

# Lighting for Safety and Performance

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## HIGHLIGHTS:

- Perception of light can vary greatly
- Recommended Lighting Levels
- Glare reduction
- Ratio of luminance

Because our eyes are so adaptable, lighting is sometimes overlooked as a factor of workplace safety. The eyes normally adapt to many different conditions, from darkness to bright sunlight, from monochrome to full color, from uniform overhead lighting to intensified lighting from a single source.

Studies have shown that the type and level of lighting can affect safety, security, productivity and customer sales.

Proper lighting is important because it can:

- Reduce trip and fall hazards by illuminating walking surfaces, stairs, ramps, curbs, hazards, etc.
- Lessen the chance of injuries caused by moving equipment, sharp objects, liquid spills, etc. by making them more detectable
- Improve productivity and product quality by permitting employees to work more efficiently with fewer errors
- Increase customer sales by highlighting displays and enhancing the color and texture of products
- Reduce the energy costs that can result from inefficient lighting systems or unnecessary lighting
- Improve security by eliminating dark areas

This reference note discusses important issues concerning lighting. You should also review the appropriate codes and standards for additional information.

Perception of light can vary greatly among individuals due to factors such as age, medical condition and fatigue. Older workers and workers with visual limitations may need lighting with adjustable intensity to increase the brightness of their work area. Light meters can provide an objective measure of the lighting level, and can be purchased from most photographic and safety companies.

To get maximum efficiency from your workplace lighting, take these factors into consideration:

### **Quantity of Illumination**

- Amount of illumination as recommended by the Illuminating Engineering Society (IES) (see Recommended Lighting Levels section)

- The source of the illumination, such as lamps or natural sunlight
- Luminaires or fixtures, and the distribution of light

**Quality of Illumination**

- Size and detail of the items being viewed
- Contrast between the item and its visual background
- Glare or the amount of light being reflected directly into workers’ eyes

**Size and Detail**

Visual tasks where employees work on small or detailed objects require brighter lighting and higher contrast. When illumination levels are low, the eye muscles react to the darkness by opening the pupil, while still attempting to maintain the necessary focus to show detail. This can result in muscular strain (workers’ vision should be evaluated and corrected when needed).

**Recommended Lighting Levels**

**Note:** These values are for efficient visual performance and may need to be adjusted to enhance visual effectiveness and safety.

**Illuminance Categories**

**Orientation and Simple Visual Tasks:**

Visual performance is unimportant.

	Lux	Foot Candles
Public spaces	30	3
Simple orientation for short visits	50	5
Working spaces where simple visual tasks are performed	100	10

**Common Visual Tasks:**

Visual performance is important. Commercial, industrial and residential applications.

	Lux	Foot Candles
Visual tasks of high contrast and large size	300	30
Visual tasks of high contrast and small size or low contrast and large size	500	50
Visual tasks of low contrast and small size	1,000	100

**Special Visual Tasks:**

Visual performance is of critical importance.

	Lux	Foot Candles
Visual tasks near threshold	3,000–10,000	300–1,000

The higher levels within each task description should be used for workers performing visually demanding tasks for long periods of time. Recommended illuminance levels should be achieved with supplemental task lighting. Higher recommended levels are often achieved by moving light source closer to the task.

**Public:**

Measure at floor or pavement level.

	Lux	Foot Candles
<b>Outdoors</b>		
Parking lots (for security)	5	0.5
Entrances-Active pedestrian and/or Conveyance	50	5
Entrances-Inactive/infrequently used	10	1

**Indoors**

- Elevators
- Office areas
- Intensive VDT use
- VDT (data processing) reading tasks
- Keyboard
- Stairways
- Walkways (minimum)
- Emergency exit routes (minimum)

50	5
300–500	30–50
300	30
30	3
300	30
20–50	2–5
10	1
10	1

**Construction:**

Measure at floor or pavement level.

**Outdoors**

- General construction
- Excavation work

Lux	Foot Candles
100	10
20	2

**Indoors**

- Tunnels, shafts, underground work
- Tunnel and shaft drilling
- Construction plant and shops
- First aid stations

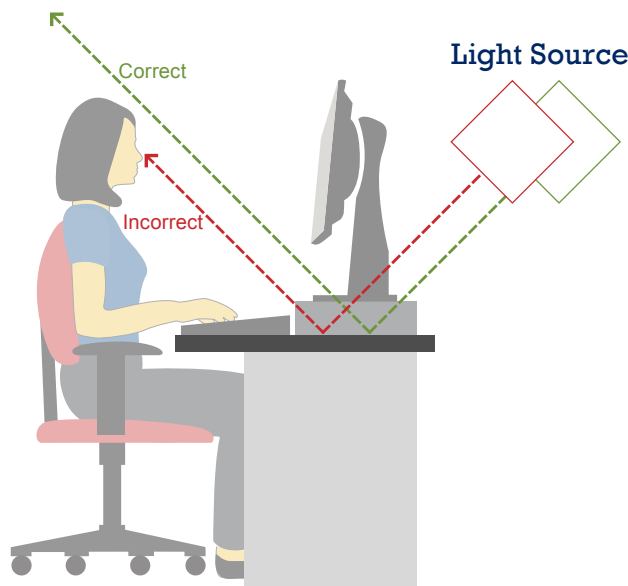
50	5
100	10
100	10
300	30

**Industrial Facilities:**

Measure at task level.

See IESNA *Lighting Handbook* and/or ANSI/IESNA RP-7 *Recommended Practice for Lighting Industrial Facilities* for recommended illuminance values for specific industrial areas/facilities.

**Minimizing Glare**



Good lighting can be enhanced by glare reduction. Glare is any brightness that is within the field of vision. It can cause discomfort, loss in visual ability and can interfere with task performance. Daylight or an artificial light source can produce direct glare. Light being bounced back from shiny ceilings, walls, desktops, machinery or materials can produce reflected glare. Lighting sources should be placed or diffused so that light is not reflected directly into the eyes.

## Contrast

The ability to see task details depends upon the ratio of luminance (brightness) between the item and its background. Generally speaking, the higher the contrast, the more easily the item can be seen. The eyes can function more comfortably and efficiently when the luminance within the surrounding environment is relatively uniform.

Use the following luminance ratios as a guideline when adjusting workplace lighting:

Between tasks and adjacent darker surroundings:	3 to 1
Between tasks and adjacent lighter surroundings:	1 to 3
Between tasks and more remote surfaces:	10 to 1
Between luminaires (windows, skylights) and surfaces adjacent to them:	20 to 1

## Light Sources

A number of different lamp types are available on the market, including incandescent, fluorescent, halogen, high-intensity discharge (HID), mercury and sodium. They differ in physical size, light output color, energy requirements, operating performance and life expectancy. Some lighting fixtures are designed to be used for general lighting and others for task lighting. Lighting manufacturers and distributors can provide information concerning which type of light is recommended for specific areas and tasks.

Determine the lighting required for safety and ensure all three conditions; quantity, quality and safety are properly weighed and addressed in the final design.

## Additional Resources

Liberty Mutual Insurance Reference Note RC 5439, Aging Workers.

## References

*Lighting Handbook*, Illuminating Engineering Society of North America (IESNA), Eighth Edition, 1995.

ANSI/IESNA RP-7-01, *Recommended Practice for Lighting Industrial Facilities*, Illuminating Engineering Society of North America, New York, NY 10018.

ANSI/IESNA RP-1-04, *American National Standard Practice for Office Lighting*, Illuminating Engineering Society of North America, New York, NY 10018.

*Kodak's Ergonomic Design for People at Work*, John Wiley and Sons, Inc., 2004.

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The illustrations, instructions and principles contained in the material are general in scope and, to the best of our knowledge, current at the time of publication. No attempt has been made to interpret any referenced codes, standards or regulations. Please refer to the appropriate code-, standard-, or regulation-making authority for interpretation or clarification. Provided that you always reproduce our copyright notice and any other notice of rights, disclaimers, and limitations, and provided that no copy in whole or in part is transferred, sold, lent, or leased to any third party, you may make and distribute copies of this publication for your internal use.

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