

Shedding Light on Concrete's Reflectivity



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US Department of Energy
www1.eere.energy.gov/femp/technologies/solid_state_lighting.html

Technical Fact Sheet

Prepared by
The National Ready Mixed Concrete Association



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Illuminance, Luminance and Concrete Pavement

In simplest terms, **illuminance** is the amount of actual light that strikes a surface. The density of the illuminance is measured in **foot-candles** (lumens per square foot, abbreviated **fc**), and is directly related to the proximity of the light source to the surface. **Luminance** is the light that is reflected by a surface, or transmitted through it, in the direction of the observer. Measured in candelas per square foot (cd/ft^2), luminance is directly related to illuminance, factoring in the reflectivity of the surface. Due to its lighter color and uniform surface texture, the high reflectivity of a concrete pavement provides greater luminance than other typical pavements. In fact, studies show that a concrete pavement's average luminance is 1.77 times higher than asphalt.

Concrete uses lower watt bulbs*

Benchmark = 22 light poles / 400 W bulbs / 3.4 cd/m^2

Asphalt = 400 W bulbs

Concrete = 250 W bulbs

Average savings of 6,027 kW-hr annually

Average 37.5% reduction in energy requirements

The LED effect

LED at 125 WATTS provides equivalent luminance of 400 W

**Influence of Pavement Reflectance on Lighting for Parking Lots (Portland Cement Association, Skokie, IL, 2005)*

One downside to LED's is that, while they consume considerably less energy than HID lamps, their efficacy is much lower, as they produce as little as 25 to 45 lumens per watt. As a result, LED lighting may not appear as bright to the eye as traditional lighting. However, a recent US Department of Energy (DOE) study at the Leavenworth, KS Wal-Mart demonstrated that when used in conjunction with concrete pavement, LED efficacy is improved. Initial response from customers and Wal-Mart personnel indicate that the luminance of the LED-lit concrete parking lot was acceptable, even though it has significantly lower illuminance than a similar asphalt lot with a traditional 1000W metal halide lighting design. The DOE reported, "Typical concrete has a higher reflectance value than asphalt, along with a smoother, more reflective texture. The higher reflectance values from concrete play as much of a role in the visibility and apparent brightness of the site as the lighting."

You can read the entire report at:

www1.eere.energy.gov/femp/technologies/solid_state_lighting.html

Concrete uses 36% fewer light poles*

Target illuminance = 3.4 cd/m^2

Asphalt requires 22 luminaires

Concrete requires 14 luminaires

Average savings 5,844 kW-hr annually

Average 36.4% reduction in energy requirements

Reduction in construction costs



With sustainability as the driving force behind development, there have been several recent legislative actions that require reductions in energy consumption to be incorporated in new design and construction. The **Energy Independence and Security Act of 2007 (EISA 2007)** mandates specific measures related to energy reduction that apply to all federal agencies. Among the requirements for federal facilities are:

- 25% greater efficiency for light bulbs, to be phased in from 2012 to 2014
- 200% greater efficiency for light bulbs, or similar energy savings, by 2020
- All new and renovated federal buildings must implement 55% reduction in fossil fuel use by 2010 and 80% reduction by 2020
- All new federal buildings must be carbon neutral by 2030

By combining the leading-edge technology in energy efficient lighting with concrete's superior reflectivity, owners and developers can easily achieve these goals.