Sustainable Waste Management by Design Designing Buildings to Optimize Environmental Performance During Construction and During Occupancy





Program Registration

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Learning Objectives

After completing this course you will be able to:

- Facilitate effective waste management during design, construction, and occupancy
- Discuss how design decisions affect sustainable waste management throughout the lifecycle of a building
- Explain the key steps in creating a comprehensive Waste Management Plan (WMP)
- Explain how an effective project plan can optimize management of construction waste and, at the same time, optimize long term operations and maintenance of the completed building

Course Overview

Managing Waste = An Increasingly Important Business Objective for Building Owners and Developers

 Environmental, Public Relations, Cost Savings and Productivity Benefits

An Opportunity for Architects

• Effective Waste Management - During Construction and During Occupancy - is Strongly Affected by Design Decisions

This Course

• Creating Effective Waste Management Plans That Address Specific Construction Site and Building Occupancy Requirements ...<u>By Design</u>

Course Outline

- Section 1: The Green Building Market and Effective Waste Management
- Section 2: Sustainable Management of Waste
- Section 3: A Systems Approach to Sustainable Waste Management
- Section 4: Case Studies

BID

We work with estimators and schedulers to identify innovative solutions that meet your specifications and drive value.

BUILD

With experts who understand the process and our flexible and reliable operations, we help minimize waste and maximize efficiencies – keeping you on time and on budget.

DESIGN

Armed with our knowledge of green building, workflow management tools and design assist capabilities, we can help you meet your design goals. With you at every stage of construction.

OCCUPANCY

Our industry experts can provide customized environmental solutions to meet and maintain your sustainability goals well into occupancy.

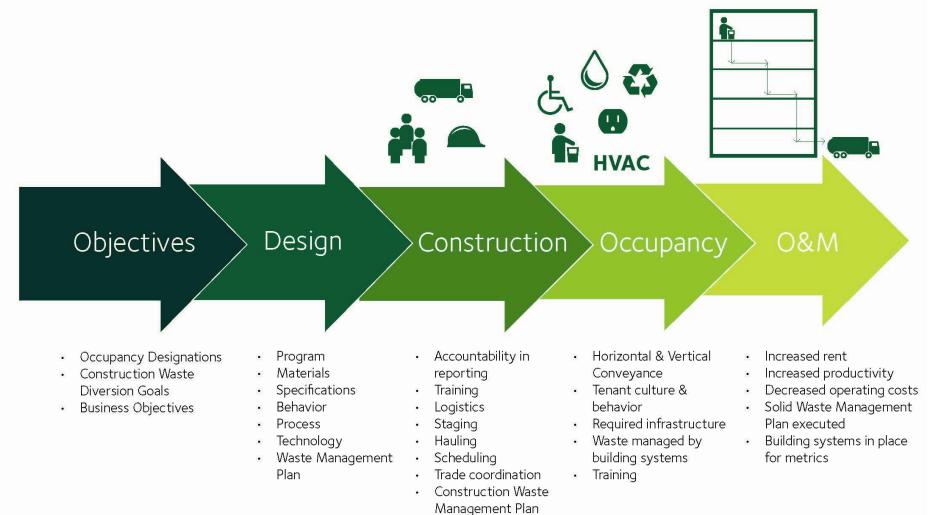
PRE-DESIGN

Before you even start drawing up a plan, we work with you to understand your financial and sustainability objectives.

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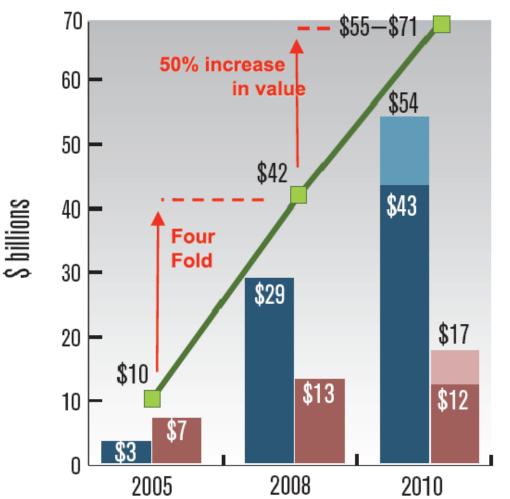
A Systematic Process designing for waste management from construction through 0&M



Section 1: The Green Building Market & Effective Waste Management

In 5 Years, New Green Building Market Has Grown Six Fold

---- Total Green Building Market



Nonresidential Green Market

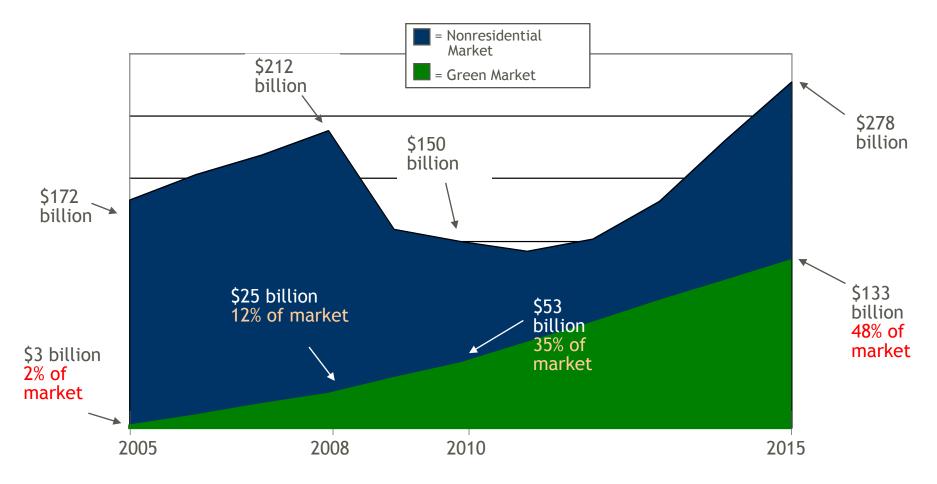
Minimum Market Size
Upper Market Size

Residential Green Market

| Minimum Market Size | Upper Market Size

> Source: Green Market Size: McGraw-Hill Construction, 2010; base value of construction market from McGraw-Hill Construction Market Forecasting Service, as of September, 2010

2015 Offers Significant Opportunity for Green Building in <u>New</u> Non-Residential



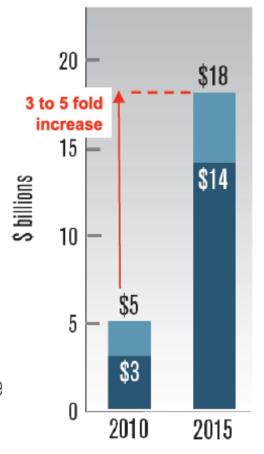
Source: Green Market Size: 2011Green Outlook Report, McGraw-Hill Construction; base value of construction market from McGraw-Hill Construction Market Forecasting Service, as of August 2011

Green Share of Renovation/Retrofit Market Growing

- Three to Five fold growth expected in five years for major green retrofit projects
- Energy efficiency in two-thirds of retrofit projects, expected to become the norm

Upper Market Size
Minimum Market Size

Projected Retrofit/Renovation Green Building Market Size



Source: McGraw-Hill Construction, 2010

Drivers: Market, Regulatory, Voluntary, Energy, Value Market conditions are encouraging cost-effective waste management

Market drivers include client demand for environmental performance

- Client demand is the number one trigger influencing sustainable waste practices
- Owner's objectives now include reducing the impact on the solid waste stream • and effective waste management
- Growing awareness of sustainable waste handling practices and significant • financial returns

Political

Opinion

- Service providers are responding with better waste management plans including comprehensive solid waste management
 - **Developers** -
 - Designers -
 - Contractors

Federal Local Regulation Awareness/ Competitive FFD/ Advantage Building Codes or Public

lient

Demand

McGraw-Hill Construction (2009). Sustainable Construction Waste Management: SmartMarket Report

Drivers: Market, Regulatory, Voluntary, Energy, Value New Regulatory Drivers are Pushing the Market

Codes - Voluntary or Mandatory

- IGCC: International Green Construction Code, Source: International Code Council 2011
- IECC: International Energy Conservation Code, Source: US Dept. of Energy 08/22/2011

Local, State, and Federal Drivers

- May 2011 US Navy and Marine Corps will aim for LEED Gold certification for all new buildings beginning in 2013
- Navy and Marine Corps Executive Order Announcement Copyright © 2011 U.S. Green Building Council
- GSA has recently increased its minimum requirement for new construction and substantial renovation of Federally-owned facilities to LEED® Gold, the next highest level of certification
- Executive Order 13514: Every federal agency must produce a plan for reducing greenhouse gas emissions

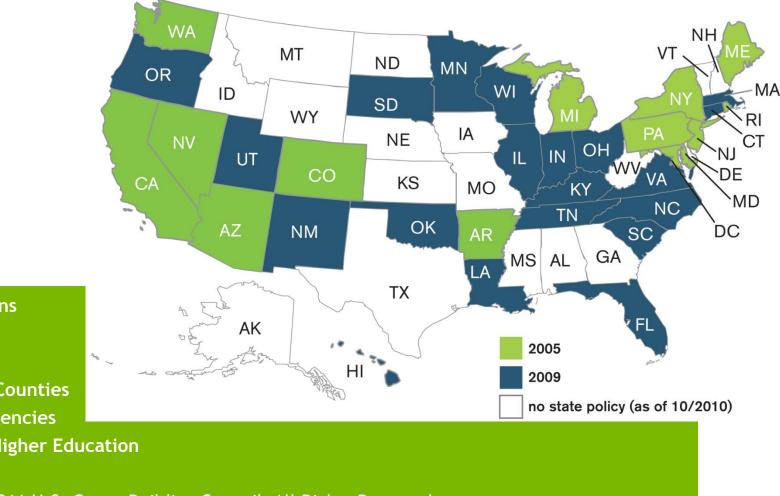
Example : California

- CHPs Program: Collaborative for High Performance Schools, Collaborative for High Performance Schools, 2011
- CALGreen: Effective January 1, 2011, code requirements including the diversion of 50 percent of construction waste generated during construction, and a required waste management plan

Drivers: Market, Regulatory, Voluntary, Energy, Value

Voluntary Green Building Programs

Green building standards have been adopted by a diverse array of clients, owners and agencies

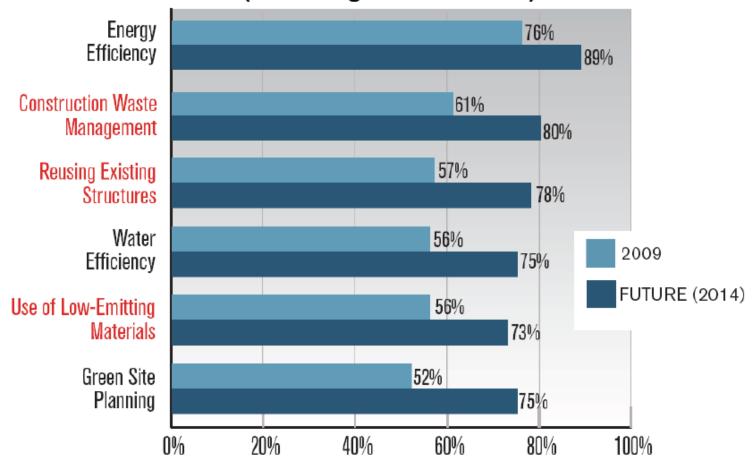


LEED Adoptions **12** Countries **45 States** 442 Cities & Counties **14 Federal Agencies** Schools and Higher Education

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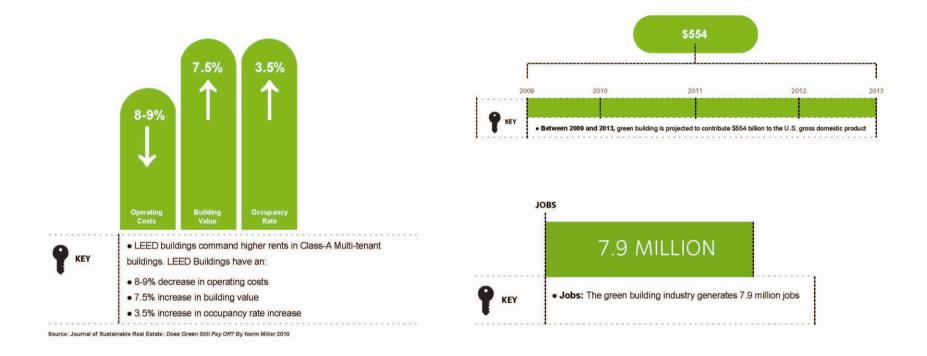
Drivers: Market, Regulatory, Voluntary, Energy, Value

Relative Importance of Green Building Practices Over Time (according to Contractors)



Source: Sustainable Construction Waste Management SmartMarket Report, McGraw-Hill Construction, 2009

Drivers: Market, Regulatory, Voluntary, Energy, Value Green Building Industry Value





i ibid.

iiBooz Allen Hamilton (2009). Green Jobs Study. iiIMcGraw-Hill Construction (2009). Green Outlook 2009: Trends Driving Change.

IvMcGraw-Hill Construction (2008). Key Trends in the European and U.S. Construction Marketplace: SmartMarket Report

How Much Municipal Solid Waste Do We Generate?

In 2009, the U.S. EPA estimated that Americans produce 243 million tons of trash = <u>4.34 pounds per person per</u> <u>day</u>. Of that, 1.46 pounds per person per day is recycled.



Source: EPA Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2009

C&D Waste Overview

Recyclable C&D Waste

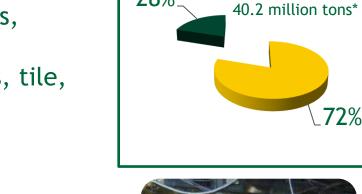
- Concrete, cardboard, clean wood, metals, masonry, plastic, rock, carpet, drywall, insulation, porcelain, rigid plastics, glass, tile, and more

Source Separated C&D Waste

- Recyclables are placed into separate containers at the job site and sorted on site. Generally more cost effective than comingled and recycling rates can be as high as 90% or greater

Commingled C&D Waste

- Waste placed into one container on site, then separated and hauled off site at a material recovery facility (MRF)



28%



28% diverted =



Five Strong Incentive Factors

- 1. Waste contains valuable resources
- 2. Diverting waste can be more cost effective than landfilling
- 3. Growing awareness of the environmental impacts of waste
- 4. Regulation of waste is increasing
- 5. Incentives: taxes, permitting bonds, plan reviews, inspections, even tipping fees

Five Strong Incentive Factors

1. Waste contains valuable resources. The following table provides a glimpse of just how valuable:

Material	Disposal Cost (\$/Ton)	Material Value (\$/Ton)
Material Oriented Strand Board (OSB)	137	725
Lumber	79	280
Gypsum Wallboard	148	269
Cardboard	42	varies

Source: National Association of Homebuilders, "Research at the Center," Builder Magazine, Feb. 95, p. 50

- 2. With a reputable environmental services provider, diverting wastes can be more cost effective than landfilling.
 - Reduced transportation costs
 - Avoiding taxes for not diverting
 - Avoiding tipping fees
- 3. There is a growing public awareness of waste and a environmental stewardship concern about having to live with what we discard.

There can be incredible brand and marketing value in creating and maintaining positive public relations.

4. There is an increase in federal, state, and local legislation mandating specific goals and actions for waste stream reduction.

- IGCC-International Green Construction
 Code
- Oregon 50% diversion
- California:
 - CALGreen effective January 1, 2011 part of Title 24
 - 50% diversion and a CWM Plan is required
 - Berkeley requires 100% of asphalt, concrete, excavated soil

- Arizona 50% diversion
- New Mexico 50% diversion
- Florida 75% diversion by 2020
- Washington
- Colorado
- Kansas
- Massachusetts
- North Carolina
- Ohio

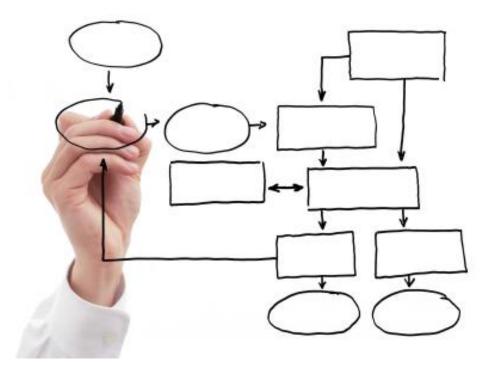
5. There is an increase in incentives. Leveraging incentives can be very valuable, expedited permitting, reduced permitting fees, tax incentives, etc.

Recycling Challenges

- Recycling is an accelerating trend
- Limited recycling market
- Market awareness
- Perceived to be too costly
- Space requirements

Section 3. A Systems Approach to Sustainable Waste Management

It Really Is Not That Complicated



A Systems Approach to Waste

Three Key Execution Strategies

Design

- Creating a Solid Waste Management Plan During Design Develop during schematic design, incorporate in design development, include in the project specification and materials selection, congruent with the Construction Waste Management Plan execution, adopted and implemented by occupancy and operations and facilities maintenance staff
- Construction Implementing the Waste Management Plan during Construction Logistical planning = Planning in Design phase, execution during construction, education and communication components, diversion calculation, measurement and reporting Construction Phase accountability

Occupancy

Design for management of solid waste generated during occupancy Develop comprehensive, realistic and efficient waste related operations and maintenance strategies in the Waste Management Plan

Strategies for Sustainable Waste Management

Checklist

Design

- Develop solid and construction waste management plans
- \checkmark Ensure waste management plans are included in the specifications
- Incorporate efficient strategies for occupant generated waste for implementation including operations and maintenance (O&M)
- \checkmark Consider the recycled content and material recyclability
- Include locally sourced materials, including both extracted and manufactured locally, verify the selected building material excess from construction can be diverted locally

Construction

Implement construction waste management plan

Occupancy

✓ Implement solid waste management plan



The Solid Waste Management Plan:

- Owner identify specific sustainability goals and expectations
- Occupants identify tenant behaviors, tasks and activities
- Define What a Successful Program Looks Like adaptability to tenant changes, market changes, technology and equipment advancements
- Events provisions for episodic events and renovations
- Implementation identify training and communication methodology
- Measurement System establishing baseline data, identifying KPIs, data reporting and repository platform
- Financial Consideration can a SWMP be implemented and managed within the defined financial parameters
- Lifecycle Management Strategy frequency of plan review, operations and maintenance cost considerations, adaptability to tenant and ownership changes



Solid Waste Management Plan: Materials Components

- Selection and specification during design
- Identification of *residuals*
- Planning and estimating
 - Planning begins in schematic design for accurate occupant and program waste management, and includes accurate construction waste estimates
- Education of the Integrated Building Design team
- "Buy in" of the Integrated Building Design team
- Conservation and reuse of materials
 - Wood, paints and adhesives
- Innovative recycling of salvageable materials
 - Ceiling tiles and fiberglass

Sustainable Waste Management and LEED

Waste Management: RECYCLE/REUSE/SALVAGE Innovation in Design Points available for Sustainable Waste Management:

- Occupant recycling, not including prerequisite requirements
- Materials minimization/recyclability decreasing conditioned space
- Waste reduction

Design

- Waste reduction operations
- Waste management master plan, reduce waste stream
- Resource reuse program
- Food composting facility and food waste reduction
- Recycling and composting program

CIRs, LEED Interpretations and Addenda Online Database - Changes November 2011 Available on the USGBC website



Checklist Help

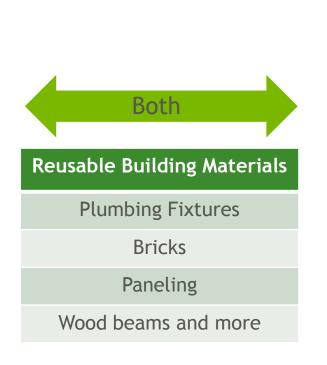
- ✓ What types of intermediate storage needs are necessary to maximize diversion?
- ✓ What types of vehicles or equipment are required to provide service?
- ✓ Will there be new signage needs?
- ✓ Is there a need for connectivity?
- ✓ What is my performance management strategy?
- ✓ What region of the country is the project in and how will consumer behavior impact things?
- \checkmark What are the diversion or recycling goals of the owners and tenants?
- What volumes and types of materials will be generated?
- ✓ What recycling services are available in the area?
- ✓ What is the generation source?
- Will the property take advantage of onsite reuse opportunities to create closed-loop systems?
- ✓ What horizontal or vertical conveyance systems are necessary?
- ✓ Supply chain considerations (Purchasing)
- ✓ Review and implement all LEED requirements for desired certification

Characterization of C&D Waste for New Construction

Predominant Materials (10% or greater)

Construction





Secondary Materials (Less than 10%)

Recyclable Materials

Steel from decking, re-rod etc.

Shingles

Brick

Concrete

Crates and Pallets

Extruded Polystyrene Insulation

Fiberboard

Kraft paper packaging

Plastic sheeting and bags

Electric wire

Overspray from fireproofing



1. Start with integrated waste management:

Integrated waste management starts in programming and planning during predesign - a systems approach to waste management treats waste as a building system, completely integrated throughout the life of the project.

- 2. Continue the systems approach into schematic design: During schematic design select and specify building materials appropriate to the context of the project, materials easily recycled in the local or regional market, appropriate for climate, look for adaptive reuse of the excess C&D materials locally. Include materials with a high post-consumer recycled content to create demand for recycled products.
- 3. Refine in design development and construction documents phase: Include a comprehensive construction waste management plan after materials selection to include: Staging, Logistical Planning, Scheduling, Diversion Calculation and Reporting



Develop and Implement a Waste Management Plan During Construction

The Construction Waste Management Plan: Key Components

- Analysis of Construction Waste What Will Be Generated and When
 - Define means to reduce or eliminate waste
 - Identify unique savings opportunities due to recycling
 - Determine disposition options and destinations
- Containerization Plan
 - Determine appropriate container size, locations and number per phase
 - Determine onsite collection and reuse locations
 - Map of construction area staging included in the CWM Plan
- Logistics Plan
- Implementation of Residual Material Strategy
 - Training, communication and execution



Implementing a Waste Management Plan During Construction

Diversion and Recycling Calculating and Reporting

- Process is moving online
- New tools and services are helping architects, contractors and owners chart, track and document waste diversion progress - 24/7
- Improves efficiency and costeffectiveness
- Simplifies reporting for LEED certification
- Easily uploaded to the Green Building Certification Institute's LEED online system





Sustainable Waste Management and LEED

Material Selection and Specification

- Important product considerations including cost and compliance with LEED
- Developing integrated project specifications manual (Focusing on CSI Divisions)
- Contractor requirements and product compliance
- Critical product information and certifications

Innovative Methods for the Design Professional

- Achieve an easy point with education and LEED accreditation
- Achieving additional points with exemplary performance and innovative approaches
- Utilizing Credit Interpretation Rulings (CIRs) successfully
- Major considerations for the various project delivery methods
 - Including Design/Build, IPD, Design-Bid-Build, using BIM for LEED
- Taking what you know and responding to a green RFP



Sustainable Waste Management and LEED

General Overview and Mandatory Requirements for LEED Projects

- Prerequisites that require attention and awareness
- Referenced Standards and important definitions within LEED: Guidelines for right sizing recycling areas, C&D material diversion goals, etc.
- When critical items should occur before/during/after project development
 - Project Conception/Initiation: Owner objectives
 - Design Development: providing recycling infrastructure
 - Construction Documents: specifications
 - Bidding/Negotiation (Sample Language)
 - Construction: Construction Waste Management Plan, accurate diversion reporting
 - Project Closeout: LEED online submittals
 - Occupancy: Solid Waste Management Plan implementation

Architects need to rely on referenced Standards and important definitions within LEED and to manage when critical items should occur before/during/after the various project phases.



Sustainable Waste Management and LEED

An integrated approach to residual management including Sustainable Management of C&D Waste can help qualify for up to 8 points in 3 categories in LEED 2009 for New Construction and Major Renovations

- SS Sustainable Sites Credit 3: Brownfield Redevelopment
 - This Construction Submittal credit is available for documented asbestos remediation

Most credits related to Sustainable Waste Management are in the Materials and Resources Category

- MR Materials and Resources Prerequisite: Storage and Collection of Recyclables
- MR Materials and Resources Credit 2: Construction Waste Management
 - Two points possible one point each for 50%, 75%, plus an additional Exemplary Performance credit available for 95% diversion
- MR Credit 3: Resource Reuse
 - Two points possible, one point each for 5% and 10% for the reuse of building materials and products
- (*LEED 2009 for New Construction and Major Renovations)



Proposed LEED 2012 Changes to the Materials & Resources Category

Two new categories: Integrated Process (IP) Credit and Performance (PF)

- (IP) Credit: Discovery: Analyses to Support Integrative Process
- (IP) Credit: Implementing Synergies

New for 2012: 3 Prerequisites: Storage and Collection of Recyclables, Construction and Demolition Debris Management, and PBT Source Reduction - Mercury (Only Healthcare)

- (MR P1) Added batteries and mercury containing lamps to storage locations
- (MR P2) Outlines specific requirements for waste management policy, including target diversion threshold and waste reporting requirement
- (MR P3) Prerequisite added for Healthcare

Credit Construction and Demolition Debris Management

- Renamed from "Construction Waste Management"
- Alternative Daily Cover is no longer be counted as diverted waste
- Materials counted as reuse in Building reuse or Materials reuse do not contribute toward credit
- Cap placed on credit for diversion of "heavy" materials including asphalt, concrete, masonry and steel
- Added credit thresholds specific to projects undergoing demolition work vs. those not
- New option for waste reduction strategy to produce no more than 2.5 lbs of waste per square foot



Develop and Implement a Waste Management Plan During Construction

Checklist Help

- \checkmark Identify sustainability goals and targets
- \checkmark Identify training and communication procedures for crafts and trades personnel
- Determine the process for capturing C&D materials (i.e.: dumpsters, skip pans, barrels, hoppers)
- ✓ Determine the process for managing C&D materials (i.e.: comingled, source separated)
- Identify the process and procedures for managing any special waste, hazardous waste, medical waste, universal waste.
- Determine the feasibility of establishing central areas for wood and pipe cutting areas (i.e.: maximize reuse of cut offs and commodity values if discarded)
- ✓ How will outbound dumpsters and small containers be documented, weighted and tracked?
- ✓ Can material packaging and dunnage be reduced, eliminated or returned?
- ✓ Have provisions been considered for adequate storage areas to prevent weatherrelated materials losses and subsequent disposal requirements?
- ✓ At what frequency will the CWMP be evaluated against established metrics and revised?
- ✓ Review and Implement all LEED requirements for desired certification



Develop and Implement a Waste Management Plan During Occupancy

Architects can add value and provide a new and specialized service to their clients by:

- Making compliance with regulations as efficient and cost-effective
- Monetizing waste streams whenever possible
- "Designing in" efficient waste management systems that take into account the program, building type, geography, occupancy, and any other special circumstances of each individual building and its occupants



• LEED



Designing for Waste Management During Occupancy

One-Size-Fits-All May Not Work

Current Practice

"Where can I find space for the compactor?"

"How can I provide access for a truck?"

"Where can I squeeze in a recycling bin?"

"What size and how many collection bins do I need and where should I place them?"

Future Practice

Signage Employee training Consumer education Collection Conveyance Containers Safety Durability Sustainable Procurement Supply Chain Impacts

LEED Credits During Occupancy

Design for Sustainable Management of Solid Waste

Can Help Satisfy 2 LEED 2009 for Existing Buildings: Operations & Maintenance Prerequisites and up to 6 Credits for LEED EBOM*

- MR Prerequisite1: Sustainable Purchasing
- MR Prerequisite 2: Solid Waste Management Policy
- MR Credit 1: Sustainable Purchasing Ongoing Consumables
- MR Credit 3: Sustainable Purchasing Facility Alterations and Additions
- MR Credit 3: Sustainable Purchasing Reduced Mercury in Lamps
- MR Credit 3: Solid Waste Management Waste Stream Audit
- MR Credit 1: Solid Waste Management Ongoing Consumables
- MR Credit 9: Solid Waste Management Facility Alterations and Additions

(*LEED 2009 for Existing Buildings Operations and Maintenance)



Designing for Waste Management During Occupancy

Checklist Help

- Establish baseline data by performing periodic waste assessments on all waste and recycling outputs
- Evaluate residuals destined for landfill and review opportunities to influence supply chain decisions towards recyclable products and packaging
- Establish a frequency of program review which allows for; changes in tenant types; changes in the recycling and commodity markets; advances in disposal and recycling technology; advances in material conveyance equipment
- ✓ Design a program which allows for process improvement input from the maintenance, engineering and janitorial staff
- Identify methods for engaging with the building occupants and tenants to obtain program "buy in", sharing of ideas and feedback
- ✓ Review and implement all LEED requirements for desired certification

Putting It All Together: Develop Comprehensive and Efficient Waste Related Operations and Maintenance Strategies

Execution of the solid waste management plan during O&M:

- Engage technology, for purchasing and procurement, and building systems technology
- Monitor and measure the waste output of the building and compare to baseline output
- Training of staff and documentation of procedures for legacy knowledge of processes to be passed to future staff
- New tenant and occupant engagement process with the solid waste management plan
- Destination sources identified for new and future solid waste as building program changes

Section 4. Case Studies

Putting Theory Into Practice

- University of Toronto, The Terrence Donnelly Center for Cellular and Biomolecular Research
- Bill and Melinda Gates Foundation Campus
- Additional case studies may be found at <u>http://www.wm.com/octwebinar</u>

University of Toronto, The Terrence Donnelly Center for Cellular and Biomolecular Research

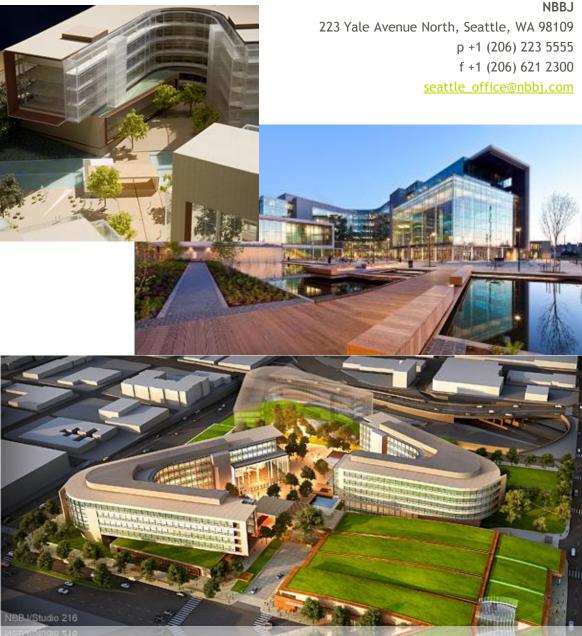
- 75% Diverted
- O&M program built-in
- Flexibility, amenity and interaction inform all aspects of the progressive design, with gardens, lounge areas, offices, seminar rooms and a cafeteria, the waste stream was as diverse as the program. Designers carefully considered the occupants and unique waste generation during programming

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Bill and Melinda Gates Foundation Campus

- LEED Platinum
- 97% Diversion
- O&M program built-in
- 639,860 sq.ft. campus
- Campus' potable water use is reduced by nearly 80 percent
- Energy use has been reduced by nearly 40 percent
- The project was able to recycle construction debris at a rate of 97 percent, while over 20 percent of the project was built with recycled content and regional materials. 21 subcontractors extracted and manufactured materials within 500 miles of the job site



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Armed with our knowledge of green building, workflow management tools and design assist capabilities, we can help you meet your design goals. With you at every stage of construction.

OCCUPANCY

Our industry experts can provide customized environmental solutions to meet and maintain your sustainability goals well into occupancy.

PRE-DESIGN

Before you even start drawing up a plan, we work with you to understand your financial and sustainability objectives.

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Thank You

This concludes the American Institute of Architects Continuing Education System Program

Please take the test to receive your AIA credits. Go here to download checklist and LEED information http://www.wm.com/octwebinar

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