

16th Street Mall: Welcome to Denver's Living Room

BY GAIL GREET HANNAH



To view a video series on the 16th Street Mall and what the project entailed, [click here](#).

A Beacon of Light in a Pioneering Public Space

Denver's 16th Street Mall has been the centerpiece of the city's downtown since 1982. The pedestrian-focused retail and commercial development capitalized on the history of 16th Street as the primary retail destination for the Rocky Mountain Region. Originally 13 blocks in length, it is now over a mile long and has expanded its function as a public transit corridor. The Mall, designed by architect I.M. Pei with landscape architecture by Laurie Olin and lighting by Howard Brandston, retains

its structural "Swiss watch precision." Granite pavers cut at 45° angles are laid in strict geometric order, while trees and lights line up at measured intervals along its length. Brandston's custom-designed light, considered avant-garde for its time, has become a signature element of the space. Strikingly original in form and groundbreaking in function, the fixtures with their large clear globe mounted on a three-pronged pole were designed to provide pedestrian-friendly illumination and multiple layers of light. The light took its place as an important part of an ordered, uncluttered and transparent environment intended to provide a stage for retail activity and a safe and welcoming

place for people. In 2007, a new Downtown Area Plan was created to address decades of change on the Mall and a retail and dining environment in need of refreshing. The plan included restoration and repairs to damaged pavement and refurbishing of street furniture and the original lights. Thirty-five years after their installation, the light fixtures wore signs of weather and age, the multilayered approach to illumination had been abandoned, and warm color incandescent bulbs had been replaced by high pressure sodium sources that emitted an unappealing yellow light.

Project Objectives

Downtown Denver Partnership (DDP,) the non-profit organization that plans, manages and develops Downtown Denver, consulted with lighting specialists Clanton & Associates on restoring the lights. Retaining the iconic light that had become identified with the Mall was the driving objective. “At the time this light was created there was nothing else like it. And because it was custom-designed it has retained its uniqueness,” declares John Desmond, Executive Vice President, Downtown Environment, Downtown Denver Partnership. The DDP plan called for repairing and refinishing the original steel fixtures and replacing existing lights sources with metal halide bulbs, which produces light closer to the incandescent light of the original design. In terms of function and performance, John Desmond explains, “Our primary concerns for lighting in the Mall are safety and the perception of safety, maintenance, and energy costs. Because we are public space managers we look hard at the lifecycle costs of things, how will things wear under heavy use, what will they look like in 10 years, are replacement parts readily available.”

Collaboration with Clanton & Associates

Nancy Clanton, President of Clanton & Associates, turned to Landscape Forms lighting engineers and Studio 431 custom products division to carry out the retrofit. After close examination of the original lights the Studio 431 team determined that severe damage caused by corrosion and wear made it more cost effective over the long term to replicate the light fixtures, replacing the steel materials with corrosion-resistant aluminum parts. Studio 431 Vice President Robb Smalldon explains, “We reverse-engineered the fixture, working from existing lights to replicate the intention and dimensions of the

original design as closely as we could. We are proud to be able to bring new materials and manufacturing technology to Downtown Denver Partnerships’ vision for an important public place that preserves history while looking to the future and a better user experience.”

On a parallel track, the Landscape Forms lighting group considered the objectives for illumination on the Mall. Rick Utting, Landscape Forms Director of Engineering + Lighting, explains, “We wanted to fulfill the original intention of illuminating a space designed specifically for pedestrians. For us, this means providing illumination that enables people to orient in a space, assess threats, identify points of egress, detect objects in the path to avoid mishaps, and perform the specific tasks and activities at hand. At Landscape Forms, lighting for urban spaces is always driven by the desire to create a great visual experience. Often, we are able to use less light to improve perception. We do this through appropriate scale and spacing, light distribution patterns that allow safe and comfortable movement, glare reduction, high color rendering, and effective uniformity that permits peripheral vision while minimizing dark spots and shadows.” Throughout the process, the lighting group worked closely with Clanton & Associates to challenge assumptions, test new ideas, and achieve a lighting solution that, in the end, surpassed expectations. Nancy Clanton says, “We worked on the options together. That’s what you need in a custom partner – people who can make the designs as you go through the process. And Landscape Forms didn’t just say, here’s your light and walk away. They were there during the installation, training the contractors and making sure things were being done right. That’s why I wouldn’t go to any other custom manufacturer for landscape lighting.”

The Landscape Forms Solution

The Landscape Forms lighting group considered the proposed use of metal halide bulbs in the re-engineered light and suggested an alternative. Since its foray into the lighting arena, the company has been a champion of LED lighting and an innovator in optic technologies, including custom designed LED arrays and diffuser lenses. The group recommended using LEDs with special optics to achieve better light distribution, and recapture some of the multi-dimensional illuminance central to the original design. To demonstrate how LED light sources would produce a superior solution it engineered and built a prototype for consideration by Clanton and the client.



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Optical Innovation

Landscape Forms lighting engineers designed LED circuit boards with proprietary optics and placed them on unique aiming angles to cast light exactly where it was needed. The aiming angles allowed the downlight to minimize shadows and reach from the fixture all the way across the sidewalk to the base of stores and restaurants lining the promenade. A diffuser lens over the array transmits 90% of emitted light and scatters the remaining light, softening the sharp edges of discreet LED “dots” to provide more uniform-appearing illumination. The optic device and diffuser lens work together to create a much broader trajectory and purposeful distribution than that provided by a single light source, and reduce glare, enhance visibility and improve safety. The aiming angles allow downlight to be cast in a wide distribution that reaches from the fixture all the way across the sidewalk to the base of stores and restaurants lining the promenade.

Color and Color Rendering

The Mall lights employ LEDs with an ecologically appropriate color temperature of 3000K, which is within the AMA recommended range. (Higher color blue/white light interferes with the production of melatonin, disturbing the circadian cycle

essential to human and animal health.) The LED Mall lights have excellent color rendering, which means they accurately replicate the color of human skin tone and clothing as well as street furniture and adjacent architecture. The good color rendering humanizes the surroundings and improves contrast, object detection, and peripheral vision, which contributes to the sense of security in public places.

Multi-layered Illumination

The Landscape Forms LED light realizes the intention of the original design by providing four levels of illumination. A downlight within the fixture’s large globe is the main light source. It illuminates the pedestrian walkway with light of comfortable intensity and broad distribution. An uplight dramatically illuminates the tree canopy along the pedestrian path, while significantly reducing the amount of uplight emitted. A re-engineered “twinkle ring” of 60 small LED lights encircling the inside of the globe reincorporates a lost feature that casts light sideways to illuminate the fronts of stores and restaurants. 30 lights are pointed outward and 30 are pointed inward where they are reflected, providing a pleasing glow within the globe. A Landscape Forms-designed optic puts the 60 LED lights at the tip of a diffused hemisphere, so light emitted from the twinkle



ring has the same intensity from any vantage point and appears as a continuous ring of light. And the lighting engineers designed a new box light installed under the triangular control box to illuminate the ground, filling in the shadows created by the legs of the structure to provide “effective uniformity” of light within the pedestrian space. With the combination of LED sources, advanced optics, and multi-layered illumination, the re-engineered light significantly reduces dark shadows and provides more uniformity, excellent illumination at a lower light level, and a richer visual experience. Two lights were installed on site and tested for more than four years. At the end of the trial period DDP enthusiastically opted for the new LED solution and 187 lights were installed on the Mall in the fall of 2016.

Building in Future Capability

The new LED lights are pre-wired and equipped with a “quick disconnect” from the power system. Wiring comes up from the pavement, through an aperture in the base plate of the light and into a junction box, which is capped and contained, making the lights easy and less costly to install, maintain and replace. Each of the four LED components for delivering multi-level illumination have independent drivers and can be individually controlled. The lights are engineered to accommo-

date dimming, timing, and seasonal activation functions, which can be implemented once the city completes the design and installation of a new underground power distribution system on which Clanton & Associates is now consulting.

Reducing Energy and Maintenance Costs

The new lights fulfill DDPs goals for reducing lifecycle and energy costs. The use of corrosion-resistant aluminum in the fixtures extends their longevity and reduces the maintenance needed to retain good appearance over time. Replacement parts can be readily provided by Landscape Forms as needed. The use of LEDs at lower wattage has reduced energy and replacement costs (see chart). The new lights consume 74% less energy than prior HPS sources. LEDs last from 15-20 years, in contrast to HPS lamps that require replacement every year or two. Pre-wiring and quick disconnect reduce labor costs for maintenance and replacement, and the additional built-in features for dimming and timing, when implemented, will further reduce energy consumption and costs. Importantly, the use of lower wattage light has been shown in research to achieve an improved perception of safety and security on the part of pedestrians using the Mall. (See energy usage graph on next page.)

Element	Wattage
Uplight	12.6
Twinkle Ring	4.2
Main Down Light	47.25
Box Down Light	9.45
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	73.5 Total

Validating Results Through Research

Research conducted by graduate student Shelby White under the guidance of the University of Colorado Boulder Lighting faculty studied the new lighting from objective and subjective points of view to gain a comprehensive understanding of the effect that the new lights have had on the Mall and those who use it. The objective components of the study included extensive lighting measurements taken before and after installation to document the physically calculable changes to the Mall lighting. Researchers measured horizontal illuminance, vertical illuminance, and luminance via high dynamic range (HDR) images. Subjective components included surveys of Mall users before and after the installation, documenting user preferences and opinions to understand how people's perceptions of the light had changed. This component focused on the changes in lighting characteristics which impact the perceptions of the user, such as light quality, reassurance or perceived safety, and visual performance.

Results of the study entitled *Urban Lighting and Pedestrian Confidence After Dark* showed, in summary:

- Post-installation objective measurements documented a reduction in light, an increase in color rendering and uniformity, and a change in color temperature.
- Post-installation subjective survey results showed a perceived increase in visual performance and in safety and security.

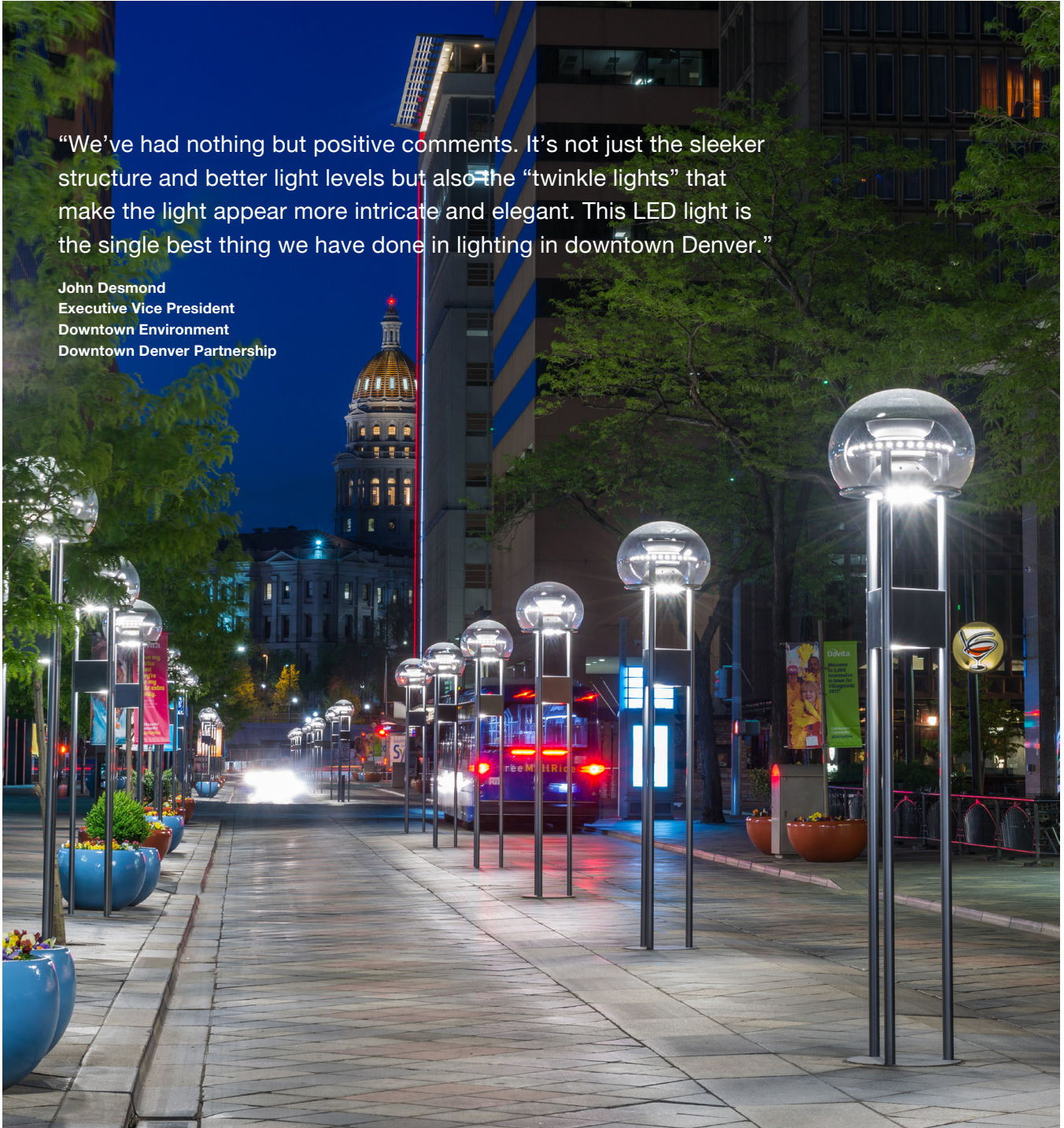
While the overall light levels on the Mall decreased as a result of the new lighting installation, the decrease was not perceived by Mall users. This is likely because perception of brightness was shown to have increased. The subjective analysis revealed that the perceived visual performance of users increased despite the reduced light levels. Although the subjective analysis did not identify user awareness of the dramatic colorimetric changes that resulted from transitioning from High Pressure Sodium to LED light sources, the increased perception of brightness and the improved ability to perform visually may have been caused by the significant increase in color rendering. The new lighting was also shown to have improved the distribution of light on the Mall by distributing it more uniformly on the sidewalk. Researchers hypothesize that the increased uniformity, along with the changes in color properties, may be the causes of the increased feelings of perceived safety and reassurance on the Mall. The new lighting did not show any changes in visual comfort, perceptions of luminous atmosphere, or general Mall usage. This study serves as a starting point for more in-depth studies of a similar nature as well as an outline for other studies that wish to observe similar, large-scale, exterior lighting changes.

Conclusion

The Landscape Forms LED light updates and improves an iconic lighting element designed for an important and enduring public place. Rick Utting, Landscape Forms Director of Engineering + Lighting, says, "The gem of this story is that we were able to use new technology to fulfill a lighting legend's forty-year-old vision." Regarding DDPs goals for safety, maintenance, and energy costs, John Desmond of DDP declares, "The re-engineered Landscape Forms light for the 16th St. Mall meets all three criteria." And he adds, "We've had nothing but positive comments. It's not just the sleeker structure and better light levels but also the "twinkle lights" that make the light appear more intricate and elegant. This LED light is the single best thing we have done in lighting in downtown Denver."

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