

Gas stations in the United States sometimes engage in price wars—repeatedly undercutting their competitors on price—to lure customers. Recently the competition between gas stations has taken a new turn: brightness wars, in which stations compete for customers by using brighter and brighter lighting. This competition is leading drivers, residents, and local officials to complain about glare and light trespass in surrounding neighborhoods. This application shows how a gas station can provide satisfactory light levels under the canopy while reducing glare and light trespass.

Application Profile

The Sunoco station at 1390 Allen Street, Springfield, MA, is located in a typical suburban area. It lies in a cluster of fast-food restaurants and shops along a divided highway, facing and backed by residential areas. In 2001, DELTA replaced the original deep drop-lens luminaires with ones that had a shallower drop lens.

Lighting Objectives

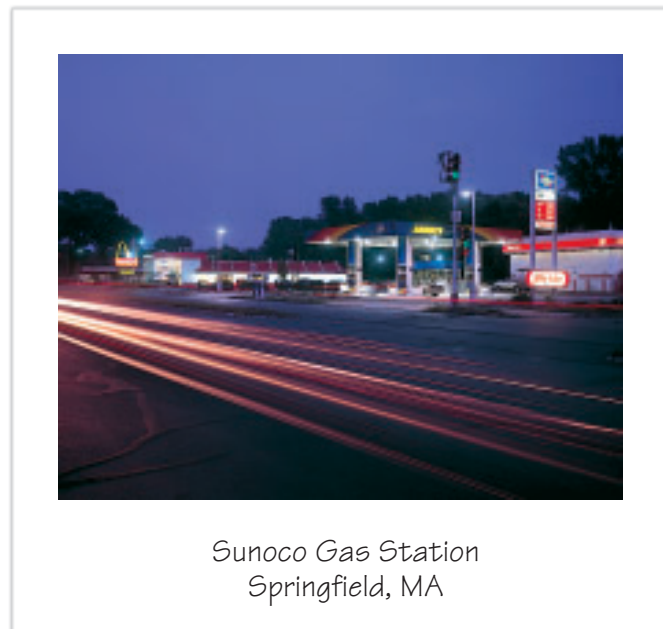
- Attract customers
- Reduce glare and light trespass
- Keep light levels high enough to promote feelings of customer safety
- Make the station visible from a distance

Lighting Features

Shallow drop-lens luminaires hide the light source but provide small areas of high brightness.

Luminaires and Lamps

The area under the station's canopy is lighted with twelve recessed luminaires in a 3 x 4 regular array, with one 320-W vertically mounted, pulse-start metal halide lamp in each luminaire. The luminaires have a shallow prismatic glass, drop-lens option. The drop lens extends only 2.5 in. below the canopy, while the prismatic elements around its circumference provide some areas of high brightness and sparkle. These luminaires replaced the original deep drop-lens luminaires, where the lamp projects down into the prismatic



Sunoco Gas Station
Springfield, MA

glass refractor. This kind of luminaire appears very bright from great distances because the lamp is visible through the refractor from many angles.

The new luminaires with the shallow prismatic drop lens provide more light downwards and less light sideways than the original deep drop-lens luminaires, reducing glare and light trespass. Illuminance measurements at the site confirm this difference. The mean illuminance measured on the floor under the canopy was 738 lux (lx) [69 footcandles (fc)] for the new lighting and 463 lx (43 fc) for the original lighting, while the vertical illuminance at eye level at the edge of the site was 19 lx (2 fc) for the new lighting and 65 lx (6 fc) for original lighting. The illuminances for the original lighting were derived from measurements at the site corrected for lamp lumen depreciation and luminaire dirt depreciation over time.

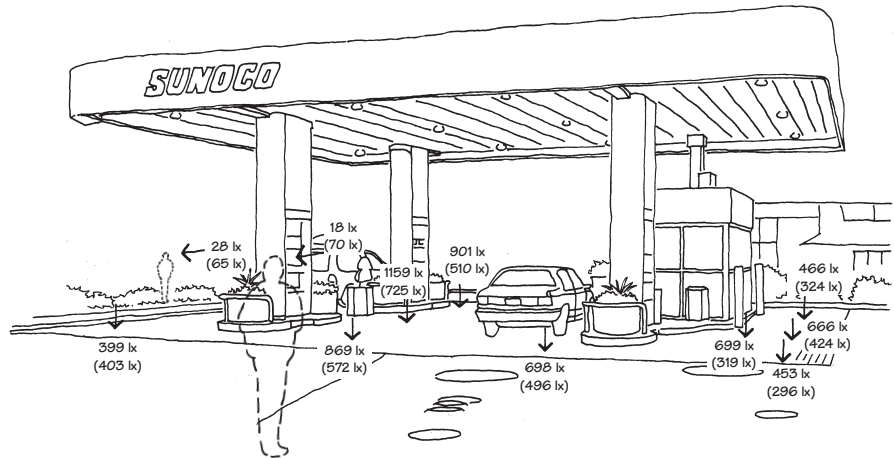
The sparkle from the prismatic elements on the drop lens of the new luminaires can still be seen from far away, preserving the station's appeal to drivers.



Original luminaires with deep drop lenses



New luminaires with shallow drop lenses



Perspective of gas station. The illuminance values shown in this illustration are a sample of the values used to calculate the horizontal and vertical mean illuminances mentioned on the front page. (Values in parentheses indicate illuminances from original lighting.)

Customer Reaction

The new installation compared very favorably with the original in customer appeal and gasoline sales. DELTA surveyed customers as they fueled their cars. The great majority said both installations had enough light to work by and found that both installations were comfortable, safe, and attractive. DELTA also took a group of local people and officials on a tour of six gas stations in the area, including this site. The group rated this site highest as a model for all gas station lighting. Interestingly, sales at this station, as well as the proportion of passing drivers entering the station, increased somewhat in the two-week period after the new luminaires were installed, although this trend will require further study to assess its reliability.

Energy and Maintenance

The lighting power density for both original and new installations remains the same at 27.4 W/m^2 (2.55 W/ft^2), but the new luminaires are at least 250% more efficient at providing the same amount of light under the canopy. The new luminaires deliver a mean illuminance of 100 lx (9 fc) under the canopy with 593 watts, where the old luminaires required 1394 watts to do the same. Both luminaires use the same number and type of metal halide lamps, so lamp maintenance and life will be similar.

DELTA Snapshots

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Gas Station Canopy Lighting

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