

# Designing, Manufacturing & Building with LED Luminaires

Cooper Lighting invited me to their manufacturing and design facility in Denver, CO to learn about the design, manufacturing and application of their products. The processes they described and demonstrated illustrate the growing importance of high performance luminaires throughout the industry.

These high performance luminaires use LEDs, which reduces the amount of energy required, allows luminaire designs to shrink, and improves indoor environmental quality.



Cooper offices act as lighting labs to test luminaires for particular applications.

## Designing Luminaires

By focusing on design strategies that embrace the physical qualities of LEDs, luminaires are able to save energy, fit in a smaller profile and generate a unique aesthetic appeal compared with traditional luminaires.

A new method of designing with LEDs uses custom injection molded plastics and edge-lit LEDs to optically redirect light from the edge in a specific distribution, which reduces the LED density of each luminaire, minimizing the material inputs and overall profile as well as providing both direct and indirect lighting in the space. By distributing the light across the surface, the edge-lit technology can also increase the spacing distance at the same light levels, reducing the energy per square foot of the space. Because of the close design margins these luminaires currently require in order to operate, the LEDs are molded into the plastic

itself, meaning that higher performance comes at the cost of decreased luminaire reuse should failure of a piece occur.

When lower cost luminaires are needed, LEDs can reinvigorate traditional luminaires to be highly efficient both in output and size using established manufacturing methods. One traditional luminaire being redesigned for LED sources is the recessed direct/indirect linear type, which can use long boards of LEDs in place of fluorescent tubes. These luminaires can take advantage of LED sources to be smaller, more energy efficient, and can replace existing installations with little to no additional costs. The need for this type of product underscores the value of manufacturing, which is a crucial step in adopting LEDs. By streamlining the manufacturing process using existing methods and equipment, LED luminaires can be produced at competitive prices, leading to greater adoption.

## Construction Methods

While the design is extremely important, the details of the construction process govern the success of LED luminaires by providing great design at a competitive cost.

The manufacturing process starts with the materials, which mostly comprise the exterior housing of the luminaire. Formed sheet metal and extruded aluminum are extremely successful due to their ease of manufacturing and quality, while high performance LED luminaires use more expensive composite materials.

The finishes applied to the housing and the testing of the luminaires also strike a balance between performance, cost and lead time that fluctuates based on the intended design. Anodizing, baked powder coating and electroplating are all extremely durable, but have differing costs, light reflection characteristics and manufacturing lead times.

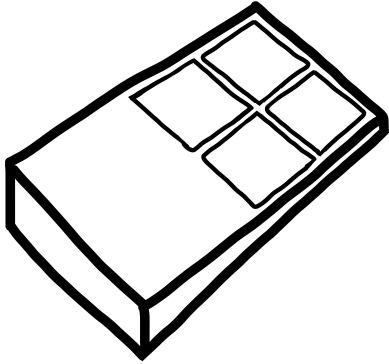
As LED designs become more fine-tuned, more extensive testing is also required. For traditional luminaire



Edge-Lit LED luminaires produce direct and indirect light for an overall brighter space.

LED retrofits, 10 minutes of testing is often sufficient. Luminaires using highly customized optics on the other hand can be extremely fine-tuned, but require more prolonged and continuous testing to accurately gauge quality.

All of these factors contribute to the cost and manufacturing time, meaning well-planned projects are able to take advantage of the highest performance.



Luminaires such as these provide uplight onto the ceiling for ambient light.

### Application Onsite

After a luminaire is designed and manufactured to deliver peak performance, it's still extremely important that it's used for the right application on a site. By designing spaces that take advantage of specific lighting applications, lighting with LED products can be extremely effective in improving light quality.

One of the most effective ways of lighting a space uses ambient lighting. By bouncing light off of the ceiling and walls, spaces feel brighter and taller, and the method eliminates glare problems. LEDs deliver indirect lighting that can be spaced farther than traditional luminaires, making the space more affordable and efficient with the same quality. This makes indirect lighting a great method for applications such as large rooms, parking areas, and covered outdoor spaces where regular maintenance access is an issue.

When the application calls for light to be directed at a particular surface, such as a bookshelf or desk layout, combined direct and indirect lighting often strikes a balance between general lighting of the space and task lighting. Edge-lit LED luminaires for example can direct light both towards the task and the ceiling using the same source of light. This method is often more practical than purely indirect lighting, but requires more luminaires than purely indirect, ambient lighting.

Indirect lighting is perfect for generally lighting an area, but when a very specific spot needs to be highlighted, direct lighting is often the best approach. Either recessed into the ceiling or directionally mounted, LED luminaires provide extremely reliable and high quality light with many more options than traditional lamps, making them a great choice for this application as well.

### The Future

By designing and manufacturing high quality LED luminaires, the lighting industry is promoting a higher standard of indoor environmental quality when it comes to lighting. And with the ability of LEDs to provide this light at a fraction of the energy than traditional luminaires, it becomes all the more important that these technologies be adopted in order to achieve a brighter future.