A Proposed Metric for Illuminated Signs

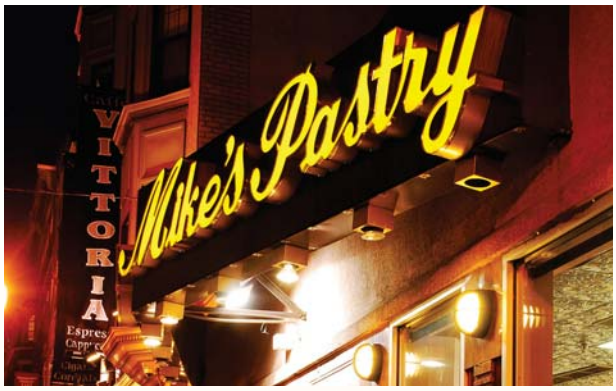
Illuminated signs are ubiquitous in the urban landscape, and each one is customized to meet the needs of the property owner and the environment where it is displayed.

Given the wide range of sign types, shapes, sizes, light sources, and diffusers, it is difficult to make comparisons of competing signs in terms of energy efficiency. In this study, the LRC reviewed past research, performed mathematical analyses, and conducted laboratory and field evaluations of sample signs to develop a proposed metric for predicting sign luminous efficacy. The metric allows for meaningful comparisons of the energy efficiency of electrically illuminated signs under the same viewing and environmental conditions.

Metric Development

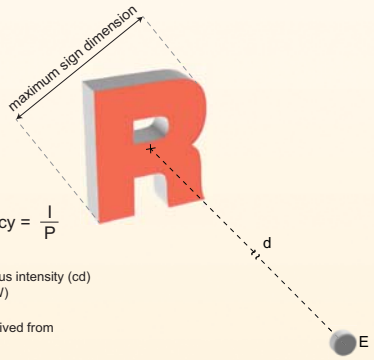
The LRC team utilized the *application efficacy* concept (which judges how well a system delivers light based upon the application's requirements) for the development of a signage metric. A field study evaluated 35 channel letter-type signs in terms of sign brightness and ease of reading. The evaluations were conducted using the same scales as those reported in the literature over different viewing distances. The present results showed a consistency of ratings, particularly for red signs, between the current field study and the literature. The field study also showed that for the same luminance, red signs are rated as being brighter than white signs, which supports a recommendation for a different target sign luminance for each of these two colors.

To optimize the energy efficiency of channel letter signs, an average faceplate luminance of 70 cd/m² for red signs and 100 cd/m² for white signs is preliminarily recommended. These recommended luminances should result in optimum subjective ratings of sign visibility for most outdoor conditions where channel letters are found.



Sign Application Efficacy Metric

The proposed sign application efficacy metric (SAE) builds on past LRC work to take the form of center beam luminous intensity (in units of cd) divided by the input power to the sign (in units of W). Given the nearly Lambertian distributions from typical channel letter signs, the average sign luminance can be estimated from the luminous intensity and the faceplate area. Step-by-step instructions are available to help sign manufacturers calculate SAE for their signs.



$$\text{Sign Application Efficacy} = \frac{I}{P}$$

Where:
- I = center beam luminous intensity (cd)
- P = sign input power (W)

Luminous intensity can be derived from

$$I = E \times d^2$$

Where:
- E = illuminance from sign (lx)
- d = measuring distance (m), d ≥ 10 × maximum sign dimension (m)

Sign average luminance can be derived from

$$\text{Luminance} = \frac{I}{A}$$

Where:
- A = sign faceplate area (m^2)

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