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

1st Steps for Success

Understand Owner’s Expectations

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

AIA/COTE 2008 Top Ten Green Projects:
Energy Resource Center

Photo credit: Nic Lehoux

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

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

Cost Breakdown by End Use

- Ventilation Fans 11%
- Space Cooling 14%
- Space Heating 22%
- Lighting (Space) 19%
- Plug Load Equipment 25%
- Heat Rejection 1%
- Lighting (Site) 3%
- Domestic Hot Water 3%
- Pumps & Elec Auxiliary 4%

PRM Baseline
Total Cost: $629,624/yr
Normalized Cost: $1.8361

1st Steps for Success

Schedule a Green Building Workshop

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

Opportunities vs. Costs over Project Timeline
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 3.0 rating guide and answer the questions below:

E:
  - What are your goals for this project? Be as specific as you can, and don’t focus solely on green building issues.
  - Are you willing to consider low-flow plumbing fixtures, dual flush toilets, efficient lighting, and energy star appliances?
  - Would you consider locating a fitness center on the site?

SEI:
  - What mechanical systems are you considering? Please be prepared to discuss 3 systems.
    - Do any of these systems support MERV-13 filters?
    - What is the cost of renewable energy savings, as compared to typical systems?
    - What is the potential cost impact for each system?
  - Will you be pursuing energy modeling services? What program do you use?
  - Does SEI provide commissioning services? If no, please provide an estimate?
  - Should we increase the ventilation rate by 20% over ASHRAE 62.1, 2004?
  - Can this project meet the requirements of ASHRAE 55, 2004?

A
t
- What are the stormwater management requirements for this project locally and countywide?
- What low impact development (LID) strategies are appropriate for this project?
Establishing Green Building Goals

Manage stormwater naturally

**Strategies**

- LID techniques
- BMPs

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**Curb cut schematic**
Courtesy Pierce County, Washington and AHBL, Inc.
www.wbdg.org

**Bio-swale schematic**
Courtesy Pierce County, WSU Extension
www.wbdg.org

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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

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**Heat Flow**

- 0°F
- 70°F

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**Solar Radiation**

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

Select appropriate materials

Consider the material’s impact over its 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?

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

**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
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

**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
**Design Phase Implementation**

**Tools to Incorporate Green Building Goals**

**Drawing and Specification Reviews**
- Confirm goals are incorporated
- Look for opportunities and problems

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**Energy Calculations**
- Computer-based
- Estimate energy use
- Compare options
- Garbage in: Garbage out
Design Phase Implementation

Tools to Incorporate Green Building Goals

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

**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

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

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**

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Construction Phase Implementation

**Differences between Design and Construction**

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

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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

**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

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<thead>
<tr>
<th>Spec Section</th>
<th>Description</th>
<th>Item(s) to Review</th>
<th>Comments</th>
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<td>Painting</td>
<td>Product info highlighting that interior</td>
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<tr>
<td></td>
<td></td>
<td>paints &amp; coatings meet referenced standard</td>
<td></td>
</tr>
<tr>
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<td>Visual Display Boards</td>
<td>Product info highlighting that interior</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>composite wood, agitbinder, adhesives &amp;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>sealants meet referenced standard</td>
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</tr>
<tr>
<td>10125 1.3 D 1</td>
<td>Bulletin Boards &amp; Display Cases</td>
<td>Product info highlighting that interior</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>10155 1.3 E 1</td>
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<td>Recycled Content</td>
<td>Recycled content varies by color; color not</td>
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<td>indicated.</td>
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<td>Manufacturer &amp; Extraction Site</td>
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<td>product &amp; extraction site.</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>sealants meet referenced standard</td>
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</table>

## Construction Phase Implementation

**Tools to Incorporate Green Building Goals**

**Contractor Tools**

- Indoor Air Quality Management
Construction Phase Implementation

Tools to Incorporate Green Building Goals

Contractor Tools
- Construction Waste Calculator

<table>
<thead>
<tr>
<th>Material</th>
<th>Diverted (tons)</th>
<th>Recycled (cubic yards)</th>
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<tbody>
<tr>
<td>Wood</td>
<td>2.0</td>
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</tr>
<tr>
<td>Concrete (poured into aggregate at Alston Land Reclamation/Recycling Facility)</td>
<td>628.75</td>
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<tr>
<td>Concrete (poured into aggregate at Ritchie Land Reclamation/Recycling Facility)</td>
<td>480.35</td>
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<tr>
<td>Metal (recycled at Joseph Smith &amp; Sons, Inc.)</td>
<td>218.09</td>
<td></td>
</tr>
<tr>
<td>Metal (continuously recycled at Joseph Smith &amp; Sons, Inc.)</td>
<td>163.88</td>
<td></td>
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<tr>
<td>Drywall (processed for mulch at SupAgri cycle inc, Wilton Rd, Lancaster, PA)</td>
<td>77.19</td>
<td></td>
</tr>
<tr>
<td>Cardboard (processed at Georgeview Paper, Glenroy, ME)</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Asphalt (recycled into aggregate at Ritchie Land Reclamation/Recycling Facility)</td>
<td>26.4</td>
<td></td>
</tr>
</tbody>
</table>

Total quantity of recycled waste: 1206.45
Total quantity of waste: 2279.45
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

- Project Name
- Project Location
- Subcontractor
- Total Credits
- Type of Credit
- Description
- Notes
- Certification Date

- ISO Credits 4.1 and 1.2 - Adhesives & Sealants and Paints

- % of VOC contained in the dry wall product

- % of the required VOC base that the above stated product must meet or exceed.
**Construction Phase Implementation**

**Tools to Incorporate Green Building Goals**

**Contractor Tools**
- Action Plan

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### 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

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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Eastern Village Cohousing
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