Parking Lot Lighting with LEDs: T.J.Maxx Plaza

CBT Development, the developer and property owner of a retail shopping center anchored by T.J.Maxx in Manchester, New Hampshire, was incurring unusually high costs for parking lot maintenance from frequent lamp replacement and determined that poor power quality was the cause.

Already preparing to replace the plaza's 25-year-old luminaires, the owner began looking for alternative lighting systems that might offer a more robust light source. During this search, the plaza architect learned about the U.S. Department of Energy GATEWAY Demonstration Program and the Commercial Building Energy Alliances (CBEA) *LED Site Lighting Performance Specification*[1] and contacted Pacific Northwest National Laboratory to learn more about both.

The owner was particularly interested in occupancy sensors, which would offer the additional benefit of reducing energy use when the plaza is unoccupied, while still providing enough lighting for visibility. Because occupancy sensors are rarely used in parking lots, this installation presented a unique learning opportunity of significant interest to the GATEWAY program.

1. The full CBEA specification and additional information about the specification can be found at http://apps1.eere.energy.gov/buildings/publications/pdfs/alliances/led_site_lighting_spec_06_09.pdf.

Source: BetaLED

Parking lot after installation of LED luminaires

Project Description

In this project, a total of 28 (twenty-two 400W [lamp rated power] high-pressure sodium and six 400W metal halide) luminaires were replaced with 25 LED luminaires (120 LEDs per luminaire) manufactured by BetaLED®, with each luminaire controlled by an integral occupancy sensor that varies operation between high and low light output settings.

Economic Performance

The economic analysis showed that replacing the existing system with the LED product would result in cost savings. The LED product achieved an estimated payback in this installation of about three years, due to the combination of high electricity ($0.14/kWh) and maintenance costs incurred by the conventional products at this location. Substituting the lower national average electric rate of $0.104/kWh and more typical maintenance rates results in a payback closer to five years. While a 58-percent reduction in energy use was achieved through use of the LED system, it was accompanied by a 47-percent reduction in average illuminance in the high-output setting. In addition, because the lighting is on for an average of 12 hours per night but the lot is estimated

Payback Using Actual Electric and Actual Maintenance Costs

Type	Equipment Cost	Maintenance Cost*	Annual Energy Cost	Total Savings	Payback (years)
Existing		$11,000.08	$8,096.69		
LED	$47,125.00	$1,250.00	$2,590.77	$15,256.00	3.09

*Maintenance costs were estimated with a flat cost per luminaire per year that attempts to include both scheduled (i.e., relamping) and unforeseen costs.

to be empty for seven of those hours, the luminaires are operating in the low state for more than half the time. Unlike a timeclock control system, the occupancy sensors can instantly raise illumination levels when occupants are present. This flexibility is not commonly available in traditional high-intensity discharge systems.

Illumination Results

Although the LED luminaires produce lower light levels than the conventional system, the parking lot still meets the "basic" minimum horizontal illuminance of 0.2 footcandle (fc) recommended by the Illuminating Engineering Society of North America in RP-20-98, *Lighting for Parking Lot Facilities*. As designed, the installed lighting systems would produce a minimum illuminance value of 0.2 fc at one point near the edge of the parking lot at the LEDs' expected end of life.[2] When the lighting system is operating in the low setting and is near end of life, this value will drop below 0.2 fc, though only when the parking lot is unoccupied.

The shopping center tenants responded positively in a satisfaction survey on the LED installation. All respondents indicated that the new lighting is equal to or better than the previous installation, despite the measured drop in photopic illumination.

Conclusions

The LED installation at the T.J.Maxx plaza produced cost savings for both the owner and the tenants. As explained by the owner, the tenants pay utility costs proportionally, based on the square footage of their individual space, and thus have the energy savings passed directly on to them. The plaza owner realizes savings through reduced maintenance costs, which are expected to be significant. The shared savings, coupled with tenant satisfaction, makes the project a win-win for both the owner and the tenants.

2. This calculated minimum value occurs along a side driveway of the site and is not characteristic of the main parking lot. Rather, the corresponding value shown in the table reflects the minimum measured illumination found in the main lot.

Initial Illuminance Measurements, T.J.Maxx Parking Lot

	Measured High-Pressure Sodium Values	Measured LED Values (High Output)	Projected LED Values (Low Output)
Average	3.81 fc	2.03 fc	0.94 fc
Maximum	16.74 fc	2.94 fc	1.36 fc
Minimum	0.60 fc	1.03 fc	0.48 fc
Max/Min	27.90:1	2.85:1	2.83:1
Avg/Min	6.34:1	1.97:1	1.96:1
Std. Dev	3.51 fc	0.51 fc	0.51 fc
Coefficient of Variation	0.92	0.25	0.25

DOE GATEWAY Demonstrations utilize a variety of commercial and residential lighting applications to identify new SSL products that achieve three goals:

- Save energy relative to the incumbent technology;
- Match or better the existing illumination and visibility produced by the incumbent technology;
- Offer economic value to users.

This Report Brief provides a summary of a full GATEWAY Demonstration report; both are available online at www.ssl.energy.gov/gatewaydemos.html.

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