



	<h2>Sustainable Hardscape Design: LEED</h2>
	<p>Program Code: FTHSDL</p>  

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	<h2>Learning Objectives</h2>
	<ul style="list-style-type: none"> ▪ The meaning and importance of “sustainable building” practices ▪ How the U.S. Green Building Council’s LEED system functions ▪ How concrete masonry and hardscape products apply to LEED-registered projects ▪ What tools are available to you ▪ Future trends in sustainable building

Sustainable Building

Sustainable development — meet needs of the present without compromising the ability of future generations to meet their own needs.

Green building — provides specified building performance requirements while minimizing disturbance to and improving the functioning of local, regional, and global ecosystems both during and after its construction and specified service life. A green building optimizes efficiencies in resource management and operational performance; and, minimizes risks to human health and the environment.

Ref. ASTM E2114-06
Standard Terminology for Sustainability Relative to the Performance of Buildings

Sustainable Design Goals

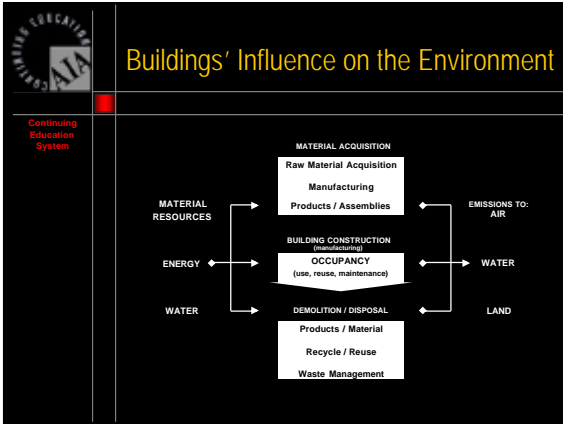
Author: Johann Dreo

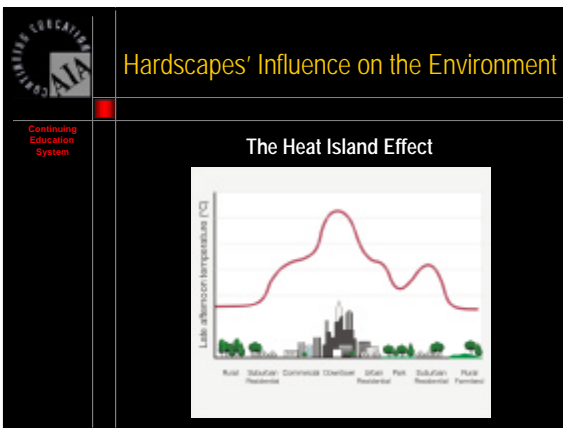
Buildings' Influence on the Environment

IMPACTS OF U.S. BUILDINGS ON RESOURCES

- 40% primary energy use*
- 72% electricity consumption*
- 39% CO₂ emissions*
- 13.6% potable water consumption**

*Source: International Association of Oilfield Contractors (IAOC) Oil Industry Energy Review
** U.S. Green Building Council (USGBC)






-
- Achieving Sustainable Projects**
- Continuing Education System
- US Green Building Council's **LEED**
 - Use **LEED** without applying for certification
 - Green Building Initiative's **Green Globes**
 - Set your own goals

Continuing Education System

What is LEED?

Our Mission

To transform the way buildings and communities are designed, built and operated, enabling an environmentally and socially responsible, healthy and prosperous environment that improves the quality of life.

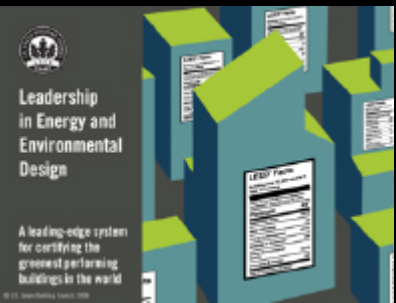


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What is LEED?

Leadership in Energy and Environmental Design

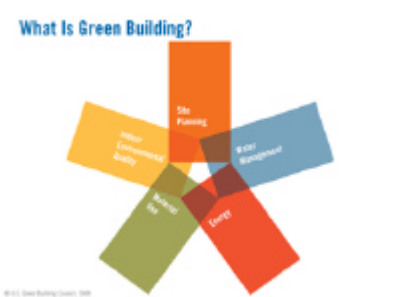
A leading-edge system for certifying the greenest performing buildings in the world.



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What is LEED?

What is Green Building?



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Some Current LEED Rating Systems

LEED 2009

- LEED – NC : new construction and major renovations
- LEED – EB : existing buildings operations & maintenance
- LEED – CI : commercial interiors
- LEED – CS : core and shell
- LEED – S : schools
- LEED – H : homes

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The Next Generation of LEED

LEED 2009


- Total of 100 possible points (up from 69)
- Points redistributed within categories, based on key environmental and human health impacts
- Reduce confusion about which rating system to use
- Scheduled to roll out in March 2009

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LEED 2009

Category	Percentage
Energy & Atmosphere	35%
Sustainable Sites	26%
Indoor Environmental Quality	15%
Materials & Resources	14%
Water Efficiency	10%

Plus:
 4 Region-specific bonus credits
 6 Innovation & Design credits




LEED 2009

TRACI
Tool for the Reduction & Assessment of Chemical and other Environmental Impacts

- **Climate Change**
- Resource Depletion
- Human Health Criteria
- Water Intake
- Human Health / Cancerous
- Ecotoxicity
- Eutrophication
- Habitat Alteration
- Human Health / Non-cancerous
- Smog Formation
- Acidification
- Indoor Air Quality
- Ozone Depletion

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LEED 2009

100 - total possible points

80 - platinum

60 - gold

50 - silver

40 - certified

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The USGBC Certifies...



Building projects



not building materials

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Can I Earn a Point for Using CM Products?

NO

- All of the points related to masonry require that the *entire building* be considered in the calculation.
- Sustainably-harvested wood is the only credit where using a single material can earn 1 point.

Can CM Products Contribute Towards Points?

YES

Concrete masonry and hardscape products can contribute to credits in:

- Sustainable Sites
- Energy & Atmosphere
- Materials & Resources
- Innovation & Design

Potential LEED Points

Category	All	Masonry
Sustainable Sites	5	14
Water Efficiency	0	5
Energy & Atmosphere	10	17
Materials & Resources	4	13
Indoor Environmental Quality	0	15
Innovation & Design	4	5

Concrete: It's Sustainable!

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Background:

- Concrete is as old as the Romans
- It's a simple mixture of readily available ingredients
- It's stable, durable, and flexible
- It addresses today's concerns about saving energy, using resources wisely and being good stewards of the environment
- It can be recycled
- It can be used anywhere—from buildings, to roads, to hardscape surfaces, to defining landscapes in decorative ways

Hardscape Surfaces


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Concrete versus Asphalt:

- Asphalt
 - Petroleum based product
- Concrete
 - Made from readily available materials
 - Water
 - Aggregate
 - Portland Cement
 - It's stronger and lasts longer
 - Better reflectivity for heat island effect reduction

SRW's, Hardscape and LEED

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Sustainable Sites in Context


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- Buildings and engineered sites have an inherent relationship with their surrounds
 - We need to be good stewards of the environment
- Development affects ecosystems in a variety of ways:
 - Can encroach on wildlife habitat
 - Increased impervious surface can disrupt natural water flows/ground water recharge
 - Sedimentation runoff and buildup can effect aquatic ecosystems
 - Increased lighting can disrupt nocturnal ecology
 - Increase heat island effect
- Development affects people's daily life
 - Travel to and from for work, play and shopping results in emissions to air and water

Sustainable Sites - 14 points

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- Prereq 1 - Construction Activity
Pollution Prevention
- Credit 1 - Site Selection
- Credit 2 - Development Density & Community Connectivity
- Credit 3 - Brownfield Redevelopment
- Credit 4 - Alternative Transportation
- Credit 5 - Site Development
- Credit 6 - Stormwater Design
- Credit 7 - Heat Island Effect
- Credit 8 - Light Pollution Reduction



Sustainable Sites

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Prerequisite 1:
Construction Activity
Pollution Prevention





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Sustainable Sites

Credit 2 : Development Density & Community Connectivity
Credit 5 : Site Development | 5.2 - Maximize Open Space



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Sustainable Sites

Credit 6 : Stormwater Design | 6.1 Quantity Control



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Sustainable Sites

Credit 6 : Stormwater Design | 6.2 Quality Control



Sustainable Sites

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Credit 7 : Heat Island Effect | 7.1 Non-Roof



Sustainable Sites


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Check out NCMA TEK Section 11

- 11-9A Articulated Concrete Block for Erosion Control
- 11-12 Articulating Concrete Block Revetment Design
- 11-13 Articulating Concrete Block (ACB) Installation

As well as ICPI Tech Specs

- 2 Construction of Interlocking Concrete Pavements
- 8 Concrete Grid Pavements
- 9 Guide Specification for the Construction of Interlocking Concrete Pavement
- 10 Application Guide for Interlocking Concrete Pavements
- 16 Achieving LEED Credits with Segmental Concrete Pavement



Materials & Resources In Context

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- **Construction and demolition waste accounts for 40% of the total solid waste stream in the United States**
 - 136 million tons annually
 - If it's not recycled, it goes to a landfill
 - If it's not organic, it doesn't break down
- **The amount of embodied energy to construct a new 250,000 ft² office building:**
 - 3.75 million gallons of gasoline
 - 15 gallons of gasoline per square foot
- **The amount of embodied energy in an existing building:**
 - Between 5 to 15 gallons of gasoline per square foot
- **Embodied Energy, what is it:**
 - Simply, the energy required to extract, process, manufacture, transport, and install building materials.



Materials and Resources - 13 Points

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Prereq 1 - Storage and Collection of Recyclables

Credit 1 - Building Reuse
Credit 2 - Construction Waste Management
Credit 3 - Materials Reuse
Credit 4 - Recycled Content
Credit 5 - Regional Materials

Credit 6 - Rapidly Renewable Materials
 Credit 7 - Certified Wood




Materials and Resources

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Credit 2 - Construction Waste Management
 Divert construction, demolition and land-clearing debris from disposal in landfills and incinerators. Redirect recyclable recovered resources back to the manufacturing process. Redirect reusable materials to appropriate sites.

Credit 3 - Materials Reuse
 Use salvaged, refurbished or reused materials



Materials and Resources

MR Credit 4 – Recycled Content

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- **Goal:** Increase demand for materials that incorporate recycled materials.
- **Requirements:** Sum of all post-consumer + ½ the pre-consumer recycled content is at least 10% (20%) of the total *value* of the materials in the project.

Materials and Resources
MR Credit 4 – Recycled Content

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Post consumer: material which has been used directly by consumers, recycled, and then reused for another purpose.



Examples: crushed concrete from demolition, recycled bottle glass

Materials and Resources
MR Credit 4 – Recycled Content

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Pre-consumer (post-industrial): material that is diverted from the waste stream during the manufacturing process

Examples: fly ash, slag cement, bottom ash

Manufactured fine aggregate?

Materials and Resources
MR Credit 4 – Recycled Content

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The *producer* reports % post-consumer and % pre-consumer, based on weight:

% post-consumer = $\frac{\text{Weight of Post-Consumer Recycled Content}}{\text{Total Material Weight}}$

% pre-consumer = $\frac{\text{Weight of Pre-Consumer Recycled Content}}{\text{Total Material Weight}}$

Materials and Resources
MR Credit 4 – Recycled Content

The *project team* determines the recycled content value for the project as a whole.

For *each material* in the project:
 Recycled content % = All post-consumer + ½ pre-consumer
 Recycled content value = Recycled content % x Material Cost

For the *project as a whole*:
 Recycled content % = $\frac{\text{Sum of all recycled content values}}{\text{Total materials cost}}$

Materials and Resources
MR Credit 4 – Recycled Content

Sand and Gravel	2,030 lb	
Bottom Ash	1,000 lb	
Portland Cement	400 lb	
Fly Ash	70 lb	
Total	3,500 lb	
Pre-consumer Recycled Recycled Content	1,070 lb	30.6% by weight

LEED Credit for Recycled Material = 15%


Materials and Resources
MR Credit 4 – Recycled Content

Method Applicable to All Construction Products*

Component:	Virgin Materials		Recycled Materials		Totals	
	Weight, lb	%	Weight, lb	%	lb	%
Sand and gravel	1,800	0	0	0.0%	1,800	59.2%
Other aggregate	50	0	0	0.0%	50	1.6%
Portland cement	50	0	0	0.0%	50	1.6%
Fly ash	80	2.6%	0	0.0%	80	2.6%
Other cement replacement	0	0.0%	0	0.0%	0	0.0%
Water [†]	0	0.0%	26	0.9%	26	0.9%
Slag	500	16.4%	0	0.0%	500	16.4%
Bottom ash	300	9.9%	0	0.0%	300	9.9%
Glass	0	0.0%	55	1.8%	55	1.8%
Crushed returns	80	2.6%	0	0.0%	80	2.6%
Ready-mix returns	100	3.3%	0	0.0%	100	3.3%
Other	0	0.0%	0	0.0%	0	0.0%
Total					3,041	100.0%

Both of these percentages: pre-consumer: 34.2% and the total cost for CMU are to be reported to the design team. post-consumer: 7.7%

* User-entered weights




Materials and Resources MR Credit 4 – Recycled Content

Alternate Method for Concrete Products⁴

Component:	Virgin Materials		Recycled Materials		Totals		
	Weight, lb	Weight, lb	%	Weight, lb	%	lb	%
Portland cement	50	0	0.0%	0	0.0%	50	38.5%
Fly ash		80	61.5%	0	0.0%	80	61.5%
Other cement replacement		0	0.0%	0	0.0%	0	0.0%
Total						130	100.0%

Both of these percentages: pre-consumer 61.5% and the total cost for CMU are to be reported to the design team. 0.0% post-consumer

User-entered weights




Materials and Resources MR Credit 5 – Regional Materials

Determining the percent, based on cost:

Use only the fraction of the material that is extracted/harvested/manufactured regionally (% by weight) when determining the regional value.


Regional \$ = $\frac{\text{Regional Content Weight}}{\text{Total Material Weight}} \times \text{Material \$}$



Innovation in Design Credits

Earn 1 to 4 points for design innovations that demonstrate exceptional performance over and above the requirements defined within the current LEED Rating System.

- Extended life expectancy & durability.
- Aiding with increasing on-site water infiltration above and beyond the minimum required.
- Reducing the temperature gradients when compared to a similar site using conventional practices.
- Aiding with restoring wildlife habitat in urban areas.
- And many more!




For More Information

National Concrete Masonry Association
www.ncma.org

U.S. Green Building Council
 Leadership in Energy and Environmental Design
www.usgbc.org

Environmental Council of Concrete Organizations
www.ecco.org

Sustainable Buildings Industry Council
www.sbicouncil.org



Questions

Thank you for your time!

This concludes the American Institute of Architects
 Continuing Education Systems Program.



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