



STAIRCASE LIGHTING

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

Staircases are required to provide lighting for emergency egress. Lighting typically remains on at full output year-round despite very low occupancy patterns. The Occu-smart® luminaire was developed to help high-rise facilities save energy in staircases while maintaining appropriate lighting conditions for safety. Occu-smart uses a built-in occupancy sensor to automatically dim lamps to a standby level to save energy when the space is unoccupied.

Application Profile

Rivercross is a high-rise residential complex located on Roosevelt Island, in the East River between New York City boroughs of Manhattan and Queens. The complex is composed of three towers, each with separate egress staircases. The staircases are straight run, with no mid-floor landing. DELTA evaluated the lighting before and after retrofit of 182 luminaires at Rivercross. DELTA also evaluated a commercial installation of similar scale in Manhattan, which resulted in comparable energy savings (see reverse).

Lighting Objectives

- Reduce energy use when staircase is unoccupied
- Increase illuminance in staircase

Lighting Features

The luminaires at Rivercross remain at one-third of full light output when stairs are unoccupied. An integral ultrasonic occupancy sensor turns lights up to full output when a person enters the staircase. Because each luminaire has its own occupancy sensor, only luminaires in the immediate area are turned on when residents enter the staircase.

Luminaires, Lamps, and Ballasts

The previous luminaire type used two T12ES linear fluorescent lamps with an electronic ballast (60 W). Lamps were recessed within the housing, and the lens was flat. Distribution of the previous lighting was primarily downward (see inset above).



Distribution at high angles allows light to reach the top stair



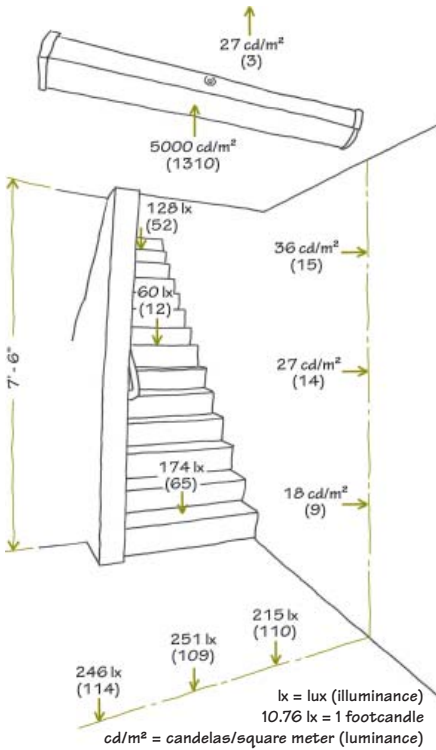
Before (inset) and after Occu-smart retrofit, Rivercross staircase, New York

The new Occu-smart luminaire operates two T8 linear fluorescent lamps with an electronic bi-level ballast (62 W full, 28 W standby; see reverse for other options). The luminaire has a wrap-around diffuser, which emits light at high angles (above 90° from vertical). At Rivercross this distribution allows light to penetrate deep into the staircase, nearly reaching the top stair (see photo, left). The Occu-smart provides higher illuminances in the staircase and exceeds the minimum code requirements of 11 lux (1 footcandle) along the path of egress, even when dimmed to standby level (see drawing on reverse).

“Wow, they’re really bright! How can they be more energy-efficient?”

–Typical comment from building resident

Residents have noticed the increased illuminances in the staircases. Building operations personnel have reassured residents that the lighting system uses less energy. Both the previous and the new luminaires feature emergency battery packs.



Perspective showing photometric conditions at full output in typical Rivercross staircase (measurements of previous lighting shown in parentheses); for standby levels, divide values by 3

Energy savings comparison, Occu-smart® options

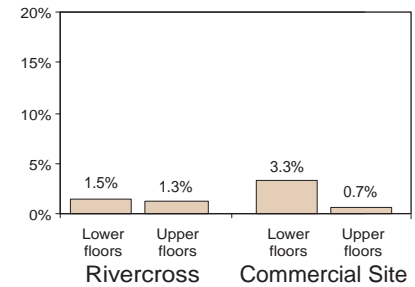
Compared to the existing luminaires at Rivercross, the following table shows what energy savings would have resulted if other bi-level ballast options had been selected.

| Standby state (when unoccupied) | 4-foot lamp quantity | Energy savings | Comments |
|---------------------------------|----------------------|----------------|---|
| Lamp(s) off | 1 | 99% | Option may be unsuitable for use in staircase applications |
| | 2 | 99% | |
| 1 lamp on, 1 lamp off | 2 | 46% | |
| Lamp(s) dimmed to 33% output | 1 | 76% | Option chosen by Rivercross |
| | 2 | 53% | |
| Lamp(s) dimmed to 10% output | 2 | 77% | Nominally 10% output, but may be lower. Ballast factor reported as .08 at standby |
| Lamp(s) dimmed to 5% output | 1 | 84-86% | Multiple ballast manufacturers may be used, resulting in a range of savings |
| | 2 | 76-77% | |

Notes:

- DELTA assumes lamp output and ballast wattage to be those reported by luminaire/ballast manufacturers. DELTA has not verified all operating wattages.
- Single-lamp configuration not acceptable to Rivercross.
- Other sites may have higher or lower savings depending on previous conditions and occupancy percentages.

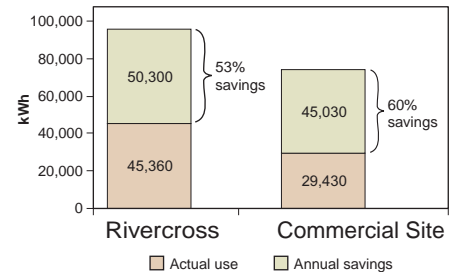
Typical Staircase Occupancy



Illuminance and Energy

The new luminaires have increased illuminances without sacrificing energy savings. At Rivercross, use of occupancy sensors resulted in a 53% energy savings, or 50,300 kWh annually. Occupancy in the staircases at Rivercross was measured to be less than 2%. As a result, the ballasts are operating at the standby level (28 W) 98% of the time. A commercial site evaluated by DELTA showed similar occupancy rates in the staircases. Other installations could show lower or higher energy savings depending on previous conditions, occupancy rates, and Occu-smart standby levels (see "Energy savings comparison" above).

Annual Energy Savings



Field Test DELTA Snapshots
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Staircase Lighting
Site Sponsors: LaMar Lighting, New York State Energy Research and Development Authority (NYSERDA)



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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.

Lighting Research Center

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