Materials and Resources (MR)

The Materials and Resources (MR) credits encourage diverting construction debris from landfills and incinerators, using recycled materials, and using materials produced. Asphalt would seem to be the perfect material to contribute towards achieving these credits. Asphalt is 100 percent recyclable and is the most recycled material in the U.S. In addition, a number of other materials can be recycled into asphalt pavements, including shingles, rubber, glass, and foundry sand. Asphalt is the clear leader in the use of recycled materials.

MR credits can be earned for the diversion of 50 and 75 percent, respectively, by weight or volume of construction debris from landfills. If the site was previously paved with asphalt and if that pavement is to be replaced, all of the asphalt could be recycled. Other credits for Materials Reuse, Recycled Content and Regional Materials are also given for reuse and recycling of materials.

In addition, MR credits can be earned for use of materials extracted, processed, and manufactured within 500 miles of the site. Asphalt pavement is certainly manufactured locally.

Innovation and Design Process (ID)

Points are available for Innovation and Design Process (ID). These points are awarded for exceptional performance above the LEED requirements, or in performance categories not addressed by LEED.

Warm-mix Asphalt

Warm-mix asphalt, a recent "green" advance in asphalt mixtures, offers the possibility of several ID credits. Warm mix provides numerous construction benefits, including reducing the consumption of natural resources and reducing emissions. The intent of LEED for Sustainable Sites is to reduce pollution from construction activities by controlling soil erosion, sedimentation, and airborne dust.[6] An ID point should be awarded for the reduced emissions from the use of warm mix. When considering fuel savings for regionally produced materials, fuel savings from the production of warm mix should also be eligible for credit.

High-RAP Pavements

The incorporation of high percentages of RAP (reclaimed asphalt pavement), above the 10 to 15 percent typically used, is highly beneficial for green construction. An ID point should be awarded for incorporating higher than 20 percent RAP in a pavement

Score Card

The concepts discussed in this brochure are valid for all of the LEED rating systems which relate to pavement. The actual credits and numbers of points vary from one system to another.

The Materials and Resources (MR) credits can be strongly influenced by the selection of asphalt pavement, but are also dependent on other factors in the project. Some credits are dependent upon the existing portion of the site paved with asphalt and the portion of the pavement to be removed. The use of warm-mix asphalt offers attractive opportunities for Innovation and Design credits.

How Asphalt Earns LEED Credits

Rating Category	Credit Description	Pavement Type	Credits
SS Credit 6.1	Stormwater Design: Quantity Control	Porous Asphalt	1
SS Credit 6.2	Stormwater Design: Quality Control	Porous Asphalt	1
SS Credit 7.X	Heat Island Effect: Non-Roof	Reflective surfaces Open-graded asphalt Porous pavements	1 to 3
MR Credit 2.X	Construction Waste Management: Divert from Disposal (based on weight/volume)	RAP	1 to 2
ID Credit 1.X	Exceptional Performance Exceeding Expectations or Areas Not Addressed	Warm-mix asphalt High-RAP mixes	1 to 4

Summary

This brochure outlines the various ways which asphalt pavements may be used to obtain or contribute to LEED credits. The references provide a number of Web sites which can be used to obtain additional information. The National Asphalt Pavement Association has a number of documents on porous pavements, recycling, and warm mix which can help the designer.

Porous asphalt pavements, open-graded surfacings, and light-colored asphalt may earn credits for Sustainable Sites. The ability to recycle asphalt pavement, the use of asphalt with high percentages of RAP, and the fact that it is produced locally, make asphalt eligible for a large number of Materials and Resources credits. Finally, warm mix and high-RAP mixes offer several advantages which may receive credit under Innovation and Design. When all these factors are considered, asphalt pavements can contribute more LEED credits than other pavement types.

1 Brundtland Report, "Our Common Future." Oxford: Oxford University Press. 1987.

2 Barrett, M. E., and C.B. Shaw. "Stormwater Quality Benefits of a Porous Asphalt Overlay." Transportation Research Record: Journal of the Transportation Research Board, Volume 2025, pp. 127-134. Washington, DC, 2007.

3 U.S. Environmental Protection Agency, "Heat Island Effect – Basic Information." October 12, 2007, 21 January 2008 from http://www.epa.gov/heatisland/about/index.html.

4 Scientific American, "Clarifying some Important Issues about Climate Change." July 15, 2007, fro m http://www.sciam.com/print_version.cym?articleID=C053EDAB-E7F2-99DF-356454A74454

5 Golden, Jay S., and Kamil E. Kaloush, "A Hot Night in the Big City, How to Mitigate the Urban Heat Island"; Public Works Magazine, December 1, 2005. (http://www.pwmag.com/industry-news.asp?sectionID=760&articleID=268116&artnum=1 Downloaded July 2, 2008.)

6 U.S. Green Building Council, "LEED® for New Construction & Major Renovations." Version 2.2, October 2005, 21 January 2008 from http://www.usgbc.org/ShowFile.aspx?DocumentID=1095.

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PS-32 10M7/08

Asphalt Pavements and the LEED Green Building System

LEED® Credits: Green Asphalt

Sustainable development is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs[1]." Sustainable development, which includes green construction practices, tries to balance the needs of people, nature, and the economy.

Opportunities to recycle, manage stormwater, mitigate urban heat island (UHI) effects, and save energy provide great potential for sustainability. There are several rating programs used to evaluate a building or construction project's environmental performance. The most prevalent system is the U.S. Green Building Council's (USGBC's) Leadership in Energy and Environmental Design (LEED).

How asphalt works for green construction:

- ✓ **Asphalt can help with stormwater management.**
- ✓ **Asphalt is America's most recycled material.**
- ✓ **Asphalt can help to reduce the urban heat island effect.**
- ✓ **Asphalt pavement is manufactured locally.**
- ✓ **Asphalt is the long-lasting pavement.**
- ✓ **Asphalt innovations reduce fuel consumption and carbon emissions.**

More About LEED®

The LEED Green Building Rating System™ serves as a benchmark or scorecard for the design, construction, and operation of green buildings. It was designed to encourage the adoption of sustainable building and development practices.

POROUS ASPHALT STREET IN FRONT OF A LEED PLATINUM MODEL HOME

How Does LEED Work?

LEED has grown and evolved from a single standard for new construction to several different project development and delivery processes. An entire portfolio of rating systems has evolved and more are on the horizon. These address existing buildings, core and shell, schools, retail, health care, homes, and neighborhood development. In many of these, pavement plays a role in the overall rating. Certification is voluntary, although some city, county, and state governments, as well as federal agencies, now require LEED certification for buildings.

The LEED system addresses six categories, not all of which apply to pavements:

- Sustainable sites
- Water efficiency
- Energy and atmosphere
- Materials and resources
- Indoor environmental quality
- Innovation and design

Each category has certain prerequisites, or "must haves," and each system awards points. A building may be certified based on four levels of accumulated points:

Certified..... 28-32 points
Silver..... 33-38 points
Gold..... 39-51 points
Platinum..... 52-60 points

Under the LEED system, asphalt pavements can potentially earn credits in three areas: Sustainable Sites, Materials and Resources, and Innovation and Design Process (ID). Available credits for Sustainable Sites include stormwater management. Under Materials and Resources, credit can be earned for diverting materials from landfills, incorporating recycled materials, and using regionally produced materials. It is possible that credits for Innovation and Design Process may be earned for such processes as warm-mix asphalt and high-RAP (reclaimed asphalt pavement) mixes.

The LEED certification process is overseen by USGBC. It is usually the general contractor or the architect who is responsible for getting the project certified; the asphalt contractor on a LEED project will interact with them and supply documentation of materials and processes beyond what is required for most jobs.

The first step is registering the project using forms provided by USGBC. Extensive documentation is required, and two reviews – one for the design phase, one for construction – are conducted. USGBC conducts credit interpretation rulings for each credit requested. The building and site are evaluated on-site by an independent party before the credits are awarded. The key to success is making a convincing argument that the design and construction pass muster on the points requested.

Sustainable Sites (SS)

Porous Pavements

Porous pavements can be used to obtain LEED credits for stormwater management. Porous asphalt pavements, which feature an open-graded asphalt surface over a stone recharge bed where stormwater is stored, provide two major benefits: first, they decrease runoff and increase infiltration; second, they help to improve water quality. A porous asphalt parking lot can earn two credits: one for controlling the quantity of runoff, plus one for improving water quality.

The same open-graded asphalt surface that is used for a porous pavement structure can also be used simply as a surface mix on top of a dense-graded pavement. In light of studies showing that such surfacings reduce pollutant loads[2], such an open-graded surface may earn one credit for improving water quality.

Urban Heat Island

The causes of increased urban temperatures include a number of factors, including displaced vegetation, heat trapped by tall buildings in "urban canyons," and waste heat from cars, air conditioners, and factories[1,3]. In a city, cars, air conditioners, and industry produce heat, so that the area heats up like a room crowded with people. Scientific American[4] magazine documents that urban heat islands (UHIs) are not a cause of global warming. However, the U.S. EPA argues that urban heat islands indirectly contribute to global warming by stimulating greater use of air conditioning, which increases demand for electricity.

Some say that dark-colored surfaces absorb solar radiation instead of reflecting it. It has been shown, however, that the UHI effect is not a black and white issue. Density, heat capacity, thickness, porosity, and a myriad of other factors affect pavement surface temperature as well.[5]

There are a number of options for reducing the urban heat island effect using asphalt pavements:

- Open-graded asphalt surfaces on top of dense pavements
- Porous pavement systems
- Lighter-colored pavements, which incorporate:
  - Light-colored aggregates (which increase solar reflectance)
  - Synthetic binders (which can be any color)
  - Durable surface coatings applied to the asphalt surface
  - Light-colored resin modifiers

An example of a highly reflective asphalt pavement would be one using a chip seal or sand seal with light-colored aggregate.

A LEED credit could also be obtained for using open-graded asphalt surfaces or porous asphalt pavements to reduce pavement temperatures. A porous pavement or an open-graded asphalt surface, like an open-grid pavement system, provides the same if not more benefits than surfaces with high solar reflectance index numbers and should be a viable alternative for reducing urban heat islands.

Porous asphalt pavement systems may earn three Sustainable Sites credits – one for reducing the quantity of runoff, one for improving water quality, and one for UHI mitigation.