



Concrete Pavers Contribute to the LEED Green Building Rating System

Originally developed for the U.S. Department of Energy, Leadership in Energy and Environmental Design (LEED) is growing in use by design professionals in response to federal, state, and local government agencies, and by private developers. LEED uses a point rating system to recognize sustainable site and building design. Complying with the rating system is voluntary and it aims to improve environmental and economic performance of buildings and sites. Developed by consensus with the participation of many organizations, the rating system and certification program (based on providing evidence of compliance to the rating system) is administered by the U.S. Green Building Council. A complete description and downloads can be found on the Internet at www.usgbc.org/LEED.

Runoff Reduction

Concrete pavers and permeable interlocking concrete pavers can earn points or “credits” in the LEED rating system. Credits are earned under several categories of use including stormwater management, local/regional materials, and exterior design to reduce heat islands. For stormwater management, Credit 6.1 (1 point) can be earned for building sites where the existing impervious area is greater than 50%. Permeable interlocking concrete pavement can meet this requirement. In some urbanized areas with this extent of impervious cover, permeable interlocking concrete pavement may be more cost-effective than a separate detention facility due to space constraints. The LEED requirement is that runoff rate and quantity be reduced by at least 25%. Permeable interlocking concrete pavements can reduce runoff to zero for the most frequent storms.

Cleaning Up Runoff

Credit 6.2 provides 1 point for treatment systems designed to remove 80% of the

average annual post development total suspended solids (TSS), and 40% of the average annual post development total phosphorus (TP). The ability of permeable interlocking concrete pavements to reduce these pollutants is typically greater than these percentages according to references in the Interlocking Concrete Pavement Institute’s manual, *Permeable Interlocking Concrete Pavements—Selection, Design, Construction, Maintenance*. (Visit www.icpi.org to obtain this publication.) The ICPI manual references studies on infiltration trenches (similar to permeable pavement bases) and porous pavements with reductions in TSS as high as 95% and TP as much as 70%.

Local Materials

Another source of credit is designated as Credit 5 (1 to 2 points), local regional materials: specify a minimum of 20% of building materials that are manufactured regionally within a radius of 800 km (500 miles). An additional point is earned if 50% of the regionally manufactured materials are extracted, harvested or recovered within this same radius. Most interlocking concrete pavers and permeable pavers will be manufactured within this distance from the project site.

Walking on the Sun

Perhaps the most intriguing Credit is 7.1 (1 point), landscape and exterior design to reduce heat islands. An option for meeting this requirement is to use light-colored/high albedo materials with a reflectance of at least 0.3 for 30% of the sites non-roof impervious surfaces, i.e., pavements. Concrete paving units can be manufactured in practically any color, so they can be tailored to register an albedo of at least 0.3.

Albedo is the ratio of outbound or reflected solar radiation to inbound radiation. It is measured with a pyronometer, a device that is mounted on an arm that

can face downward toward the paving and measure reflected radiation, and then be turned upward toward the sky to measure inbound radiation from the sun. This is typically done on a clear cloudless day (see photo).

The device complies with the requirements of ASTM E 1918, Standard Test Method for Measuring Solar Reflectance



A mounted pyronometer measures albedo, the ratio of out-bound to in-bound solar radiation.



The LEED system gives credits to the runoff and pollution reduction characteristics of permeable interlocking concrete pavers.

of Horizontal and Low-Sloped Surfaces in the Field. The pyronometer is made by The Eppley Laboratory Inc., 12 Sheffield Avenue, Newport, Rhode Island 02840 tel: 401-847-1020, www.eppleylab.com. According to President, Tom Kirk, the device can be rented for US\$1500 for two months or purchased with the tripod and readout for \$3750. He noted that long term measurements should be done with two pyronometers rather than one, to better understand and compare diurnal changes in the radiation flux of pavements. He also noted that there are certain winter months of the year that the equipment can't be used due to a low angle of the

sun. This will depend on the latitude at which the measurements are taken.

According to a year 2000 study by Lawrence Berkeley National Laboratories, new asphalt exhibited an albedo of 0.04 and five year-old pavements 0.12, substantially lower than the 0.3 recommended in the LEED rating system. In their experiments, they found that an increase in albedo of about 0.1 produces a change in pavement temperature of about $-4^{\circ} \pm 1^{\circ}$ C ($-7^{\circ} \pm 2^{\circ}$ F) when there is little wind. Increasing wind speed lowers the surface temperature and diminishes the influence of the change in albedo. Fresh concrete has an albedo of about 0.35 and higher

reflectance can be achieved with light colored or white cement and light colored aggregates. While the study didn't examine concrete pavers, they likely can easily meet this recommendation in the LEED rating system if manufactured with natural or light colored finishes.

In conclusion, LEED seeks materials with local material use, high reflectance or albedo, plus runoff and pollution reduction potentials. Interlocking and permeable concrete pavers can contribute credits to sites and buildings evaluated under the LEED rating and certification. ♡