



# COMMERCIAL LIGHTING DESIGN GUIDE









Designing an office lighting plan involves more than calculations and luminaire selection. The lighting solution affects the ambiance of the office; the psychological well being, interest, and enthusiasm of its employees. It should enhance the feeling of well-being and productivity, so consideration must be given to the design of the office interior to create a stimulating work place. Employees need to perform tasks comfortably and effectively in the environment where they spend one-third of their lives.

ConTech Lighting will guide you through the lighting process and be your lighting resource. Uniquely qualified to fulfill your lighting needs, ConTech manufactures a variety of lighting systems including track, recessed, hi-bay, and decorative that keep spaces fresh and up-to-date. It takes time and effort to ensure that your investment in lighting will be returned to the bottom line, and it's a partnership we'll be involved with every step of the way.

## COMMERCIAL LIGHTING DESIGN GUIDE

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# GOALS OF COMMERCIAL LIGHTING

Lighting is one of the best, and easiest, ways to improve the office environment. The challenge is that office lighting plans must be cohesive and effectively illuminate different types of spaces that coexist under one roof: the reception area, open office space and private offices of varying sizes. It must represent and reinforce the corporate image. There are energy codes to follow, concerns about energy costs and efficiency of the lighting system, as well as the need to incorporate flexibility for easy adjustments as the company grows and lighting needs change.

- Create a cohesive environment that enhances the feeling of well-being and productivity of the office staff.
- Create a flexible lighting plan that enables employees to perform tasks comfortably, effectively, and safely.
- Integrate and balance ambient, task, accent, and decorative lighting into each area of the office.
- Allow a comfortable transition from space to space.
- Design a lighting plan for long-term employee comfort, with a proper balance of energy savings and lighting quality.
- Integrate and control daylight to improve employee morale and cut energy costs.
- Address energy efficiency and energy codes.

The primary function of lighting in the office space is to support work. It effects the ambiance in the office; it effects how employees, clients and customers view the company and it's image. It has a profound effect on the feeling of well-being and productivity of the office staff. Therefore, it is essential that office lighting be included as a vital consideration towards the successful operation of any business.

A designer must consider a variety of key characteristics when developing their lighting plan including lamp life, system efficiency, lumen maintenance, color rendering and appearance, daylight integration and control, light distribution, points of interest, cost, system control and flexibility.



# COLOR, REFLECTION, and CONTRAST

Two units of measure are used defining light source color properties: Correlated Color Temperature (CCT) and Color Rendering Index (CRI).

Choosing light with the right color temperature and CRI is crucial. Lighting is a key factor in projecting and supporting company image and affects the feeling of the space itself.

All light sources are not equal. Two white light sources may look the same, but can render colors differently or provide a different feel to the space. By using lamps of the same Correlated Color Temperature and with the same, or very similar, Color Rendering Indices, the space will have even, consistent illumination throughout.

Reflection and glare are both useful and potentially harmful to office lighting; well designed lighting can allow the eye to see tasks and devices clearly, but also may create unproductive and damaging conditions.

Using luminaires with good glare control avoids direct glare and disturbing reflections on specular surfaces.

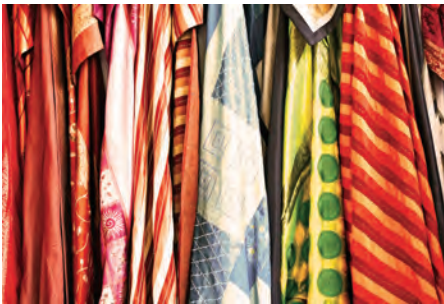
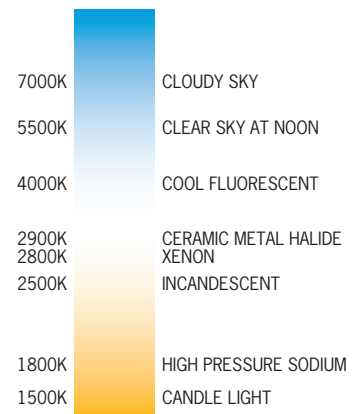
A very bright space is not the most effective lighting solution. Proper fixture selection and placement of luminaires creates a welcoming and productive environment.



# CORRELATED COLOR TEMPERATURE

Correlated Color Temperature, or CCT, is a measure of a lamp's color appearance when lighted. All lamps are given a color temperature based on the color of the light emitted. White light falls into three general categories: warm, neutral and cool, measured in Kelvin (K). White light with a hint of yellow-like candlelight is called "warm white" (below 3000K); it enhances reds and oranges, dulls blues, and adds a yellow tint to whites and greens. Neutral white (3000K – 3500K) enhances most colors equally, and does not emphasize either yellow or blue. Bluish white, like moonlight on snow, is considered "cool white" (above 3500K); enhancing blues, dulls reds and imparts a bluish tint to whites and greens.

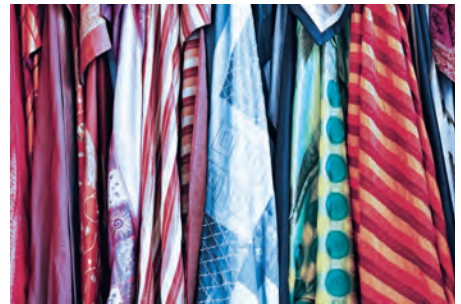
Warm light makes a space feel smaller, more comfortable and familiar, where cooler light make areas appear more spacious.



WARM



NEUTRAL



COOL

# COLOR RENDERING INDEX

Color Rendering Index, or CRI, is a measure of how a light source renders colors of objects compared to how a reference light source renders the same colors. CRI can be used to compare sources of the same type and CCT.

A palette of specific reference colors is used, and each R value calculation is the difference between each color sample illuminated by the test light source and the reference source. The group of samples is averaged, and a score between 0 and 100 is calculated, with 100 being the best match between light sources.

The higher the CRI of a light source, the better – and more natural – colors appear. For products to be presented in a true-to-life way, which increases visual comfort, a CRI value of 80 – 100 is recommended.

|     | APPEARANCE               |
|-----|--------------------------|
| R1  | Light Grayish Red        |
| R2  | Dark Grayish Yellow      |
| R3  | Strong Yellow Green      |
| R4  | Moderate Yellowish Green |
| R5  | Light Bluish Green       |
| R6  | Light Blue               |
| R7  | Light Violet             |
| R8  | Light Reddish Purple     |
| R9  | Strong Red               |
| R10 | Strong Yellow            |
| R11 | Strong Green             |
| R12 | Strong Blue              |
| R13 | Light Yellowish Pink     |
| R14 | Moderate Olive Green     |



Low CRI



High CRI



# REFLECTION

| MATERIAL   | REFLECTANCE PERCENT |
|--|---------------------|
| <b>Diffuse:</b> <i>Uniform surface brightness</i>                            |                     |
| Limestone  | 35-60               |
| White Paint  | 75-90               |
| White Structural Glass   | 70-80               |
| <b>Spread:</b> <i>General diffuse reflection</i>                             |                     |
| Brushed Aluminum   | 55-60               |
| Etched Aluminum  | 70-82               |
| Processed Aluminum (Diffuse)   | 70-80               |
| Satin Chrome   | 50-55               |
| <b>Specular:</b> <i>Directional control of brightness at specific angles</i> |                     |
| Chrome   | 60-65               |
| Metal coated plastic   | 75-95               |
| Mirrored and optical coated glass  | 80-95               |
| Polished aluminum  | 69-70               |
| Stainless Steel  | 55-65               |

Reflection of light off of the various surfaces within the space should be accounted for in the lighting design. When surfaces with a higher reflectance are used, light is reflected back into the space, and higher illuminance levels are created. Light reflectance is based on a scale of 0, total surface light absorption, to 100, total light reflection.

Spread reflection materials, such as brushed aluminum, have a high, though diffused, reflection, reflecting 5-10% of light. Diffused reflection materials, as simple as a white painted wall, give a uniform brightness, and are good reflecting backgrounds for coves and smaller spaces.

## CONTRAST RATIOS

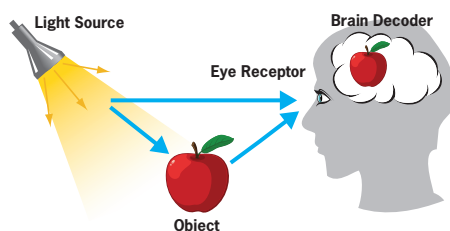
Simply increasing brightness in a space is not only a waste of electricity, but is also not effective; the key is layering light and using contrast throughout the space.

There are four basic layers of lighting: general lighting, also called ambient, accent lighting, task lighting, and decorative lighting. Measured in footcandles, the IESNA has illuminance level recommendations based on the type of lighting, the type of space, the type of person, and how the lighting will be used (Page 19). By layering these light types, depth and dimension is added to the space.

Contrast is achieved by using an increased illumination within the different types of light, commonly task and accent, to emphasize objects against the general light levels. Contrast can be used to create visual hierarchies within the environment. For example, a 2:1 contrast ratio, with the accent lighting being two times brighter than the general lighting level, creates a barely recognizable contrast. Whereas a 30:1 contrast ratio will create a strong focal effect on the focal items.

Each type of lighting has many options, and by incorporating the recommended light levels and contrast ratios, the end result is a space with high visual interest, depth, and dimension.


## OPTICAL PERFORMANCE



Performance requirements for lamps and integrated luminaires:

1. Visual appearance of light on a surface
2. Numerical performance, light level, and efficiency
3. Visual appearance and glare control of the luminaire itself





HALVORSON KAYE STRUCTURAL ENGINEERS



# LAYERS OF LIGHT

There are four layers of light typically used in commercial lighting: general (also called ambient) lighting, task lighting, accent lighting, and decorative lighting. Combining and balancing these lighting types gives visual interest to the space and creates a more attractive, exiting and inviting environment.

## GENERAL LIGHTING

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General lighting is the main source of illumination in a space. This uniform, base level of lighting can easily become the focus of energy reduction, as the light levels from other fixtures can be lowered, especially when using LED sources.

Recommended light levels for general lighting is 30 - 50 foot-candles. It should provide the area with overall illumination; more specifically for orientation, general tasks, and to control contrast ratios. Diffused general lighting ensures a sense of well-being, which makes employees feel comfortable. A simple way to achieve this is by arranging recessed fixtures using reflectors, baffles, and lensed trims in overlapping positions.

Perimeter lighting, or wall washing, helps define spaces, provides vertical lighting, and makes the space feel larger. Done with sconces or wall washers, vertical lighting creates a pleasant, welcoming environment. It is important that vertical surfaces are lit for visual comfort, spaciousness and visual and directional cues. Vertical brightness makes orientation easier, helps to define spaces, and aids in making the space's appearance to be larger, open and more welcoming.

## TASK LIGHTING

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Task lighting is used to illuminate an area for a specific task; providing a focused, localized, and higher level of illumination. Necessary to the functioning of a space, it is important to use energy efficient sources to reduce operating costs.

Task lighting is most effective when used as a supplement to general lighting in workspaces, conference areas and on counter tops. Effective task lighting should eliminate shadows on the specific illuminated area, while preventing glare from the lamp or off surfaces. Glare impedes office work, and is easy to control by increasing the brightness of surrounding areas, decreasing the brightness of the glare source, or both.

Recommended light levels for task areas are 50 – 200 foot-candles. When lighting a task area, take into account the difference in brightness, or contrast, between the task area and the surrounding space. A 3:1 ratio of task lighting to general illumination provides a nice contrast. The amount of light needed on the task, or luminance, is usually the most flexible variable of task lighting, and can be increased to compensate for low contrast levels. For office spaces, utilizing a generally low level of ambient light with strategically placed task luminaires is an ideal solution. Using this combination, the optimal seeing conditions in the work environment are met, and energy is conserved since the high-level illumination is provided only where it is needed. Task lighting reduces the reliance on overhead lighting, and provides a better quality of light for specific tasks.



## ACCENT LIGHTING

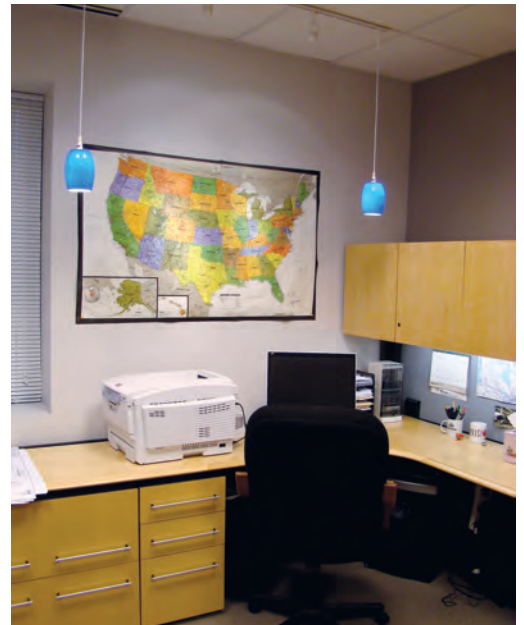
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Accent lighting reinforces design aesthetics and creates a dramatic emphasis on shapes, textures, finishes, and colors using a focused, or point, light source or sources. If this light is directed ambiguously, the end result may have many unwanted shadows as well as distracting glare.

The key is to make this illumination more precise and of higher intensity than the surrounding ambient light. Track fixtures, recessed housings with adjustable trims and concealed adjustable illumination with point source lamps provide directional control and are especially effective for accent lighting. They are easy

to aim precisely to highlight objects' best attributes. Accenting everything and emphasizing nothing is a common mistake with accent lighting; always keep in mind that there is such a thing as providing too much light.

The IESNA recommends a 5:1 ratio of accent lighting to ambient light to make objects stand out and create a significant visual effect. Recommended light levels for accent lighting are between 150 – 500 footcandles.



## DECORATIVE LIGHTING

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Decorative lighting serves a dual purpose: not only to contribute to the lighting layers in a commercial environment, but also to enhance the look of the space as a design element. Decorative lighting includes pendants, sconces, chandeliers, table and floor lamps, and cylinders. Decorative lighting should complement and add visual interest to the interior, as well as provide or contribute to the overall lighting plan.

Pendants should be mounted 8 - 12 feet above the finished floor (a.f.f.) so they are within view, but not too low as to become a distraction. Pendants displayed over desks and counters should be hung 36 - 48 inches above the horizontal plane; low enough to provide task and/or accent lighting and provide some sparkle, but not be a hindrance to the occupants of the space.

Wall sconces and wall mounted cylinders should be mounted approximately 5-1/2 feet a.f.f.; this helps to create a sense of human scale, especially in a large space.

Adding décor, beauty and style using decorative lighting is also an important reflection of a company's image, and reinforces the theme and style of the space. Decorative lighting can also contribute a feeling of hospitality and comfort.

By combining and layering these lighting types, your environment will be more attractive, exciting, and inviting.











# APPLICATION SOLUTIONS

## SUSTAINABLE LIGHTING DESIGN

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The IALD (International Association of Lighting Designers) defines sustainable lighting design as meeting the qualitative needs of the visual environment with the least impact on the physical environment, in other words, finding the balance between visual needs and product sustainability.

### Five Goals of Energy Smart Design

1. Illuminate the space appropriately for its uses by considering both the architectural elements as well as the human interaction within the space.
2. Integrate layers of light to maximize illumination where it is needed.
3. Use the most efficient lamp and ballast technology appropriate for the space.
4. Use appropriate controls for light level and energy management
5. Integrate daylight.



## CONSIDERATIONS FOR COMMERCIAL LIGHTING:

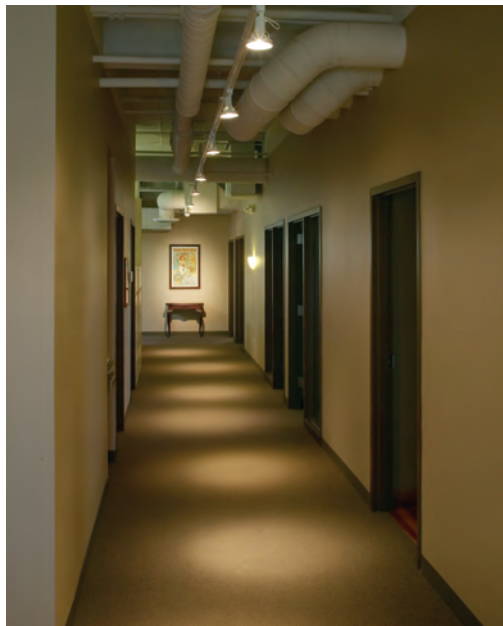
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- Size and shape of the space
- Traffic patterns through the space
- How each room will be used: there is almost always some type of task involved in each space and some tasks require more light than others.
- The ceiling height and shape: if light will be reflected off these surfaces and contribute to the ambient light level in the room.
- Color of the walls: darker walls absorb more light and may require higher levels of illumination. A light, bright office will reflect a better image of a company than a dull one.
- Art work and highlight areas: determining the pieces and places to be highlighted helps determine the number of accent lights needed.
- Families of luminaires: recessed downlights used as adjustable accents and wall washers should match in aperture size and trim finish as well as use similar lamp types. Compliment these choices with the same, or similar, finished fixtures to avoid drawing attention to the lighting system.

The best lighting is integrated into the architecture of the space: enhancing the architect's conception of the space, reinforcing the activity occurring in the space, and highlighting prominent areas. When lighting commercial spaces, a "one size fits all" approach is unsuccessful, as different areas require different lighting needs. It is important to work on a space-by-space basis to determine specific lighting design criteria with enough flexibility for personal touch. The lighting design needs to be kept simple to avoid visual clutter; use a family of luminaires for cohesiveness in the design. It is important to layer the light, ambient (general), task and accent to get the best balance of light in the space.

Lighting uses about 30% of the electricity used in an office space. Dimming controls can also reduce energy costs by lowering light levels to conserve energy and increase lamp life and alter the intensity of light to suit particular tasks and activities. Many of ConTech Lighting's products can be operated by a dimming control.





## RECEPTION AREA

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The first impression of your business is often formed when visitors and potential customers enter your space. Lighting needs to compliment the architecture, provide a safe exterior-to-interior transition, and convey a strong corporate image.

This area usually requires lighting two separate conditions: a task area for the receptionist as well as an area for waiting visitors. Care should be taken to light the receptionist's face so they appear approachable. Lighting in the waiting area should be restful, but provide sufficient illuminance for simple tasks.

## CORRIDORS

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The corridors throughout the office must remain illuminated for long, if not continuous, periods of time. To conserve energy, provide at least one-fifth the illuminance level of the surrounding areas. This is a safe, navigational level, and will not effect eye adaptation when moving in and out of the hallways.

If the walls and ceilings are lit, the area will feel larger and more open. All corridors must have emergency lighting, as they are paths of egress.

## CONFERENCE ROOMS

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The conference room serves many different functions: from video and power point presentations to brainstorming sessions, the lighting design needs to accommodate the range of activity occurring in the space. It is vital that the lighting in these spaces is designed for maximum flexibility and visual comfort.

General lighting in the room, at a comfortable, navigational level, needs to be dimmable to vary the illuminance level for visual presentations. Appropriate task lighting needs to be provided for reading and writing at the table, and ample illumination on the people seated at the table also needs to be provided.



## OPEN PLAN OFFICE SPACE

Open plan office space is a dynamic space where a wide variety of different tasks are carried out. The ambient light level in the open plan office needs to provide a comfortable, functional light and be lit consistently with the overall lighting plan. The furniture used in the space will have a major impact on the distribution characteristics and general luminance of the ambient lighting. Therefore, the task lighting in the space will provide the higher

illuminance levels that are needed at task locations. The lighting should be distributed uniformly, avoiding hot spots and glare. Glare contributes to eye strain, visual fatigue, and headaches, as well as making tasks more difficult to see. It is important to keep the open lighting plan very flexible, as the transient nature of work stations will alter the planned lighting layout.

## PRIVATE OFFICE SPACE

Private offices are used for individual work as well as group meeting space. The ambient light in the room should be sufficient for navigation and conversation with adequate task lighting over the desk and other work surfaces. Accent lighting can provide variety and interest, and serve a dual purpose by creating

simple light patterns on the wall while highlighting artwork or other work-related material. This can be achieved with adjustable recessed housings or track heads. Luminaire design and style should compliment the architectural and interior design qualities of the room.

## EXIT & EMERGENCY LIGHTING

ConTech offers a variety of high quality exit and emergency lighting fixtures to suit your space. When general lighting systems fail, exit and emergency lighting direct the safe exit of the building's occupants. If no exit is required, the lighting should

provide security and comfort until the general lighting can be restored. ConTech's exit and emergency fixtures are tested to the highest safety standards; meeting or exceeding NFPA101, NEC and UL294.



## ILLUMINANCE CATEGORIES AND ILLUMINANCE VALUES FOR GENERIC TYPES OF ACTIVITIES IN INTERIORS

| Type of Activity  | Illuminance Category | Footcandles    | Reference Work-Plane  |
|---|----------------------|----------------|---|
| Public spaces with dark surroundings  | A                    | 2-3-5          | General lighting through spaces   |
| Simple orientation for short temporary visits   | B                    | 5-7.5-10       |   |
| Working spaces where visual tasks are only occasionally performed                       | C                    | 10-15-20       |   |
| Performance of visual tasks of high contrast or large size                              | D                    | 20-30-50       | Illuminance on task   |
| Performance of visual tasks of medium contrast or small size                            | E                    | 50-75-100      |   |
| Performance or visual tasks of low contrast or very small size                          | F                    | 100-150-200    |   |
| Performance of visual tasks of low contrast and very small size over a prolonged period | G                    | 200-300-500    | Illuminance on task, obtained by a combination of general and local (supplemental lighting) |
| Performance of very prolonged and exacting visual task                                  | H                    | 500-750-1000   |   |
| Performance of very special visual tasks of extremely low contrast and small size       | I                    | 1000-1500-2000 |   |

## WEIGHTING FACTORS TO BE CONSIDERED IN SELECTING SPECIFIC ILLUMINANCE LEVELS

| For Illuminance Categories A through C      |                  |           |               |
|---|------------------|-----------|---------------|
| Room and Occupant Characteristics           | Weighting factor |           |               |
|   | -1               | 0         | +1            |
| Occupant Ages                               | Under 40         | 40-55     | Over 55       |
| Room Surface Reflectances*                  | Greater than 70% | 30-70%    | Less than 30% |
| For Illuminance Categories D through I      |                  |           |               |
| Task and Worker Characteristics             | Weighting factor |           |               |
|   | -1               | 0         | +1            |
| Worker's Ages                               | Under 40         | 40-55     | Over 55       |
| Speed and/or Accuracy <sup>1</sup>          | Not Important    | Important | Critical      |
| Reflectance of Task Background <sup>2</sup> | Greater than 70% | 30-70%    | Less than 30% |

\*Average weighted surface reflectances, including wall, floor, and ceiling reflectances, if they encompass a large portion of the task area or visual surround. For instance, in an elevator lobby, where the ceiling height is 25 feet, neither the task nor the visual surround encompass the ceiling, so only the floor and wall reflectances would be considered.

- In determining whether speed and/or accuracy is not important, important, or critical, the following questions need to be answered: What are the limitations? How important is it to perform the task rapidly? Will errors produce an unsafe condition or product? Will errors reduce productivity and be costly? For example, in reading for leisure there are no time limitations and it is not important to read rapidly. Errors will not be costly and will not be related to safety. Thus, speed and/or accuracy is not important. If, however, a worker is involved in exacting work, accuracy is critical because of the close tolerances, and time is important because of production demands.
- The task background is that portion of the task upon which the meaningful visual display is exhibited. For example, on this page the meaningful visual display includes each letter which combines with other letters to form words and phrases. The display medium, or task background, is the paper, which has a reflectance of approximately 85%.

## COMMERCIAL ILLUMINANCE RECOMMENDATIONS FOR GENERAL LIGHTING AND SPECIFIC VISUAL TASKS

| Areas/Activity                              | Illuminance Category |          |
|---|----------------------|----------|
|   | Horizontal           | Vertical |
| <i>Conference Rooms</i>                     |                      |          |
| Meeting                                     | D                    | B        |
| Video Conference                            | E                    | D        |
| <i>Offices</i>                              |                      |          |
| Filing                                      | E                    | C        |
| Open Office, Heavy Computer Use             | D                    | B        |
| Open Office, Intermittent Computer Use      | E                    | B        |
| Private Office                              | E                    | B        |
| Mail Sorting                                | E                    | A        |
| Copy Rooms                                  | C                    | A        |
| <i>Lobbies, Lounges and Reception Areas</i> |                      |          |
| <i>Service Spaces</i>                       |                      |          |
| Stairways and Corridors                     | B                    |          |
| Elevators, Passenger                        | B                    | A        |
| Toilets and Washrooms                       | B                    | A        |



# WHAT SETS US APART

## INNOVATION

We combine the latest energy efficient technology and design styles to create an extensive range of attractive and sustainable luminaires. We have over 5,000 products, including many high performance products that can't be found anywhere else. Our EcoTechnology solutions offer sustainable energy solutions that meet the qualitative needs of the visual environment with the least impact on the physical environment.

## SUSTAINABILITY

At ConTech Lighting, our commitment to the environment is as important as our commitment to innovation, quality and our customers. We believe that lighting can be environmentally responsible and energy efficient, while providing high-quality performance and outstanding aesthetic design. EcoTechnology applies to our daily operation as well as to our products; from materials, manufacturing and transportation to the disposal process for our products and by-products.

## QUALITY

We use the best components and manufacturing methods resulting in the highest quality fixtures. From cast housings and high performance reflectors, to the testing of each ballasted fixture before it ships, ConTech Lighting is defined by its quality. For consistency, we use only the most reliable LED chip makers including Cree, Nichia, Lumileds, Bridgelux and Sharp.

## SERVICE

Our responsive, personalized customer focus, and market expertise represents an oasis of outstanding service in an industry that values it, but frequently doesn't receive it. We are here for you, live and in person, Monday through Friday 7:30am – 5:30pm CST.

## PRODUCT AVAILABILITY & SPEEDSHIP™

Our products are in stock and ready to ship. Our unique SpeedShip™ process helps us toward our goal of shipping 100% of placed orders within 48 hours; at no additional cost to you.

## MARKET EXPERTISE

Each market has its own unique lighting challenges. Designs can get tricky, having to verify every fixture, test every connector and make certain that every length of track is just right. We have an experienced staff of sales professionals to assist you with your projects from concept to completion.

## LIGHTING EXPERIENCE

Lighting is more than just numbers on a spec sheet. Visit one of our facilities near you to experience the power of light to make your space more productive, more aesthetically pleasing, and more energy efficient. Visit our corporate Inspiration Center in Northbrook, Illinois, or one of our Leviton LIVE centers in San Francisco, California or New Orleans, Louisiana.



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