

LEDS FOR CONSTRUCTION LIGHTING

Demonstration and Evaluation of Lighting Technologies and Applications ▲Lighting Case Studies

In the winter of 2012-2013, the Lighting Research Center (LRC) evaluated the field performance of an LED construction lighting product at the new campus of New York City's Police Academy. The construction site was a 50,000 ft² (4625 m²) gymnasium with a 27.5 ft (8.4 m) ceiling height.

Objectives

- Evaluate photometric conditions
- Evaluate worker acceptance
- Evaluate installation and maintenance

Manufacturer-reported product features

Light source	Light-emitting diode
Manufacturer	Clear-Vu Lighting
Watts per luminaire	33.1 W*
System voltage	24 Vdc
Additional feature	"T-Connector" quick disconnect
Rated light output	2400 lumens
Rated life	50,000 hours

* Assuming power supply efficiency of 0.86 and optimal loading of power supply

Lighting Layout

The construction manager requested that the construction lighting provide an average illuminance of 10 footcandles (fc) (110 lux). The electrical contractor, with the assistance of the manufacturer, selected the layout of the construction lighting; LED luminaires were spaced in a regular array at approximately 20 ft x 12.5 ft (6.1 m x 3.8 m) apart. The luminaires were suspended from chains at approximately 19 ft (5.8 m) above the floor. Power supplies providing 24 volts of direct current (Vdc) were also suspended from chains; one power supply was provided for each row of 14 lights.

Photometry Results

LRC researchers measured illuminance at night, in open areas and in the aisles between construction materials, directly under and between luminaires. As shown at right, illuminance at the construction site met the target (10 fc [110 lx]), but exceeded the requirements (5 fc [54 lx]) established by the Occupational Safety and Health Administration (OSHA).¹ It would have been possible to install about half as many luminaires and still meet the OSHA requirements.

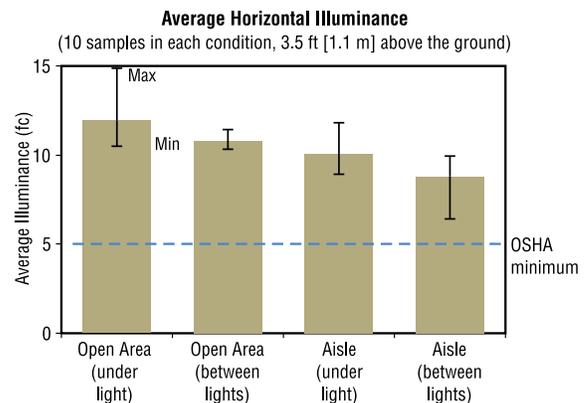
¹ United States Department of Labor, Occupational Safety and Health Administration (OSHA). Standard 1926.56 "Safety and Health Regulations for Construction." Accessed online October 2013 at: www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10630



A job site in New York City using LED construction lighting

Power and Energy Results

The LRC verified the number of operating luminaires on three site visits. The quantity varied (199 to 203 luminaires) during the study period. Assuming 203 luminaires were operating, the total installed power was about 6700 W. These construction lights were left on 24 hours a day, resulting in approximately 4900 kWh of energy use per month.² The energy cost to operate this system was approximately \$780 per month.³ For matched illuminances, the LRC calculated that the LED system used about 60% less energy than construction lighting with a conventional 400 W pulse start metal halide lamp. If fewer LED luminaires had been installed, energy use would have been lower.



² Month calculated as annual use divided by 12 months

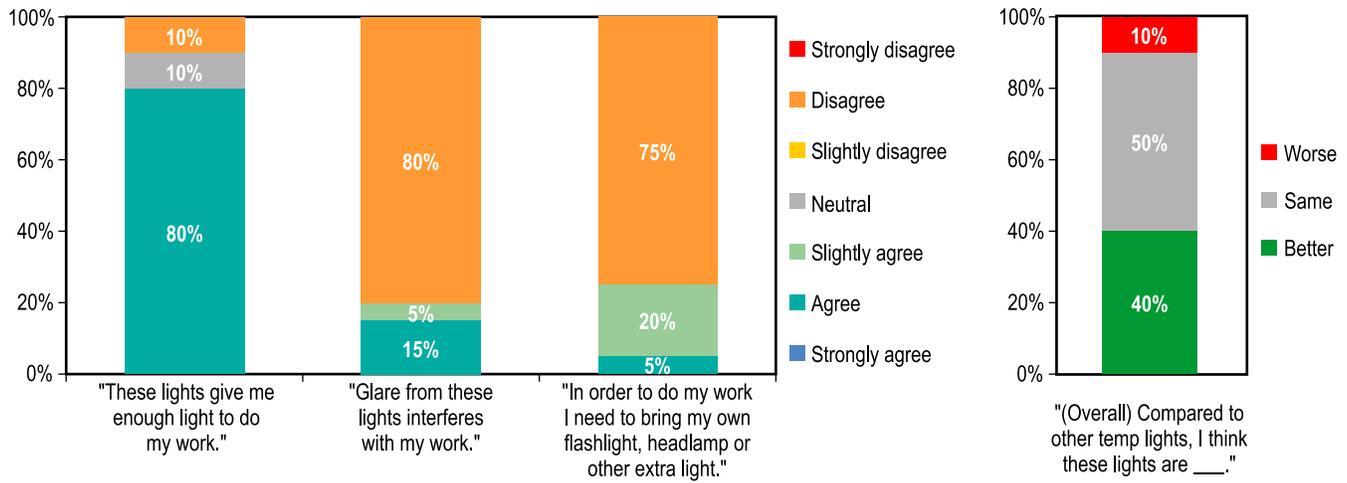
³ Assuming local utility's charge of \$0.129/kWh and \$23/kW monthly demand

Worker Response

The LRC interviewed a sample of 20 workers, including plumbers, steam fitters, sheet metal workers, and other trades people, to gather feedback about the LED luminaires. All workers answered the questionnaire when daylight was present. Most of the workers (80%) indicated that they had enough light to do their work. A few workers commented that the electric lighting was not noticeable due to plentiful daylight. Glare from the LED luminaires was not a major concern of these workers (80% “disagree”). Occasional use of supplemental lighting was reported by a quarter of respondents. Overall, the LED luminaires were rated as “better” than other construction lights by 40% of respondents, and were rated “same” by 50% of respondents.

Installation and Maintenance

The LRC interviewed two site representatives for the electrical contractor. Their impression was that the LED luminaire was “not as powerful” as conventional pulse start metal halide construction lighting. They believe that the LED luminaires required more work to install at this site because they must be spaced more closely together than conventional sources (partly because of the higher light levels requested for this project). None of the electricians commented about quick-disconnect wiring, a potential labor-saving feature of the product. One electrician stated that additional installation time was also required because the LED luminaires require two mounting points, as well as leveling, unlike conventional construction lighting.



Lessons Learned

- Energy savings were estimated at approximately 60%.
- Measured illuminances in open areas were about twice the minimum required by code. By reducing the quantity of luminaires by about half, energy use and installation costs could have been reduced commensurately.
- Worker feedback was generally positive.
- According to this electrical contractor, the LED luminaires required more work to install than conventional construction lighting.

<p>Field Test DELTA Snapshots Issue 7, November 2013 LEDs for Construction Lighting</p> <p>Sponsor: New York State Energy Research and Development Authority (NYSERDA)</p> <p>DELTA Program Director and Author: Jennifer Brons Additional Assistance: Jean Paul Freyssinier, Howard Ohlhaus, Bonnie Westlake Technical Review: Russ Leslie Editor: Rebekah Mullaney Graphic Design: Dennis Guyon Lighting Manufacturer: Clear-Vu Lighting</p>	<p>CREDITS</p> <p>NYSERDA: Marsha Walton Clear-Vu Lighting: Danny Lax, Roy Jacob General Contractor: Tomasz Stachrya, P.E., and Ronald Speicher, Turner Construction Electrical Contractor: Natasha Vysotskaya and Gary Marx, Zwicker Electric</p> <p>Field Test DELTA evaluates new energy-efficient lighting products to independently verify field performance claims and to suggest improvements. A primary goal of the Field Test DELTA program is to facilitate rapid market acceptance of innovative energy-efficient technologies.</p> <p>ISSN 1075-3966</p>	<p>Lighting Research Center</p> <p>Rensselaer Polytechnic Institute 21 Union Street Troy, New York 12180-3590 (518) 687-7100 e-mail: lrc@rpi.edu • www.lrc.rpi.edu</p>
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