



Figure 1. Entry corridor at Alston & Bird, LLP, showing a conference room beyond the art wall. The firm has an extensive art collection, each piece accented by recessed adjustable LED downlights. © Carson Guest. Photography: Gabriel Benzur.

Introduction

Alston & Bird's Law Offices in Atlanta occupy approximately 365,000 square feet of space in One Atlantic Center. The firm's corporate values include optimizing energy efficiency and sustainability while striving to provide attractive, functional spaces for its employees, clients, and visitors. Alston & Bird sought and received LEED-Commercial Interiors (CI) Gold certification as part of its sustainability commitment. One Atlantic Center is also LEED Silver-certified as an existing building. In renewing its lease, Alston & Bird achieved an important objective: consolidate the law practice in one building to gain space use efficiency. Through the remodel, completed in 2013, they were able to accommodate all their attorneys, several administrative departments, and conference space in 16 floors of One Atlantic Center, and meet their energy efficiency goals.

Alston & Bird's leadership wanted to expand access to quality video and videoconferencing capability using the most cost-effective, state-of-the-art equipment. This capability has now been achieved on each office floor and on conference floors. Because replacing lamps and maintaining the lighting system can be time-consuming and disruptive to the law practice, the firm wanted this facility as maintenance-free as possible. The original offices contained a combination of recessed downlights, using a variety of halogen and CFL lamps. Maintenance staff had retrofitted many of these with an assortment of CFL products, resulting in low light output, color inconsistency, and glare issues.

Next Generation Luminaires™ (NGL) Solid-State Lighting (SSL) Design Competition and Downlight Project

The NGL Design Competition encourages technical innovation and recognizes excellence in the design of energy-efficient LED luminaires for commercial, industrial and institutional applications. For more information on the NGL Competition, see <http://www.nglc.org/>. This is the second report in the NGL Downlight Project, a series of demonstrations that focus on the implementation of LED downlight luminaires, with preference given to downlight manufacturers winning NGL recognition. Conducted by the U.S. Department of Energy (DOE) to increase the adoption rate and development of high quality, energy-efficient LED systems, these projects document the real-world performance of LED luminaires relative to conventional lighting technologies. About 700 million downlight luminaires were installed in residential and commercial buildings in the U.S. as of 2012, with LED luminaires representing less than 1% of this installed base.

PROJECT PROFILE

LEED Gold certified, Commercial Interiors

- ▶ Remodel and expansion of 10 floors of office building to 16 floors.
- ▶ Fully reopened and occupied, January 2014.
- ▶ Design Team headed by Carson Guest (see complete credits on last page).

Law Firm Tenant Floor Specifications

- ▶ 365,000 ft² total tenant area on 16 floors, including core areas
- ▶ Space types include law offices, administrative areas, corridors, meeting rooms, videoconference rooms, mock trial courtrooms, dining room, kitchens, lobby, and reception spaces.

2,342 LED downlights installed instead of CFL downlights, at 17% higher cost for 50% annual energy savings (83,785 kWh).

Comparative Performance Data for CFL and LED USAI
Downlight Luminaires

	Aperture	CCT	Luminaire Light Output (Lm)	Luminaire Power (W)	Luminaire Efficacy (Lm/W)
CFL ¹	4.5"	3,500 K	980	35.3	27.8
LED ²	4.5"	3,500 K	1316	16	82.3

¹ Product No.: 4400-10-F

² Product No.: 3110-AB1-LSTD4-F-9016

One renovation goal was to have all 2,342 new downlights use a single type of light source so that they would match in appearance, even if the light engines were changed out in the future. During the design phase, dimmable LED downlights were just becoming viable in terms of lumen output and color quality. Their cost premium was acceptable compared to CFL downlights with full-range dimming ballasts. The design team found that USAI BeveLED[®]2.0 and NanoLED[®] downlights met their quality standards for fit, finish, and photometric performance, and were recognized by the DOE's NGL program in 2012. Their low power use and their easy controllability helped the project earn LEED-CI Gold certification.

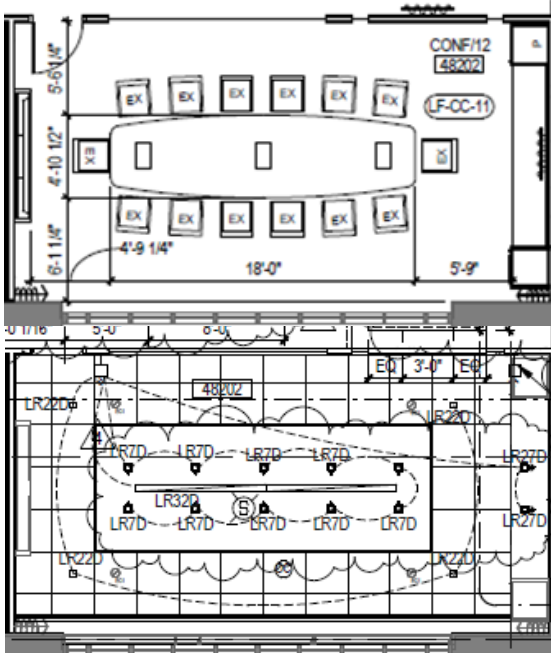


Figure 2. Floor plan and reflected ceiling plan of the videoconference room. LR7D is the LED wallwasher; LR27D is the artwork accent light. © Carson Guest and Newcomb and Boyd.



Figure 3. Typical videoconference room, with a T5 fluorescent linear slot luminaire and pairs of recessed LED wallwashers with angled diffusers, located to highlight faces for videocamera transmission. © Carson Guest. Photography: Gabriel Benzur.

Power and Energy Results

Alston & Bird floors are separately metered from the core building areas and other tenants. The monthly power usage since January 2014 shows dramatic electric energy savings compared to usage in earlier years. This is attributable to lighting and plug-load improvements, as well as the new HVAC ducting and VAV controllers, since air handlers remained in place. Because the electrical panels contain all three kinds of loads, separating reductions due to lighting and controls alone is not possible.

Comparing energy use before and after the renovation is complicated because Alston & Bird increased the number of floors they occupy, and because any lighting power reduction during winter months may have resulted in increased use of the electric heating system. The building engineer has been able to normalize each month's usage values based on heating degree days, allowing a comparison to the 2009 baseline data, in spite of weather differences between the comparison years. The following are the changes per square foot of tenant space after the renovation: 22% energy use reduction during winter months; 37% energy use reduction during summer months; 26.5% average energy use reduction over the 10 months of energy evaluation in 2014.

The total lighting power density (LPD) calculated for energy code compliance is 0.94 W/ft² for the 16 floors. This LPD is 17.7% below the ASHRAE/IES 90.1-2007 allowed watts using its Space-by-Space method of calculation. This connected load does not include savings from occupancy sensors and occupant dimming, so the actual energy savings should be even greater. The power savings from the LED downlight products compared to triple-tube CFL products are substantial. As an example, a USAI 4.5-inch square beveled aperture downlight with 50-degree beam angle is available in both 32 W CFL and 16 W LED. The table to the top left summarizes the comparative performance data. The annual energy savings from just the 2,342 LED downlights is roughly 83,785 kWh, for an annual electrical cost savings of \$8,546. (Assumptions: 2,342 LED downlights installed in the 16 floors, drawing an average of 15.9 W when dimmed to a 90% power level. LED power is 50% of the CFL downlight's, or 15.9 W each; 3,000 annual operating hours, assuming 75% of downlights switched on during that time. Electric rate is \$0.102 per kWh.)

Cost of Lighting and Controls

At the time of ordering, the dimmable LED luminaires averaged 17% higher in contractor price than an equivalent CFL luminaire equipped

with a premium dimming ballast. Alston & Bird considered this a good investment for a product that also draws less than half the watts to deliver the same light output as the CFL product, with longer life expectancy. That cost differential is likely to grow smaller with time.

Design Choices

Lighting for faces during videoconferencing posed an important lighting challenge. Cameras must pick up face and body gesture details and present them on-screen just as someone within the room would see them. Video communication is enhanced when expressions and gestures are easy to see and facial appearances are not marred by harsh shadows, or exaggerated by video camera transmissions. Overhead downlighting tends to produce excess shadowing on faces. Diffuse light from angles close to horizontal provides the softest shadows, but is also more likely to produce glare for that individual. The Newcomb & Boyd Lighting Group designer chose recessed wallwashers with diffuse glass apertures for lighting faces in most videoconference rooms, a compromise between perfect facial modeling and visual comfort. (Figures 2, 3, and 4.) Artwork is illuminated with recessed adjustable accent lights with small apertures. Specified with 3,000 K correlated color temperature (CCT), 90+ color rendering index (CRI) LEDs, they are slightly warmer and higher in color rendering than the 3,500 K, 80+ CRI LEDs used elsewhere.

Construction Documents and Installation Issues

Luminaire manufacturers face frequent product changes because of new generations of LED chips and drivers with different characteristics. However, USAI maintained the same size, color, lumen output and light distribution characteristics over time, so the design team did not have to deal with product evolution issues. Even if the power draw and efficacy had improved between the specification date and the product ordering date, the number, location, and appearance of the downlights remained unchanged. Weekly jobsite meetings among the contractor, client, and design team members allowed most coordination conflicts to be addressed early enough for problems to be quickly resolved. Of the 2,342 LED downlights installed, only 38 failures (1.6%) occurred within the first year, a rate the design team considered acceptable. The manufacturer reported that failed components were most likely driver failures, rather than LED chip or board failures.

Lighting Controls

Most of the lighting on the 16 Alston & Bird floors is LED, although linear T5 and T8 fluorescent luminaires are also used in offices and other areas. Most of the luminaires are dimmable, using 0-10 V dimming drivers and ballasts, controlled on attorney and administrative floors by an Acuity Brands “nLight” control system with occupancy sensors. Rooms with direct sunlight use sensors set to vacancy operation, requiring the occupant to manually switch on lights, but automatically switching them off upon departure. The control system in interior areas turns lights on during core work hours or with occupancy outside those hours. A control panel on each floor sends 0-10V control signals to each luminaire over CAT5 cable, daisy chained from luminaire to luminaire. USAI’s LED downlights were made controllable by adding an nLight module to the luminaire’s junction box or to a switch that in turn

LIGHTING PERFORMANCE MEASUREMENTS IN VIDEOCONFERENCE SPACE

Figure 4 illustrates the vertical illuminances on faces and the ambient light on the conference table. At the maximum output level for all room lighting, and no daylight contribution, vertical illuminances on faces of participants around the table range from 461 to 708 lx (43 to 66 fc). Table illuminances ranged from 575 to 1,015 lx (53 to 94 fc). The facility managers commented that no room users have complained of glare, probably because the light patterns from the wallwashers and recessed linear luminaires are soft-edged, producing surface and facial illuminances that are in a similar range (generally less than a 2:1 ratio). The glass diffusers eliminate any direct view of bright LEDs. Visual comfort is further improved by high wall surface reflectances, which reduce the perception of glare. Alston & Bird considers these videoconference spaces very successful because cameras in two locations of the room transmit clear visual information, and because employees have no trouble using the controls and A/V technology.

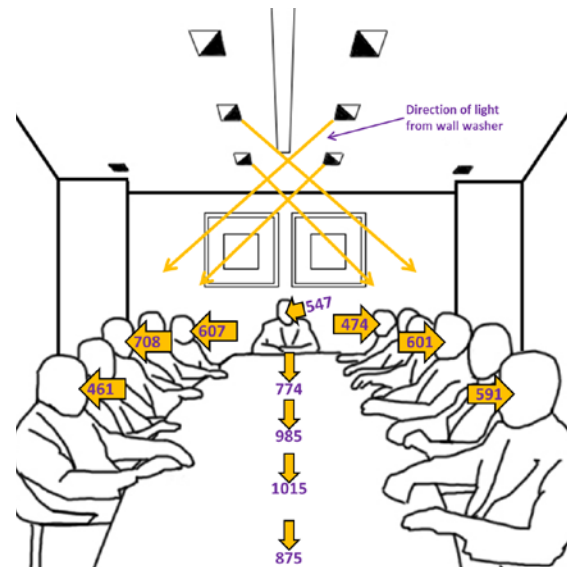


Figure 4. Illustration of vertical illuminances on faces and horizontal illuminances on table in videoconference room. Illuminances are expressed in lux (to convert to footcandles, divide by 10.76). Measurements were taken by PNNL using a Konica-Minolta T-10A meter.

LIGHTING DESIGN GOALS

- ▶ Provide excellent facial modeling in all spaces, especially conference rooms and videoconference rooms where gestures and expressions are critical for clear communication.
- ▶ Deliver excellent color rendering of skin tones in occupied spaces (3,500 K, 80+ CRI), and color quality that makes the firm's art collection visible and pleasing (3,000 K, 90+ CRI).
- ▶ Control glare from luminaires for occupant comfort, especially from luminaires designed to light faces.
- ▶ Provide smooth luminaire dimming in spaces like conference rooms, to support different kinds of activities.
- ▶ Within an enclosed space, specify downlights with the same LED module from a single manufacturer, to reduce inconsistencies of emitted light color.
- ▶ Use luminaires that use a minimum of watts, while delivering needed light levels and satisfying quality issues.

CREDITS

- ▶ Architecture/Interior Design: Carson Guest, Atlanta GA
- ▶ Lighting Design: Newcomb & Boyd Lighting Design Group, Atlanta GA
- ▶ Mechanical and Electrical Engineering: Heery International, Atlanta GA
- ▶ Property Owner and Manager: Hines, Atlanta GA
- ▶ Tenant: Alston & Bird, LLP, Attorneys at Law
- ▶ LED Lighting Manufacturer: USAI Lighting, LLC, New Windsor NY

controlled a group of luminaires. Alston & Bird facilities staff is trained to modify the nLight system programming, if needed. The controls qualify for one to three points under credit EA 1.2 V 2009 toward LEED certification.

Larger and more complex videoconference rooms and the mock courtroom are equipped with Crestron touchscreen control products or computers operating a Crestron iLux system. These also control the A/V equipment and the motorized shades. Staff may also control the system using a wireless remote control on a laptop or wall-mounted dimmers. Crestron programmers worked closely with Alston & Bird's A/V staff to write and implement a custom controls program to make room setup and videoconferencing controls simple and intuitive so that attorneys could use them without needing on-staff A/V experts to set up a meeting.

Before the renovation, all lighting was manually controlled and switched off by building cleaners and security staff, often at 10 p.m. or later. Now, lighting in common spaces and corridors is energized from 7 a.m. until 7 p.m., Monday through Friday. After hours, dual-technology motion sensors – passive infrared (PIR) and microphonic sensing – set to 30-minute vacancy delays, automatically control lighting. Motion sensor-controlled plug strips at desks automatically switch off noncritical plug loads, including task lighting, when unoccupied. After some initial issues with setting vacancy delays, and overriding sensors controlling corridor lights during work hours to eliminate distracting on-off cycling, there has been no reported negative staff reaction to motion sensors.

The LED luminaires are expected to decay slowly in light output over time, and the downlights have been programmed to deliver 90% of their maximum lumens now, saving 10% of the power while the installation is new. In a few years, when the LEDs have decayed in light output and additional light is needed, the lighting control system can be adjusted to deliver maximum output and draw full power. The videoconference room downlight dimming drivers dim to less than 10% of full light output, then fade quickly to off. That dimming behavior is acceptable for this client.

Lessons Learned

There were few LED downlight failures, but there were a handful of recessed downlights that needed an LED board or driver change-out. For future projects, it would be helpful to order spare parts with the luminaire order to avoid lead times for repairing the luminaires. Having all downlight replaceable parts accessible from below the ceiling would be a labor- and time-saving benefit. The design team desired a common 0-10 V control protocol among manufacturers, so that a single driver could speak to all control systems used in the remodeled floors, without modification or translator devices. (0-10 V controls protocols are only partially defined; OFF is sometimes incorporated into the control signal, and sometime requires a separate switch or relay. Furthermore, a 5 V signal may indicate full output for one driver, but 20% output in another.) **The design team emphatically responded that they would use these LED downlights, wallwashers, and accent lights on future projects.**