with Free-Flow Layout



*Space was illuminated by a general overhead lighting system.

Increasing Profitability

A well-illuminated store directly contributes to the bottom line – whether it be through energy cost savings or influencing increased sales. Rather than adding additional artificial lighting, which increases energy consumption, use of high-contrast lighting can improve consumer perception and raise attention levels, leading to a customer purchase. The sales floor is where the brand comes alive. Products must be viewed as close to their actual color and design as possible using a well-balanced mix of light. By specifying a high-reflectance floor, all sources of light can be captured and reflected throughout the space to increase illumination at all merchandising levels without increasing costs. Goods on the higher and lower level shelves will get the attention they deserve.

References

1. *Infographic: Commercial Flooring Reflectivity*. Lowes ProServices. Web. https://www.lowesforpros.com/articles/infographic-commercial-flooring-reflectivity_a2581.html. 15 Feb. 2016.
2. *Light Reflectivity vs. Glare for Flooring*. Armstrong. Web. <http://www.armstrong.com/commflooringna/light-reflectivity.html>. 15 Feb. 2016.
3. McLean, Peter. *Best Practices in Lighting Program 2004: Electric Lighting – Design Techniques*. 2004. Print.
4. Mistrick, Richard G. and Ling Chen. *The Impacts of High Reflectance Flooring Materials in Retail Applications*. The Pennsylvania State University. Nov. 2015. Print.
5. *The Art of Attraction: Retail Lighting from OSRAM SYLVANIA*. Sept. 2012. Web. <https://assets.sylvania.com/assets/Documents/RETAIL%209-12.f92f5ff8-0caf-4af4-b3f9-4453806e8f67.pdf>. 19 Feb. 2016.
6. *Retail Lighting Guide*. Holophane. Aug. 2004. Web. http://www.holophane.com/hlp_library/guides/HL-2146.pdf. 15 Feb. 2016.
7. *Retail Lighting Design Guide*. Contech Lighting. Web. <http://www.contechlighing.com/sites/default/files/contechretaillightingguide.pdf>. 15 Feb. 2016.
8. *Flooring Options Flourish In Retail Environments*. National Real Estate Investor. 1 Apr. 1998. Web. <http://nreionline.com/mag/flooring-options-flourish-retail-environments>. 15 Feb. 2016.
9. Portland Cement Association. Web. <http://www.concretethinker.com/solutions/Lighting-Efficiency.aspx>. 15 Feb. 2016.