Sustainable Design Consulting

S42 - How to Build Green:
Developing a Start-to-Finish Process for Improving the Environmental Performance of Your Building

Sustainable Design Consulting, LLC
Richmond, VA Washington, DC

Acknowledgements/Credits

Sustainable Design Consulting Introduction

- Offices in Washington, DC and Richmond, VA
- Small woman-owned business
- Focus on greener solutions for the built environment
- Consulted on over 100 green building projects, mostly LEED-related
- Project consulting mostly to Developers/Owners and Architects
- Increasing number of repeat clients
- Increasing number and types of training programs

www.sustaindesign.net

Eastern Village Cohousing

Past Experiences with Building Green

Horror Stories

- What went wrong
- What green building features didn't work

Workshop Agenda

- 1st Steps
- Establishing Green Building Goals
- Group Exercise
- Design Phase Implementation
- Group Exercise
- Construction Phase Implementation
- Verification

What is ‘Green’ Design?

Design and construction practices that significantly reduce or eliminate the negative impact of buildings on the environment and occupants in six broad areas:

Sustainable site planning

Safeguarding water and water efficiency

Energy efficiency and renewable energy

Conservation of materials and resources

Indoor environmental quality

Operation & Maintenance

AIA/COTE 2008 Top Ten Green Projects:
Pocono Environmental Education & Visitor Center
Photo credit: Nic Lehoux

1st Steps for Success

Understand Owner’s Expectations

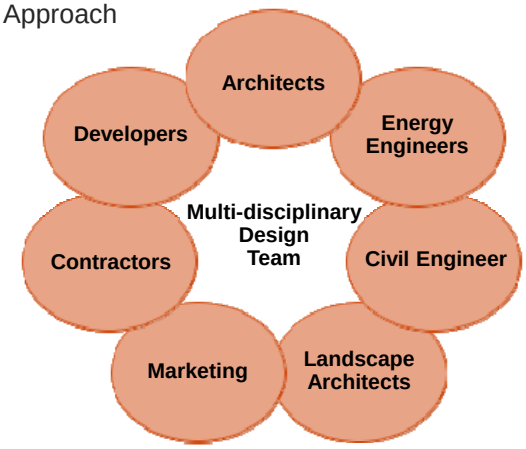
- Certification Level
- Pay-back Period
- Energy Efficiency
- Water Savings
- Indoor Air Quality

Energy Resource Center.
Photo: Construction Technologies Group Inc.

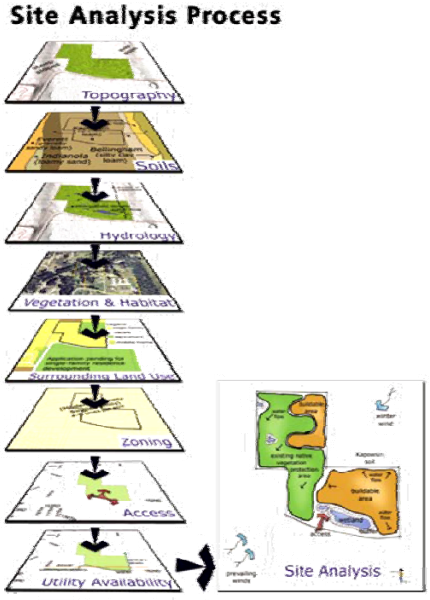
1st Steps for Success

Choose the Right Team

- Project Type Experience
- Green Building Experience
- Integrated Design Approach
- Enthusiasm
- Research Options



1st Steps for Success



Gather Data

Harvest free energy

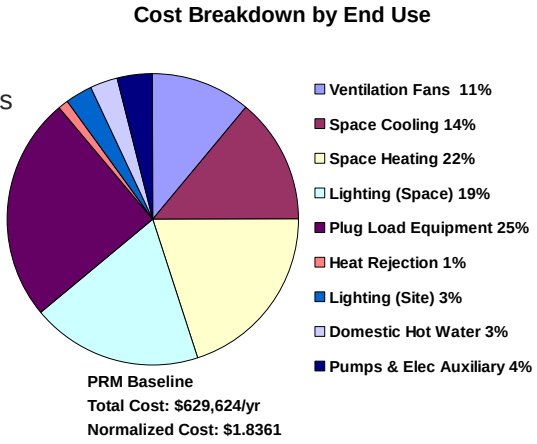
- Facilitate passive solar design
- Facilitate daylighting
- Capture natural breezes
- Protect from damaging storms

1st Steps for Success

Gather Data

Analyze the existing building

- Re-use as much as possible
- Where is energy wasted
- Find out what is working

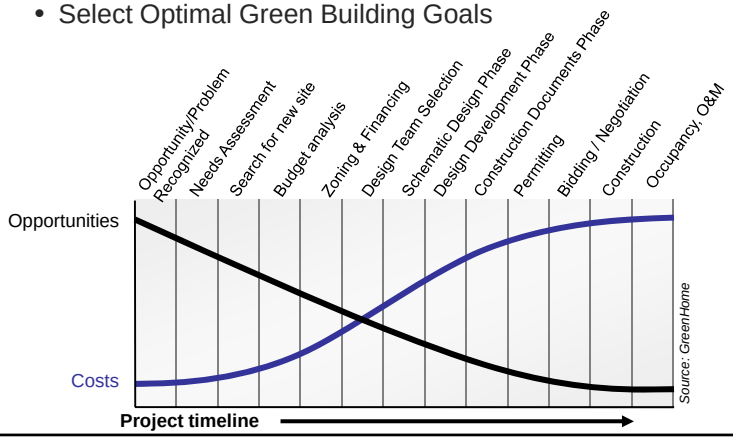


1st Steps for Success

Schedule a Green Building Workshop

Purpose

- Get Everyone Involved
- Reinforce Owner Requirements
- Select Optimal Green Building Goals



1st Steps for Success

Schedule a Green Building Workshop

Organizing an Effective Workshop

- Select the Right Attendees
  - Design Team
  - Owner
  - User
  - Marketing
- pre-Workshop Research
  - Costs
  - Feasibility

Good afternoon,

I want to welcome everyone to the LEED Workshop for the 23 Eye Street project. Our objective will be to review the green building goals for the project and determine the number of LEED credits that can be reasonably achieved.

Prior to next Monday's meeting, please take a moment to review the LEED-NC 2.2 rating guide and answer the questions below:

JPI
- What are your goals for this project? Be a generic as you want, and don't focus solely on green building issues.
- Are you willing to consider low-flow plumbing fixtures: dual flush toilets, efficient sinks, shower, and energy star appliances?
- Would you consider locating a Zipcar (or two) onsite?

SEI
- What mechanical systems are you considering? Please be prepared to discuss 3 systems.
  - Do any of these systems support MERV-13 filters?
  - Do any of these systems use HCFC-free refrigerant?
  - What is the approximate energy savings, as compared to ASHRAE 90.1-2004?
  - What is the potential cost impact for each system?
- Will you be providing energy modeling services? What program do you use?
- Does SEI provide commissioning services? If so, please provide an estimate.
- Should we increase the ventilation rate by 30% over ASHRAE 62.1-2004?
- Can this project meet the requirements of ASHRAE 55-2004?

AMT
- What are the stormwater management requirements for this project (quality and quantity)?
- What low impact development (LID) strategies are appropriate for this

1st Steps for Success

Schedule a Green Building Workshop

Potential Agenda

- Green Building Education
- Introduce the Project
- Review Owner Requirements
- Create Opportunities for Feedback
- Develop Potential Goals
- Indicate Areas of Further Research

The Heights at Georgia Avenue
Green Charrette
Washington, DC
2 February 2008
1:00pm – 4:30 pm

Agenda

I.	1:00 pm	Introductions ▪ Participant self-introductions ▪ Review purpose of charrette
II.	1:10 pm	Review the building project scope (program, schedule, etc.)
III.	1:30 pm	Review the DHCD RFP green design and building requirements
IV.	1:45 pm	Brief introduction to green building
V.	2:00 pm	Review Green Vision and Green Goals for project review project constraints and risk tolerance
VI.	2:15 pm	BREAK
VII.	2:30 pm	Discussion of Green Communities Criteria and other Green Building Options ▪ Identify strategies, commitment and implementation issues, Champion
VIII.	4:15 pm	Conclusion ▪ Reconfirm green vision and goals

Establishing Green Building Goals

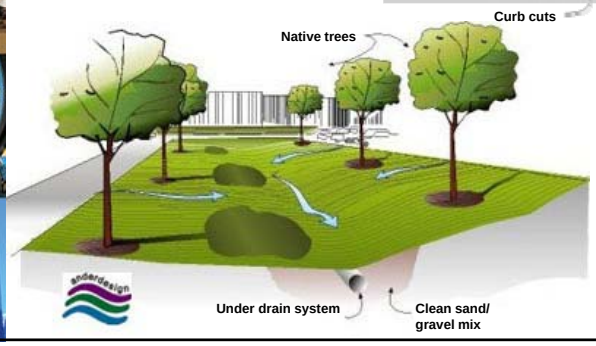
Manage stormwater naturally

Strategies

- LID techniques
- BMPs

Curb cut schematic

Courtesy Pierce County, Washington and AHBL, Inc.
www.wbdg.org



Bio-swale schematic

Courtesy Pierce County, WSU Extension
www.wbdg.org

Establishing Green Building Goals

Optimize building systems

Schematic-level energy modeling

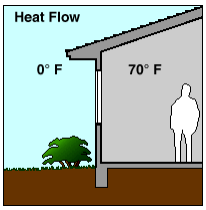
- Test site location, building massing, and building orientation
- Biggest opportunities for savings
- Update at each phase of design
- Right size the system
  - Design load modeling
  - Peak occupancy

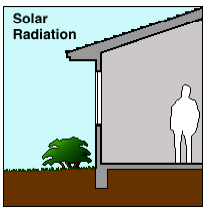
Building envelope

- Wall and roof insulation
- Window selection

Lighting options

- LED lighting
- Occupancy sensors





Efficient Windows Collaborative
www.efficientwindows.org

Establishing Green Building Goals

Reduce potable water needs

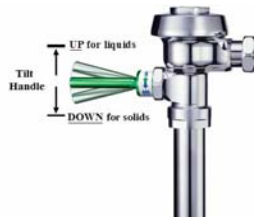
Select low-flow plumbing fixtures

- Waterless urinals
- Automatic sensor faucets with aerators
- Dual-flush, high efficiency, toilets

Cooling tower water

- Chemical-free water treatment

Select Energy Star appliances



Establishing Green Building Goals

Improve Indoor Environmental Quality

Design the interior to improve occupant health & comfort

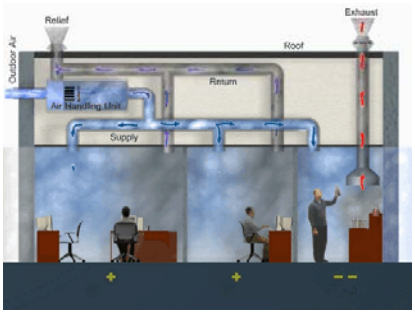
- Thermal comfort & control
- Operable windows
- Views to the outside
- Natural Daylight
- Adequate ventilation
- Low-emitting finishes
- Low-emitting furniture
- Construction IAQ
- Green Cleaning

Establishing Green Building Goals

Improve Acoustics

Design the interior to improve occupant comfort

- Select sound absorbing materials (ceiling and floors)
- Insulate partitions
- Design ducted air return system
- Locate mechanical equipment rooms away from occupied areas
- Offset door locations

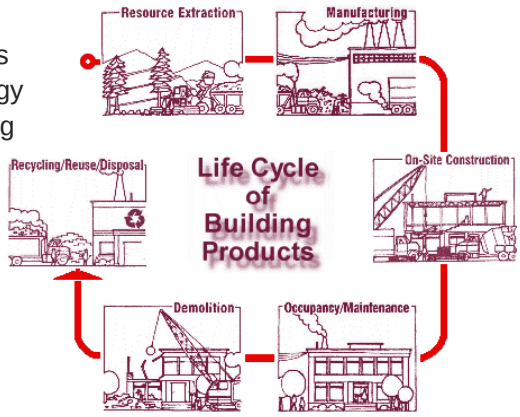


Establishing Green Building Goals

Select appropriate materials

Consider the material's impact over it's entire life cycle

- Energy Efficiency
- Recycled materials
- Salvaged materials
- Renewable materials
- Low-embodied energy
- Low or no off-gassing
- Local/indigenous



Establishing Green Building Goals

Summary of Potential Green Building Goals

- Understood Owner's Expectations
- Choose the Right Team
- Gathered the Data
- Managed Stormwater Naturally
- Optimized the Building Systems
- Reduced Potable Water Needs
- Improved Indoor Air Quality
- Improved Acoustics
- Selected Appropriate Materials
- What else?

www.avinc.com

Establishing Green Building Goals

Introducing the projects

Great Seneca Creek Elementary School

- Building Size: 82,511 sf
- Location: Germantown, MD
- Owner: Montgomery County Public Schools

Establishing Green Building Goals

Introducing the projects

Camille Kendall Academic Center

- Building Size: 191,923 sf
- Location: Rockville, MD
- Owner: University System of MD

Images by Cannon Design

Establishing Green Building Goals

Introducing the projects

Eastern Village Cohousing

- Building Size: 92,582 sf
- Location: Silver Spring, MD
- Owner Occupied

Establishing Green Building Goals

Introducing the projects

Potomac Yard Buildings 1 & 2

- Building Size: 329,644 sf each
- Location: Arlington, VA
- Tenant: U.S. EPA

Establishing Green Building Goals

First Exercise

Desired Outcomes

- Read through project information
- Determine 3 priority green building goals & 6 specific strategies for achieving them

How to Build Green: A Step by Step Guide

Green Building Goals

Determine the Top 3 Green Building Goals for the project and 6 specific strategies to achieve them.

	GOALS		STRATEGIES
Ex.	*Reduce Indoor Air Quality impacts during construction*	i.	*Require the contractor to follow SMACNA IAQ Guidelines*
		ii.	*Require the contractor to use the lowest-emitting materials possible*
A.		1.	
		2.	
B.		3.	

Design Phase Implementation

Tools to Incorporate Green Building Goals

Maintain Lines of Communication

- Schedule Frequent Team Meetings
- Email Reminders to the Team
- Call when necessary

What to ask

- Review Building Goals
- Request Updates on Assignments

Design Phase Implementation

Tools to Incorporate Green Building Goals

Track Progress

- Review Building Goals
- Next Steps to Accomplish Strategies
- Who's Responsible for Accomplish the Next Step
- What Resources are Needed
- Where in the Documents will the Strategy be Incorporated

POINTS			PREREQUISITE/ CREDIT REQUIREMENTS	ACTION ITEMS / COMMENTS	PROVIDE INFO.	DUE
Y	?	N				
	1		SSc5.2 - OPTION 2: For areas with no local zoning requirements (e.g., some university campuses and military bases), provide vegetated open space area adjacent to the building that is equal to the building footprint; OR	9/17/07 - As there is no zoning requirement for public schools, Civil Engineer to determine if sufficient open space is available. 11/19/07 - LSA provided sketch showing proposed open space; SDC to review requirements with PGCPS.	PGCPS	50% CD
			Site Credit 6: Stormwater Design (Intent: Limit disruption and pollution of natural water hydrology by reducing contamination of and managing r			
1			SSc6.1 - OPTION 1 — EXISTING IMPERVIOUSNESS IS LESS THAN OR EQUAL TO 50%: If existing imperviousness is less than or equal to 50%, implement a stormwater management plan that prevents the post-development peak discharge rate and quantity from exceeding the pre-development peak discharge rate and quantity for the one- and two-year 24-hour design storms; OR	9/17/07 - Will depend upon the SWM system selected. If a pond is constructed, then the credit is likely. If an underground system is selected, requirements may not be achieved. Civil Engineer to verify. 11/13/07 - Will be met as part of LSA's	LSA	Ready to Document

Design Phase Implementation

Tools to Incorporate Green Building Goals

Drawing and Specification Reviews

- Confirm goals are incorporated
- Look for opportunities and problems

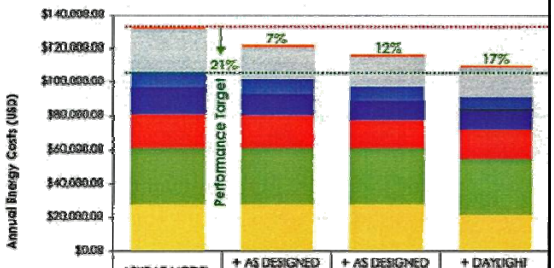
Dwg. Discipline	Dwg. No.	LEED Credit	Complies ? Y/N	Drawing Review Checklist
Civil/Land		General		Appropriate LEED project boundaries shown
Civil/Land		SSp1		Sediment control drawing(s) and details included in Civil set
Civil/Land		SSc4.2		Sufficient # bike storage spaces shown
Civil/Land		SSc4.3		Sufficient # alt. fuel stations indicated (or sufficient # LEV spaces)
Civil/Land		SSc4.3		Details for parking sign shown (Low Emissions Car Parking Only)
Civil/Land		SSc4.4		Minimum parking spaces shown and suffcient # carpoolspaces indicated, verify local requirement OR Sufficient # carpool spaces indicated if parking provided for less than 5% FTE occupants OR Minimum parking spaces shown, verify local requirement OR No new parking
Civil/Land		SSc4.4		Details for parking sign shown (Car/Van Pool Parking Only)

Design Phase Implementation

Tools to Incorporate Green Building Goals

Energy Calculations

- Computer-based
- Estimate energy use
- Compare options
- Garbage in: Garbage out



	ASHRAE MODEL	+ AS DESIGNED HVAC	+ AS DESIGNED ENVELOPE	+ DAYLIGHT HARVESTING
Dom Hot Water	$1,660.00	$1,660.00	$1,660.00	$1,660.00
Ventilation Fans	$25,000.44	$19,242.04	$18,003.36	$17,413.71
Pumps and Aux	$9,357.87	$8,210.44	$7,844.75	$7,671.57
Heat Rejection	$188.04	$144.73	$138.11	$130.66
Space Cooling	$13,411.35	$12,583.29	$11,873.44	$11,356.09
Space Heating	$20,348.00	$19,342.00	$16,236.00	$17,692.00
Misc Equipment	$33,391.12	$33,478.21	$33,473.13	$33,547.93
Ambient Lights	$27,603.43	$27,675.42	$27,671.22	$20,829.91

Design Phase Implementation

Tools to Incorporate Green Building Goals

Water Calculations

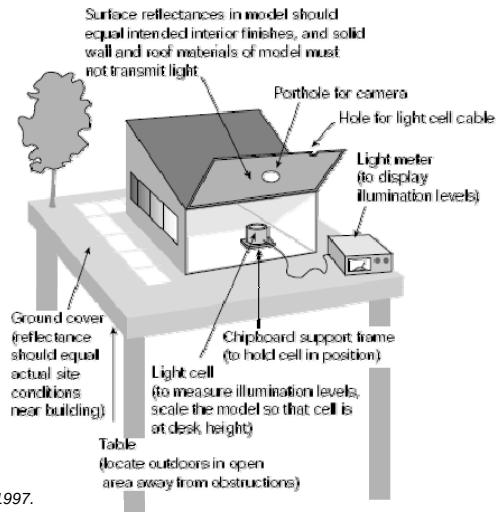
- Stormwater
- Plumbing Fixtures
- Appliances
- Cooling Water
- Irrigation

Design Phase Implementation

Tools to Incorporate Green Building Goals

Daylighting Calculations

- Sketching
- Scale model
- Spreadsheet
- Simulation



Building Technologies Program, Tips for Daylighting with Windows - The Integrated Approach

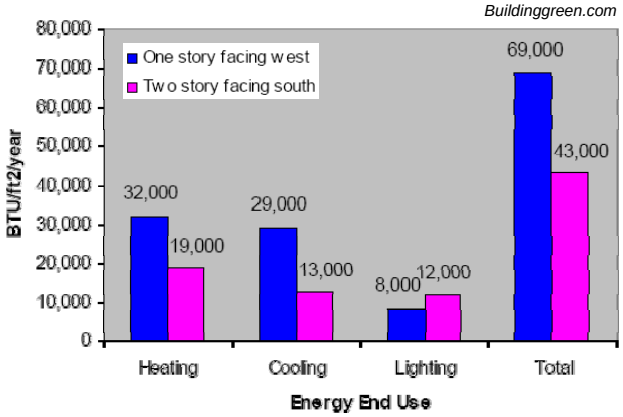
Lawrence Berkeley National Laboratory, 1997.

Design Phase Implementation

Schematic Design Phase Strategies

- Consider Building Massing and Orientation
- Schematic Level Energy Analysis
- Low Impact Development Strategies

Buildinggreen.com



Design Phase Implementation

Design Development Phase Strategies

System Selection

- Optimize Building Envelope
- Plumbing Fixture Selection
- Mechanical Systems
- Lighting Systems
- Acoustical

AIA/COTE 2008 Top Ten Green Projects
Yale Sculpture Building and Gallery
Photo credit: © Peter Aaron, Esto

Design Phase Implementation

Construction Documents Strategies

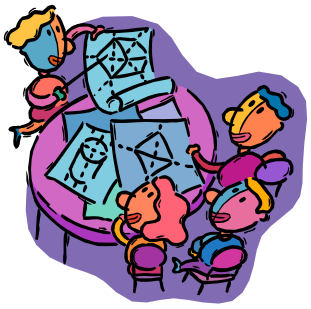
Developing Specifications

- Material Selection
- Indoor Air Quality
- Contractor Submittal Requirements

Design Phase Implementation

Using these Strategies

Find a better approach to solving past problems



Design Phase Implementation

Second Exercise

Desired Outcomes

- Using the 6 strategies for achieving your green building goals, determine
  - When to Incorporate Goals
  - Who is responsible
  - Where the goal will be incorporated
  - Helpful resources

How to Build Green: A Step by Step Guide

Green Building Goals

Develop a plan for implementing your green building goals.

	STRATEGY from previous handout	WHEN to implement	WHO will implement	WHERE in the documents	RESOURCES where to look for more information
ii.	Require the contractor to follow SMACNA IAQ Guidelines	Construction Documents	Specification writer	Division 1 spec section	To buy guidelines: www.sheetmetal.com To write spec: www.csinet.org
i.					

Construction Phase Implementation

Differences between Design and Construction

- Turning theory into practice
- Talking about real money
- New, perhaps uninspired member on the team

AIA/COTE 2008 Top Ten Green Projects:
Queens Botanical Garden Visitor Center
Photo credit: Jeff Goldberg, Esto

Construction Phase Implementation

Tools to Incorporate Green Building Goals

Maintain Lines of Communication

- Schedule Regular Construction Meetings
- Email Reminders to the Contractor
- Call when necessary

What to ask

- Review Building Goals
- Request Updates on Submittals

Construction Phase Implementation

Tools to Incorporate Green Building Goals

Kick-off Meeting

- Educate the Contractor about Green Building
- Review Green Building Goals
- Review Project Requirements
- Provide Sample Documentation
- Discuss Opportunities to Improve Communication

Construction Phase Implementation

Tools to Incorporate Green Building Goals

Submittal Log

Spec Section	Description	Item(s) to Review	Comments
09900 1.3 H 1	Painting	Product info highlighting that interior paints & coatings meet referenced standard	
10101 1.3 E 1	Visual Display Boards	Product info highlighting that interior composite wood, agrifiber, adhesives & sealants meet referenced standard	
10125 1.3 D 1	Bulletin Boards & Display Cases	Product info highlighting that interior composite wood, agrifiber, adhesives & sealants meet referenced standard	
10155 1.3 E 1	Toilet Compartments	Recycled Content	Recycled content varies by color; color not indicated.
10155 1.3 E 1	Toilet Compartments	Manufacturer & Extraction Site	Manufacture site varies by product. Specify product & extraction site.
10431 1.3 C 1	Signage	Product info highlighting that interior composite wood, agrifiber, adhesives & sealants meet referenced standard	

Construction Phase Implementation

Tools to Incorporate Green Building Goals

Contractor Tools

- Indoor Air Quality Management

[Project Name] — **LEED Indoor Air Quality Plan**

[Address] — Based on the LEED™ Green Building Rating System

[Date]

Construction IAQ Manager on site during construction is: **[Insert Name]**

Construction IAQ Checklist

	General Items	Date Begun/ Completed	Responsible Person /Affiliation Grunley	SubContractor	Location
1	Confirm + enforce the non-smoking policy within the building.				
2	Maintain smoking policy + guidelines for the immediate outside perimeter of the building to enhance IAQ at all points of entry to the building.				
3	Are workers provided and wearing respirators as necessary?				
4	Are all product MSDS sheets accessible on site during the construction shifts at time of product application or installation?				

Construction Phase Implementation

Tools to Incorporate Green Building Goals

Contractor Tools

- Construction Waste Calculator

How and where waste is diverted	Diverted Material, in: (•) tons ( ) cubic yards ( ) _____
Wood (processed for mulch at Ritchie Land Reclamation/Recycling Facility)	2.5
Concrete (recycled into aggregate at Ritchie Land Reclamation/Recycling Facility)	258.72
Concrete, cont. (recycled into aggregate at Ritchie Land Reclamation/Recycling Facility)	463.31
Metal (recycled at Joseph Smith & Sons, Inc.)	213.03
Metal, continued (recycled at Joseph Smith & Sons, Inc.)	163.59
Drywall (processed for mulch at Gyp-Agricycle Inc. Willow Rd. Lanacaster, PA)	77.19
Cardboard (processed at Georgetown Paper, Bladensburg, MD)	1.7
Asphalt (recycled into aggregate at Ritchie Land Reclamation/Recycling Facility)	28.4
Total quantity of diverted waste	1206.44
Total quantity of waste	2279.48
Percentage of waste diverted	**52.93%**

Construction Phase Implementation

Tools to Incorporate Green Building Goals

Contractor Tools

- Certification Letters for Subs

LEED CERTIFICATION LETTER
Indoor Environmental Quality Credit 4

Project Name
Project Location

Subcontractor	Product Name
Prepared by:	Spec. Section
Date	

Attach a product data sheet(s) and/or MSDS that highlights the information provided below.

☐ IEQ Credits 4.1 and 4.2: Adhesives & Sealants and Paints

____ g/L of VOC are contained in the above submitted product.

____ g/L is the required VOC limit that the above submitted product must meet or exceed.

Adhesives, Sealants and Sealant Primers: *South Coast Air Quality Management District, Rule 1168* (www.aqmd.gov)
Aerosol Adhesives: *Green Seal, Standards GC-36* (www.greenseal.org)
Paints and Coatings: *Green Seal, Standards GC-03 and GS-11* (www.greenseal.org)
Clear wood finishes, floor coatings, stains, sealers, and shellacs: *South Coast Air Quality Management District, Rule 1113* (www.aqmd.gov)

Construction Phase Implementation

Tools to Incorporate Green Building Goals

Contractor Tools

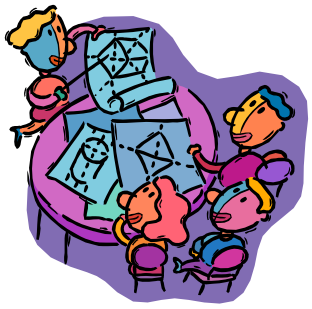
- Action Plan

Spec section and Material Description	Construction Cost (enter costs for all division 2-10 materials)	Estimated Material Cost (provide if known, otherwise calculate 45% of construction cost)	MRc4 Recycled Calculations: Post Consumer Content (provide % if known)	Post Industrial Content (provide % if known)	Recycled Content (calculated per LEED)	Recycled Content Cost	MRc5 Regional Mate: Manuf. Miles (enter material cost if material manufactured within 500 miles)	Harv Miles materia mat harv with
DIV. 8: DOORS AND WINDOWS								
082416 Flush Wood Doors		$0.00			0.00%	$0.00		
084115 Alum.-Framed Entrances		$0.00			0.00%	$0.00		
089600 Slope Glazing System		$0.00			0.00%	$0.00		
0891100 Glazed Alum. Curtain Walls		$0.00			0.00%	$0.00		
088000 Glazing		$0.00			0.00%	$0.00		
DIV. 9: FINISHES								
092110 Non-Load Bearing Steel		$0.00	67.00%	30.00%	82.00%	$0.00	$0.00	
092000 Gypsum Wall Board		$0.00	5.00%	28.00%	19.00%	$0.00	$0.00	
093013 Ceramic Tile		$0.00			0.00%	$0.00		
095100 Interact. Acoustical Panel		$0.00			0.00%	$0.00		
099100 Painting		$0.00			0.00%	$0.00		
DIV. 10: SPECIALTIES								
		$0.00			0.00%	$0.00		
		$0.00			0.00%	$0.00		
TOTALS:	$0.00	$0.00						

Construction Phase Implementation

Using these Strategies

Find a better approach to solving past problems



Verification

Why it's important

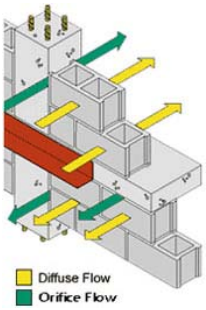
- Confirm Green Building Goals were met
- Discover Opportunities to Improve Building Performance
- Learn How to Design Better Buildings

Alberici Corporate Headquarters in Overland, MO

Verification

Commissioning

- Design
- Installation
- Testing



Air Leakage through a Building Enclosure

www.wbdg.org

Verification

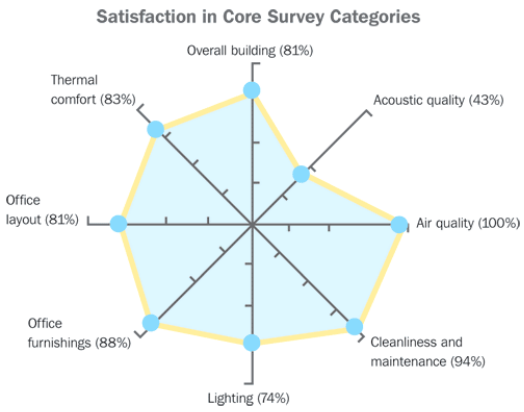
Monitor Systems

- Mechanical
- Lighting
- Computer Usage
- Water Usage
- Indoor Air Quality

Some modern building operations centers, such as this one in Johnson Controls' LEED-certified Brengel Technology Center in Milwaukee, Wisconsin, evaluate information from many facilities.

Verification

Post Occupancy Evaluation



Percentage of satisfied Global Ecology Center occupants.
Graph courtesy Center for the Built Environment

Architectural Record February 2008 "Looking Back and Moving Forward"

Great Seneca Creek Elementary School

- 1st LEED Certified Public School in MD
- Goal of Certified, achieved Gold!
- Pilot for future Montgomery County Public Schools
- Extensive User Education Program

Camille Kendall Academic Center

- 30% more energy efficient than ASHRAE 90.1-1999
- Pursued LEED-NC Silver, achieved Gold!
- User Education
- 40% Water Use Reduction in plumbing fixtures but decided to install permanent irrigation

Eastern Village Cohousing

- 1st LEED Certified Cohousing Community in the US
- Affordable, but compromised on quality of materials
- Struggling with green roof

Potomac Yard Buildings 1 & 2

- Diverted nearly 75% of construction waste
- Exceeded energy goals
- Failed IAQ testing
- Lessons learned

Conclusion

Any project can be green

- Start with a plan
- Get everyone together
- Develop green building goals
- Design a green building
- Build a green building
- Verify your goals were met

AIA/COTE 2008 Top Ten Green Projects:
Discovery Center at South Lake Union
Photo credit: Lara Swimmer Photography

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