



# Designing with Light Reflectance Value

## Flooring Solutions for Healthcare and Retail Spaces

The light reflectance value (LRV) of flooring helps designers anticipate how light or dark a color will look in a space. LRV also affects the brightness, ambiance, energy efficiency and aesthetic appeal of a space. These effects, in turn, can affect an occupant's comfort, mood and emotions and could affect outcomes of certain activities.<sup>3</sup>

Spaces are composed of surfaces. When rays of light strike a surface, they can then be reflected, absorbed, transmitted, scattered or diffracted.<sup>1</sup> This paper focuses on the effects of light reflected from commercial flooring — specifically, harder surfaces such as LVT, resilient homogeneous and heterogeneous sheet and tile, and rubber sheet and tile. These harder surfaces are prevalent in healthcare and retail environments.

This paper provides a foundation for understanding the LRV of flooring and how to work with different LRVs of flooring in healthcare and retail applications. This paper also provides guidelines for creating the LRV required to meet the needs of a setting and the needs of people using the setting.

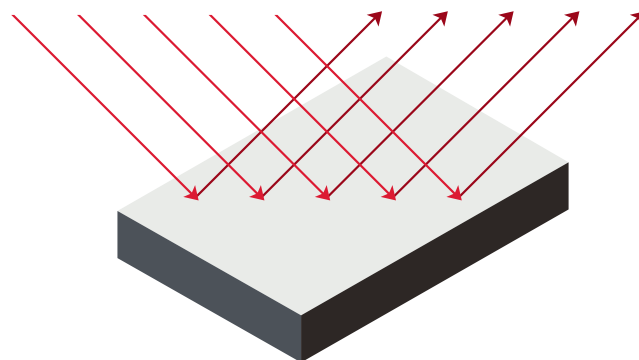
### The ABCs of LRV

Visible light is the portion of the electromagnetic spectrum that the human eye can see. Our eyes perceive the different wavelengths of this light as the colors of the rainbow.

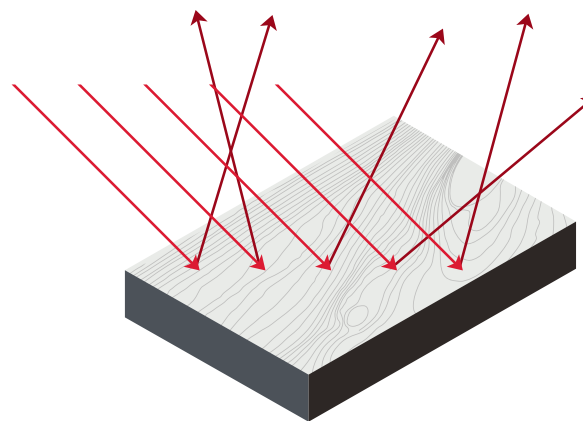
Reflectance is the ratio of the intensity of light reflected by a surface to the intensity of the light when it strikes the surface. There are two types of reflection: specular and diffuse. **Specular reflection** occurs when parallel light rays strike a smooth surface and then all the rays bounce off in the same direction. **Diffuse reflection** occurs when light rays strike a non-smooth surface and then scatter in many directions. Both specular and diffuse reflection can occur when light reflects off the surface of flooring.<sup>5</sup>

LRV is a measure of the amount of visible and usable light reflected from a surface. LRV is expressed as a percentage ranging from 0% (absolute black, which absorbs all light) to 100% (pure white, which reflects all light).<sup>6</sup>

Appropriate application of reflected light can reduce the amount of artificial light needed in a space, helping to reduce energy costs and emissions from power generation. Perhaps equally important is the effect of reflected light on an occupant's overall comfort, visual comfort and mood which, in turn, can affect behavior and outcomes in healthcare, retail and other types of spaces.<sup>7</sup>



SPECULAR REFLECTION



DIFFUSE REFLECTION



### There are several ways to measure LRV<sup>8</sup>

- The most accurate method uses a spectrophotometer to measure the amount of light reflected from a surface across the visible color spectrum. This method is commonly used by professionals and finish manufacturers.
- Using a colorimeter to measure the color of a surface and obtain an LRV reading is a less precise method than using a spectrophotometer but may be a more affordable and easier-to-use option for non-professionals.
- The visual comparison method involves comparing by eye the color of a surface to a color chart with known LRV values. This method is imprecise and somewhat subjective but is useful and relatively inexpensive.

Because LRV measures the inherent reflectivity of a surface, the brightness of light does not directly affect a surface's LRV. Rather, it affects the perceived brightness of a color. Colors with high LRVs will appear brighter and more reflective in a well-lit room compared to a dimly lit room, though the actual visual effect can vary due to differing light intensities.<sup>11</sup>

The wavelengths of light factor into a surface's overall LRV. Different wavelengths are perceived as different colors, and surfaces reflect these wavelengths to varying degrees. A surface might reflect more light in the blue (short wavelength, high energy) spectrum than in the red (long wavelength, low energy) spectrum, which is why the color of a surface can appear different under different lighting conditions.

### Effects of Surface Properties on LRV

The surface properties of commercial flooring that affect LRV include color, which is the most significant property, as well as surface gloss level, texture and pattern.<sup>12</sup> The effects of these properties on LRV are discussed below.<sup>13</sup> Ultimately, using LRV to achieve the desired ambiance and functionality of a space involves managing the interplay between these properties.

- **Color**  
Lighter-colored flooring, such as white, beige

and light gray, tends to have a high LRV — often above 60. Lighter colors reflect more light, which can make spaces appear brighter and more open, enhance visibility and reduce the need for artificial lighting, thereby contributing to energy efficiency.

Darker-colored flooring, such as black, dark brown and navy blue, have a lower LRV — typically below 20. Darker colors absorb more light, which can make spaces feel more intimate and cozier. Spaces with darker-colored flooring may require more artificial lighting to maintain adequate brightness.

Mid-tone colored flooring, such as medium gray and muted blues and greens, have LRVs ranging from 20 to 60. Mid-tone colors balance light reflection and absorption, providing a moderate level of brightness in a space.

- **Surface Gloss, Texture, Patterns<sup>14, 15, 16, 17</sup>**

Flooring with a high-gloss surface reflects more light, resulting in a higher LRV and making colors appear brighter and more vibrant. Flooring with a matte surface absorbs more light, resulting in a lower LRV and making colors appear darker and more subdued.

Smooth flooring causes specular reflection and reflects light more evenly, producing a higher LRV and enhancing the brightness and clarity of colors. Rough or textured flooring, such as faux wood or stone, causes diffuse reflection, reducing the amount of light reflected and reducing the surface's LRV.

Flooring with uniform or simple patterns or designs tend to have a more consistent LRV. Complex installation patterns involving dramatically different colors may create variations in light reflection.

### Effects of LRV on Human Factors

The LRV of commercial flooring can affect the comfort and mood of people within a space. Below are some examples.



- **Visual Comfort<sup>18</sup>**

Appropriate use of LRV can help minimize glare, reducing eye strain and improving overall visual comfort. Flooring with a high LRV reflects a lot of light, which can cause glare. Low LRV flooring can absorb more light and reduce glare.

A balanced lighting environment can be achieved by mixing high LRV flooring with low LRV flooring. High LRV flooring brightens a space. Low LRV flooring can create shadows and contrast, which can enhance visual interest and reduce monotony.

- **Psychological Comfort<sup>19, 20, 21</sup>**

High LRV (light-colored) flooring can make small spaces feel larger and more open. In confined areas, the perception of being in a larger space can be psychologically comforting. By contrast, low LRV (dark-colored) flooring can enhance psychological comfort by making large open spaces feel cozier and more intimate.

- **Thermal Comfort<sup>22, 23</sup>**

High LRV flooring reflects more light, which can make a space feel cooler. The perception of coolness can be particularly beneficial to people in warmer climates. Low LRV flooring absorbs more light, which can make a space feel warmer. The perception of being in a warmer space can be comforting to people in cooler climates.

- **Visibility and Navigation<sup>24, 25</sup>**

In hospitals, care facilities, and other settings where visibility is crucial, high LRV flooring can ensure good visibility and help with navigation, which enhances comfort and safety. Proper use of flooring products with contrasting LRVs can also help with navigation for people who are visually impaired.

- **Mood<sup>26, 27, 28</sup>**

Light reflectance can have a profound impact on mood by affecting how people perceive and experience space. Below are examples of how to provide the desired ambiance using floors with high, mid-range and low LRV colors.

**Uplifting and Energizing:** High LRV colors reflect more light, making spaces feel bright and open. This can have a positive and energizing effect on mood, making people feel happier and more alert.

**Inviting and Positive:** High LRV floors can create an inviting atmosphere that feels welcoming and friendly. This is particularly beneficial in social settings.

**Balanced and Stable:** Floors with mid-range LRV colors provide a sense of balance and neutrality. They neither overstimulate nor dull the senses. Rather, they create a stable and comforting environment that can help maintain a steady, calm mood.

**Versatile and Flexible:** Mid-range LRV colors can adapt to different lighting conditions and can be used to create various moods.

**Cozy and Relaxing:** Darker, low LRV colors absorb more light, which can make a space feel more intimate and restful. Darker colors are often used for creating a cozy, relaxed atmosphere and are ideal for spaces where the goal is to unwind.

## Effects of LRV on Retail and Healthcare Settings

The LRV of flooring can positively influence the ambiance, functionality and overall success of many commercial and institutional settings. Below are examples of how LRV can be used to positively influence experiences and outcomes in retail and healthcare settings.

- **Retail Settings<sup>30, 31</sup>**

LRV plays an important strategic role in retail environments. It is crucial to attracting and retaining customers, making them feel comfortable and enhancing their experience — potentially increasing sales. Below are examples of the strategic use of LRV.

**Bright and Inviting Atmosphere:** High LRV floors make a space feel bright and welcoming, encouraging customers to enter and stay longer and contributing to an enhanced shopping experience.

**Highlighting Products:** High LRV flooring can be used selectively to help draw attention to specific product displays, making those products more noticeable and attractive to customers.



**Creating the Right Mood:** High LRV floors can create an energetic and upbeat environment, which can be particularly beneficial.

**Perception of Space:** High LRV floors can make smaller environments feel more open and spacious, reducing any feelings of claustrophobia and making the shopping experience more comfortable. In larger stores, lower LRV floors can be used to create cozy, defined areas that feel inviting and special, helping to break up large spaces into more manageable customer-friendly zones.

- **Healthcare Settings**

Healthcare settings run the gamut from hospitals and urgent care centers to ambulatory surgery centers, short- and long-term care facilities, medical office buildings and more.

Below are examples of how flooring with different LRVs can be applied to address some of the unique requirements that most, if not all, healthcare settings have in common: healing and comfort, infection control, accessibility, patient privacy and wayfinding.

**High LRV Flooring (Light Colors, Glossy Finish):**

Bright, high LRV floors can make a room feel more uplifting and positive, which can help boost patients' spirits. High LRV floors can also make a room appear clean and fresh, contributing to a sense of well-being.

**Mid-Range LRV Flooring (Mid-Tone Colors, Matte Finishes, Moderate Texture):**

Floors with mid-range LRV colors can provide a balanced environment, creating a calming and stable atmosphere, which is ideal for recovery. Mid-range LRV colors are also less likely to cause

visual fatigue and can be comforting for patients and less stressful for caregivers.

**Low LRV Flooring (Dark Colors, Flat, High Texture Surfaces):** Darker, low LRV flooring can create an intimate and restful environment, which can help patients relax and can help inpatients sleep better. Darker tones and higher textures may help in creating the sense of a quiet and peaceful ambiance, as they absorb more light and more textured floors may scatter soundwaves. NOTE: In hospitals, low LRV flooring is used selectively to avoid making a room feel too confined or somber.

## Conclusion

Several topics were discussed in this wide-ranging document, including:

- Descriptions of light and reflection
- The effects of color, gloss and surface texture of flooring on LRV
- The effects of LRV on visual comfort, psychological comfort, thermal comfort, visibility and navigation, and mood.
- And finally, the contributions of these effects specifically to healthcare and retail settings.

This document is an overview, and there is more detailed information available on these topics. Nevertheless, it is hoped that the information herein will further the reader's understanding of LRV, and the significant role that it can play in commercial and institutional interior design.



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