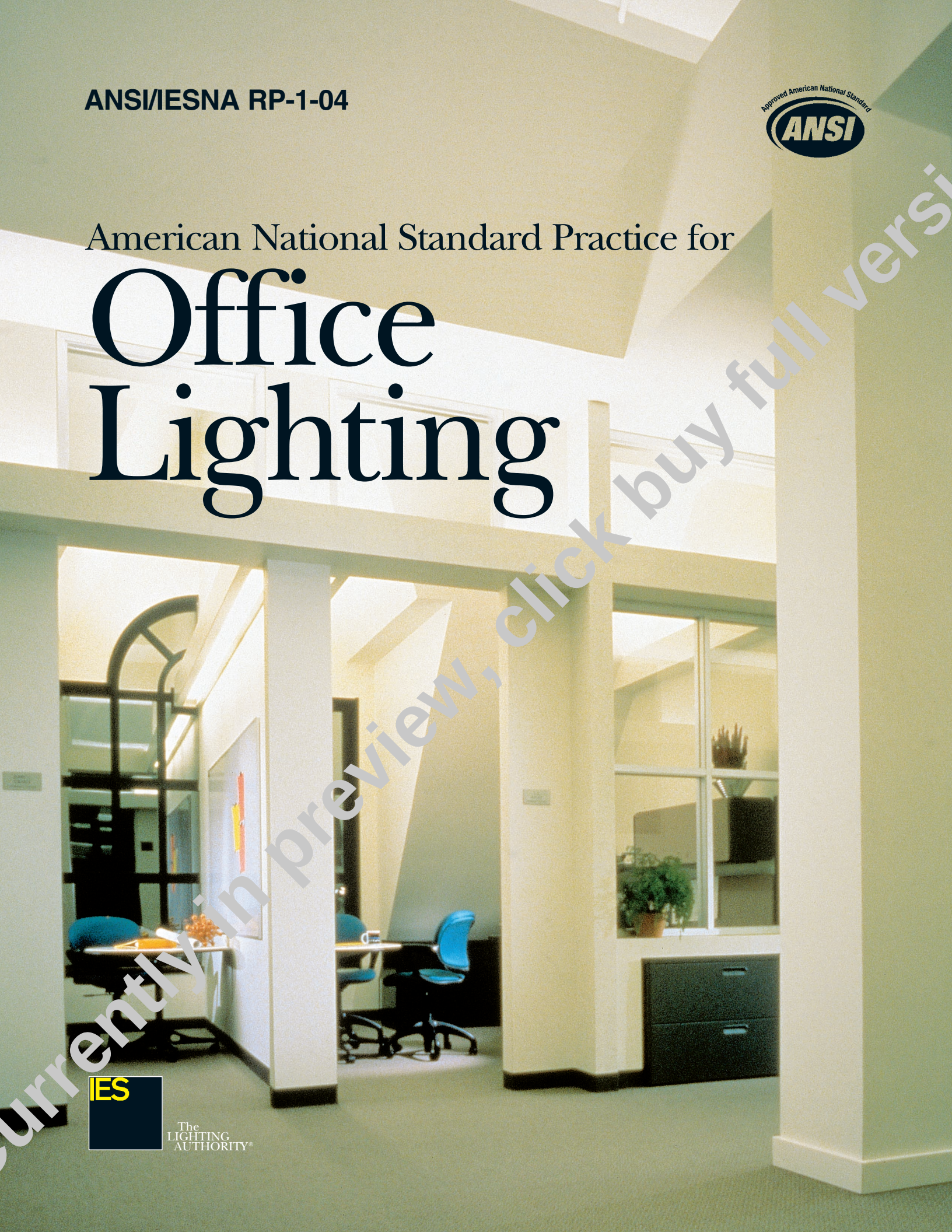
ANSI/IESNA RP-1-04

Approved American National Standard
ANSI

American National Standard Practice for

Office Lighting



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American National Standard Practice for Office Lighting

Publication of this Recommended Practice has been approved by the IESNA. Suggestions for revision should be directed to the IESNA.

Prepared by:
The IESNA Office Lighting Committee

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Prepared by the IESNA Office Lighting Committee

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INTRODUCTION

Offices are designed to house working people engaged in thought and in multiple forms of communication — written, visual, aural, electronic, and face-to-face. Office lighting should enable these workers to perform such tasks comfortably and effectively in an environment where they will spend one-third of their lives. It is essential that office lighting be included as a vital consideration towards the successful operation of any business. Although initial cost concerns often limit lighting design choices, business owners should understand that while $3.00 - $8.00/square foot might be spent initially on lighting equipment and its installation, and that electrical energy consumes $2.00/square foot annually, the cost of light is only $0.52/square foot. In comparison, the cost of salaries is typically $145.00/square foot (see **Figure 1**). Research suggests that employees are nearly six times more expensive than the total annual cost of the facility they occupy. Since lighting affects people and their productivity, it will directly impact a corporation's profitability. Even when high quality lighting is initially designed, it may fall victim to the "budget crunch" where lower quality luminaires are substituted and/or the lighting layout is changed without fully considering the implications for the application at hand. The cumulative effect of an attempt to save money may well be to raise operating costs through diminished productivity in the office environment.

The primary consideration in lighting the office environment is providing visibility for visual tasks. However, both visibility values (quality and quantity of light) and aesthetic values (worker perceptions and mood) must coalesce for successful interior lighting.

Designing lighting for an office environment involves more than calculations and luminaire selection. Since feelings of psychological well being, interest, and enthusiasm, which enhance productivity, are affected by the environment, consideration must be given to the design of office interiors in an effort to create a stimulating work place.

It has become important for aesthetic, economic, and practical reasons to consider the luminous environment and the lighting of visual tasks separately. However, these aspects must work together to provide an invigorating yet comfortable environment and good visibility. In smaller offices spaces, the same lighting system might contribute to both, but in larger open-plan spaces separate luminaires are typically used to illuminate the visual task, the surrounding office environment, and accent art or architectural features in an aesthetic, energy-efficient manner.

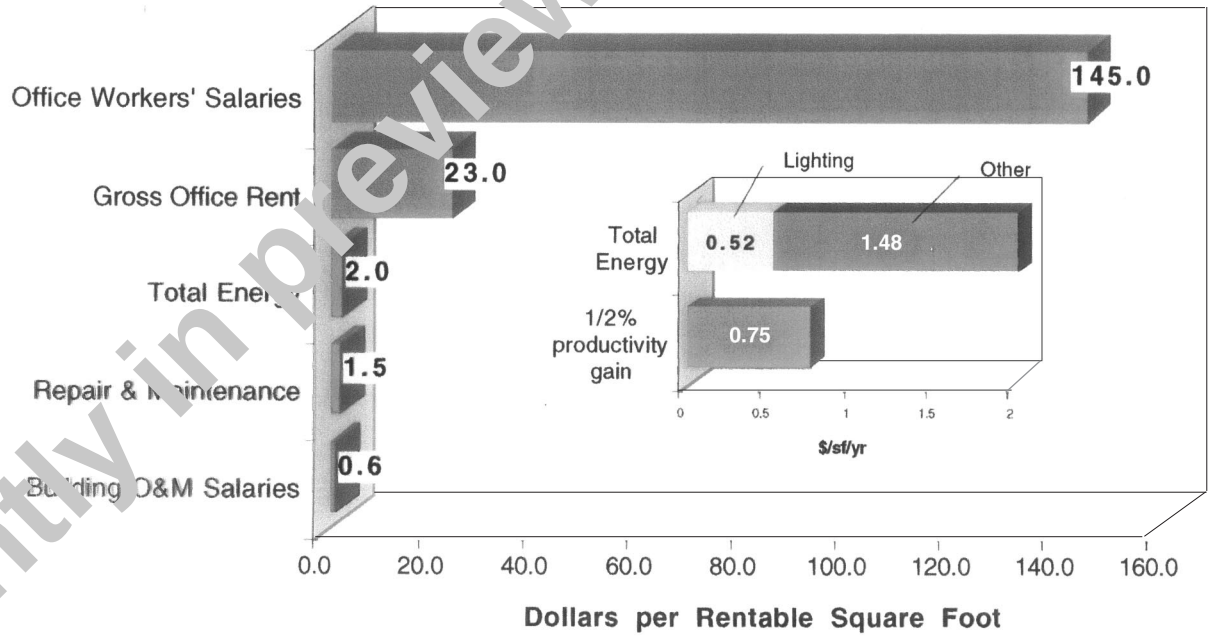

Figure 1. This annual operating cost breakdown for a commercial office building shows that most of the money is spent on workers' salaries and rent, while the cost of light is just a portion of the total expense for electrical energy.

The efficient use of energy is critical to office lighting design and reductions in operating costs and environmental pollution are worthy benefits of a conscientious energy philosophy.

This Standard Practice provides useful, practical information on not only the technical issues, which current research and consensus opinion have advanced, but also information on design elements that can produce both a productive and pleasant environment.

Good lighting design practice recognizes that human perception is as important as numerical standards. Results cannot be judged merely by computer predictions, visualizations, or meter readings even though every effort should be made to use all available tools to ensure that envisioned designs become useful realities. The primary function of light in the office is to support work. Thus the ultimate criteria for an office lighting solution is how well it facilitates work performance and user satisfaction. No matter how pleasing, or how well it conforms to a set of quantitative values, if a lighting design does not support the work, it has failed.

1.0 THE LUMINOUS ENVIRONMENT

1.1 Composition

The visual effect of an office space depends on variations in perceived luminance and color. These may be achieved by varying surface reflectance, color and/or illuminance. Shadow, as a design element, can be just as important as light. One common method of varying luminance, called *wall washing*, provides a greater luminance on the wall area than of the ceiling or floor. Another method, *localized task lighting*, provides pools of higher luminance within a space. This luminance variation at a workstation helps give office workers a "sense of place" within an open office. Careful design can provide interesting variations without producing distracting or uncomfortable luminance differences.

1.2 Color

Both surface and light source color play important roles in the office lighting environment. Color adds visual interest to a space, making it more inviting and pleasant. The spectral composition of the light source is critical where detailed color work is performed. Spectral composition also affects the general appearance of people, furnishings, and room surfaces and should be selected carefully.

1.2.1 Surface Colors. In offices, where workers are exposed to the same environment for long periods, color can affect their performance positively or negatively. Small offices can be made to appear larger and less crowded if woodwork and furniture placed against walls have the same hue or a similar reflectance. The placement of light at high angles on wall surfaces may be used either for uniformity (to create the appearance of a larger space) or to create drama and visual interest. Contrasting colors or light and dark values of the same color may be used as accents in wall coverings, furniture upholstery, pictures, or tapestries. Lighting is often used to enhance these aesthetic statements. Large surface areas should have reflectances as recommended in **Figure 2**. At low illuminance levels, interior spaces may be made to appear sharper or brighter by creating greater color contrast through the use of more colorful surfaces.

1.2.2 Light Source Color. Two distinct application considerations exist with respect to color and light sources: the *chromaticity* (correlated color temperature) and the *color rendering properties* of the source.

Chromaticity refers to the color appearance of the lighting source and is designated by its correlated color temperature in Kelvin. Sources exhibiting color temperatures in the 2700 K to 3200 K range are considered to have a warm white appearance, while those exhibiting a color temperature around 3500 K are considered to have a neutral white appearance. Sources exhibiting color temperature around 4100 K are considered to have a cool white appearance.

The perceived color of an object will be affected by the color rendering properties of the lamp. The color rendering index (CRI) is a measure of the color shift induced by a given lamp relative to a standard lamp of the same correlated color temperature. The maximum CRI value is 100. Where color discrimination is important (for example, color matching in an advertising agency), lamps with a CRI of 90 or higher should be employed.

Two lamps with the same chromaticity may have different color rendering characteristics. Fluorescent lamps offer several chromaticities with good to excellent color rendering and high luminous efficacy. The color rendering properties of various lamps can be demonstrated by installing them in display boxes or rooms, each with an identical selection of colored objects.