



LEED BD&C Version 3.0 (2009) Certification & Accreditation

Session 5: Materials & Resources

June 1, 2009

California Department of General Services

Today's Agenda

- Storage & collection of recyclables
- Building reuse
- Construction waste management
- Materials reuse
- Recycled content
- Regional materials
- Rapidly renewable materials
- Certified wood

Materials & Resources

	NC 14 Pts.	Schools 13 Pts.	CS 13 Pts.
Prereq 1 Storage & Collection of Recyclables	Req'd	Req'd	Req'd
Credit 1.1 Building Reuse , Maintain % of Existing Walls, Floors & Roof	1 to 3	1 to 2	1 to 5
<input type="checkbox"/> Bldg. Reuse, Maintain % of Exist. Walls, Floors & Roof	1 - 55%	1 - 75%	1 - 25%
<input type="checkbox"/> Bldg. Reuse, Maintain % of Exist. Walls, Floors & Roof	1 - 75%	1 - 95%	1 - 33%
<input type="checkbox"/> Bldg. Reuse, Maintain % of Exist. Walls, Floors & Roof	1 - 95%	NA	1 - 42%
<input type="checkbox"/> Bldg. Reuse, Maintain % of Exist. Walls, Floors & Roof	NA	NA	1 - 50%
<input type="checkbox"/> Bldg. Reuse, Maintain % of Exist. Walls, Floors & Roof	NA	NA	1 - 75%
Credit 1.2 Bldg. Reuse , Maintain 50% of Int. Non-Structural Elements	1	1	NA
Credit 2.1 Construction Waste Mgmt. , Divert 50% from Disposal	1	1	1
Credit 2.2 Construction Waste Mgmt. , Divert 75% from Disposal	1	1	1
Credit 3.1 Materials Reuse , 5%	1	1	1
Credit 3.2 Materials Reuse , 10%	1	1	NA
Credit 4.1 Recycled Content , 10% (post-consumer + ½ pre-consumer)	1	1	1
Credit 4.2 Recycled Content , 20% (post-consumer + ½ pre-consumer)	1	1	1
Credit 5.1 Regional Materials , 10% Extracted, Processed & Manuf. d.	1	1	1
Credit 5.2 Regional Materials , 20% Extracted, Processed & Manuf. d.	1	1	1
Credit 6 Rapidly Renewable Materials , 2.5%	1	1	NA
Credit 6 Certified Wood , 50% (diff. credit number for Core & Shell)	NA	NA	1
Credit 7 Certified Wood , 50%	1	1	NA

Materials & Resources

See LEED BD&C v2009 Reference Guide

- Pages 335-400
- MR Credit Metrics - Table 1 (page 337)

Material	MRC1 Building Reuse	MRC2: Construction Waste Mgmt.	MRC3: Materials Reuse	MRC4: Recycled Content	MRC5: Regional Materials	MRC6: Rapid Renew. Mats	MRC7: Certified Wood
CSI Divisions 3-10	Based on Area	Based on weight or volume, include construction & demolition waste	Based on replacement value (\$)	Based on cost of qualifying materials as a percent of overall materials cost for Divisions 3-10 (\$)			Based on cost of FSC wood as % of all new wood
Mechanical Electrical Plumbing Furniture & Furnishings (CSI Div. 12)	Not available for these items		Not available for these items			May be included with Divisions 3-10, if done consistently for credits 3-7	

MR Prerequisite 1:

Storage & Collection of Recyclables

1. Requirement for NC, Schools & CS
2. Design Phase Prereq.
3. Intent
 - Facilitate the reduction of waste generated by building occupants that is hauled to and disposed of in landfills.



MR Prerequisite 1:

Storage & Collection of Recyclables

4. Requirements

- Provide easily accessible dedicated area for entire building for collection & storage of materials for recycling
 - For non-hazardous materials
- Include (at a minimum):
 - Paper
 - Corrugated cardboard
 - Glass
 - Plastics
 - Metals
- If material is not recycled at building location, provide space for future



MR Prerequisite 1: Storage & Collection of Recyclables

5. Strategies & Implementation

- Coordinate with anticipated collection services for size and functionality of recycling areas
- Consider:
 - Cardboard balers
 - Aluminum can crushers
 - Recycling chutes
 - Several recycling collection points
 - Break rooms, indiv. floor areas
 - Open office areas
 - Bins at individual workstations
 - Organic wastes - composting
- CS projects include tenant guidelines
- Co-mingling could reduce space



Recycling Area Guidelines (recommended)

Commercial Building (sf)	Minimum Recycling Area (sf)
0 to 5,000	82
5,001 to 15,000	125
15,001 to 50,000	175
50,000 to 100,000	225
100,000 to 200,000	275
200,001 or greater	500



MR Prerequisite 1: Storage & Collection of Recyclables

6. Documentation

- Enter building area
- Verify dedicated building collection & storage area for recyclables
 - Plastics, metals, paper, glass, corrugated cardboard
- Attach drawings showing recycling storage areas (site, floor plans)

Plastics	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Paper	<input checked="" type="checkbox"/>
Cardboard	<input checked="" type="checkbox"/>
Glass	<input checked="" type="checkbox"/>

NARRATIVE (Optional)

Please provide any additional comments or notes regarding special circumstances or considerations regarding the project's credit approach.

Beverage and paper recycle bins are to be installed as part of the project. The School For The Deaf Campus currently participates in a campus wide recycling program that will regularly service these new bins after construction.

Cardboard and Metals are collected in large containers that are emptied by a contracted recycler when full.

Attached is a copy of the campus recycling procedures and policies.

MR Cr 1: Building Reuse

MR c1.1 Maintain Exist. Walls, Floors & Roof

- NC – 1-3 Points
- Schools – 1-2 Points
- CS – 1-5 Points (MR c1)



MR c1.2 Maintain Int. Non-Struct. Elements

- NC – 1 Point
- Schools – 1 Point
- CS – Not Available

2. Const. Phase Credits

3. Intent

- Extend the life cycle of existing building stock, conserve resources, retain cultural resources, reduce waste and reduce environmental impacts of new buildings as they relate to materials manufacturing and transport.

MR Cr 1.1: Building Reuse: Maintain Existing Walls, Floors & Roof

4. Requirements - Credit MR Cr. 1.1

- Maintain the existing building structure
 - structural floor and roof decking
- And envelope
 - Exterior skin and framing
 - Excluding window assemblies
 - Excluding non-structural roofing material
 - Based on surface area
- Hazardous materials remediated as a part of project excluded from calculation of % maintained
- Not applicable for additions that are:
 - ≥ 2 times the existing building s.f. for NC & Schools
 - ≥ 6 times the existing building s.f. for Core & Shell



MR Cr 1.1: Building Reuse: Maintain Existing Walls, Floors & Roof

4. Requirements - Credit MR Cr. 1.1

Building Reuse			Points
NC	Schools	CS	
55%	75%	25%	1
75%	95%	33%	2
95%	NA	42%	3
NA	NA	50%	4
NA	NA	75%	5



* Exemplary Performance for CS reusing 95%

MR Cr 1.2: Building Reuse: Maintain 50% of Interior Non-Structural Elements

4. Requirements

- Use existing interior non-structural elements in at least 50% (by area) of the completed building.
 - Interior walls, doors, floor coverings and ceiling systems
 - Include area of additions in calcs
- Credit not available if addition is ≥ 2 times the square footage of the existing building.
- See Reference Guide page 354 for sample table



MR Cr 1: Building Reuse

4. Technologies & Strategies

- Consider reuse of existing buildings, including structure, envelope and interior non-structural elements.
- Remove & upgrade elements posing contamination risks.
- Upgrade components to improve energy and water efficiency
 - Windows
 - Mechanical systems
 - Plumbing fixtures



MR Cr 1: Building Reuse

5. Documentation

- Enter building area & area of addition, if any
 - Addition cannot exceed 2x existing building area
- Classify building
 - a) Renovation without addition
 - b) Renovation incl. addition
- For MR Cr. 1.1-1.2, list areas of each exist. structural shell & envelope element (existing & reused sq. ft.)
- For MR Cr. 1.3, list areas of each interior non-structural element
 - Compare ratio of areas of existing elements reused with total of both new & existing elements reused.
- See sample calculations in Ref. Guide pp 245, 247
- Optional narrative for any special circumstances

MR Cr 2: Const. Waste Management

1. Credits for NC, Schools & CS
2. Construction Phase Credit
3. Intent

- Divert construction, demolition and land-clearing debris from disposal in landfills and incineration facilities.
- Redirect recyclable recovered resources back to the manufacturing process.
- Redirect reusable materials to appropriate sites.



MR Cr 2.1: Const. Waste Management: Divert 50% From Disposal

4. Requirements

- Recycle and/or salvage $\geq 50\%$ of const. and demolition (C&D) debris
- Develop and implement a construction waste management plan
 - Identify materials to be diverted from disposal
 - Determine whether materials will be sorted on-site or co-mingled.
- Calculate by weight or volume (be consistent)
- Exclude materials from calculations:
 - Land-clearing debris & excavated soil
 - Hazardous materials



50%	1 Point
75%	2 Points
95%	Exemplary Performance

MR Cr 2.2: Const. Waste Management: Divert 75% From Disposal

4. Requirements

- Same as MR Cr. 2.1, except recycle, divert and/or salvage $\geq 75\%$ of (C&D) debris.
- ★ Innovation credit obtainable for $\geq 95\%$



MR Credit 2: Const. Waste Management:

5. Strategies & Implementation

- Develop Construction Waste Management Plan
 - Establish diversion goals
 - Identify materials to be diverted
 - Steps to implement Plan
 - Who is responsible for diversion

- Consider recycling:

Metal	Brick & stone veneers	Insulation	Ceramic tile
Concrete	Gypsum wallboard	Glass	Acoust. tile
Asphalt	Plastic & cardboard	Carpet	Wood

- Designate construction site area(s) for segregated or co-mingled collection of recyclable materials
- Track recycling efforts throughout the construction
- Identify construction haulers and recyclers to handle the designated materials.
- May include donation of materials to charitable organizations and salvage of materials on-site.

MR Credit 2: Const. Waste Management:

6. Documentation

- Select units to be used for diversion/waste calcs (tons or cy)
- Keep logs and enter data into table for diverted & landfilled waste
 - Description, hauler/location, & quantities
- Calculates total % diversion
- See sample tables in Ref. Guide p.360
- **Required narrative describing projects construction waste management approach & plan**



MR Credit 2: Const. Waste Management:

7. Resources

- California C&D Debris Recyclers Database
www.ciwmb.ca.gov/Condemo/Recyclers/RecyclerSearch.aspx
- California Integrated Waste Management Board (CIWMB) – tools, model ordinances, databases
www.ciwmb.ca.gov/Condemo
- C&D Recycling Toolkit for Contractors
www.ciwmb.ca.gov/Condemo/Toolkit
- Construction Materials Recycling Association
www.cdrecycling.org

MR Cr 3: Materials Reuse

1. Credits

- **NC – 1-2 Points**
- **Schools – 1-2 Points**
- **CS – 1 Point**

2. Construction Phase Credit

3. Intent

- Reuse building materials and products to reduce demand for virgin materials and reduce waste, thereby reducing impacts associated with the extraction and processing of virgin resources.



MR Cr 3: Materials Reuse

4. Requirements

- Use salvaged, refurbished or reused materials totaling **≥ 5% or 10%** of the project materials total value

Reused Materials			Points
NC	Schools	CS	
5%	5%	5%	1
10%	10%	NA	2
15%	15%	10%	Exemplary Performance



- Specialty items excluded from calcs
 - Mechanical, electrical and plumbing, elevators and equipment

- Only include permanent materials

- Furniture may be included if also included in MR Credits 3–7 (Cr 6 in CS)

- From prior location okay if purchased at least 2 years before

MR Cr 3: Materials Reuse

5. Strategies & Implementation

- Identify opportunities to incorporate salvaged materials into building design and research potential material suppliers.

- Consider:

- Beams & posts	- Flooring	- Paneling	- Cabinetry
- Doors & frames	- Brick	- Stone	- Furniture
- Decorative items	- Grilles	- Hardware	- Other

- Calculate using new equivalent cost

- California Materials Exchange: www.ciwmb.ca.gov/CalMAX

- Used Building Materials Exchange: www.build.recycle.net

$$\text{Percentage Reused Materials} = \frac{\text{Cost of Reused Materials (\$)}}{\text{Total Materials Cost (\$)}} \times 100$$

MR Cr 3: Materials Reuse

6. Documentation

- Maintain a list of reused or salvaged materials and their corresponding costs
 - Use CSI MasterFormat 2004 Div. 3-10, 32 & 33 **-OR-**
 - Use actual material cost (excluding labor & equipment)
- See sample Tracking Log (Table 1, page 366)
- Enter descriptions & data, vendor & cost of salvaged or reused materials into table
 - Calculates % of salvaged value compared to total matl. costs
- Optional narrative describing special circumstances

MR Cr 4: Recycled Content

1. Credits for NC, Schools & CS
2. Construction Phase Credit
3. Intent

- Increase demand for building products that incorporate recycled content materials, thereby reducing impacts resulting from extraction and processing of virgin materials.



MR Cr 4: Recycled Content

Recycled Content – Definition:

- Internat. Organiz. of Standards document, **ISO 14021**
- **Post-consumer material:** waste material generated by product end users, no longer usable.
 - Households, commercial, industrial, and institutional
- **Pre-consumer material:** material diverted from the waste stream during the manufacturing process.
- Excludes reutilized materials capable of being reclaimed within same process that generated it.
- For purposes of LEED MR Credit 4:
 - Only includes materials permanently installed in project.
 - Furniture may be included, when included in all MR Credits 3–7

MR Cr 4: Recycled Content

4. Requirements

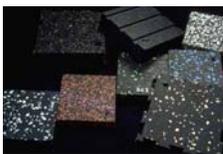
- Use materials with recycled content $\geq 10-20\%$ of the project materials' total value
 - **Recycled content = post-consumer recycled content plus $\frac{1}{2}$ pre-consumer content**
- Calculations for material assemblies:
 - Determine recycled fraction of assembly by weight
 - Recycled fraction of assembly is multiplied by the cost of assembly to determine the recycled content value of assembly
- Mechanical, electrical, plumbing and specialty items (i.e. elevators) not included in this calculation

Recycled Content	Points
10%	1
20%	2
30%	Exemplary Performance

MR Cr 4: Recycled Content

5. Strategies & Implementation

- Establish project goal for recycled content materials & identify material suppliers who can achieve this goal.
- During construction, ensure that the specified recycled content materials are installed.
- Consider environmental, economic and performance attributes when selecting products and materials.



MR Cr 4: Recycled Content

Recycled content building materials may include:

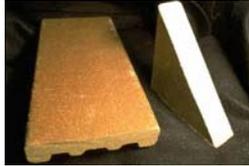
- Steel
- Aluminum
- Concrete
- Masonry
- Acoustic Tile
- Toilet Partitions
- Gypsum Wallbd.
- Paint
- Carpet
- Carpet Cushion
- Ceramic Tile
- Insulation
- Resilient Flooring
- Access Floor
- Metal Roofing
- Engineered Lumber
- Formwork



MR Cr 4: Recycled Content

Recycled content site materials may include:

- Park benches, picnic tables
- Playground Equipment
- Landscape Timbers
- Road base, asphalt paving
- Playground surfacing
- Dock bumpers
- Precast Concrete Products
- Mulch
- Concrete – flyash, slag
- Signage
- Tile
- Fencing, gates



MR Cr 4: Recycled Content

6. Documentation

- Select method for determining total materials cost & enter corresponding value
 - **Actual materials value**
 - Excluding labor & equipment
 - 2004 CSI div. 03-10, 31 (foundations) & 32 (paving, site improvements and planting only)
 - **Default materials value**
 - 45% of project budget for LEED project, calculated from project construction costs
 - **Division 12 (furniture) optional**
- Enter material data: (material name, manufacturer, material cost, percentages of post-consumer & pre-consumer recycled content by weight)
 - Online form calculates combined recycled content value as % of total materials costs
 - Sample calculations on page 373 & 374

Material Name	Manufacturer	Material Cost* (\$)	Post-Consumer Recycled Content (%)	Pre-Consumer Recycled Content (%)	Recycled Content Information Source
Structural Steel	Nucor	\$97,245.00	80.00	10.00	Validating Letter from Manufacturer
Steel Studs / Steel Framing	Clark-Wesler	\$11,251.00	67.00	29.00	Validating Letter from Manufacturer
Gypsum Wallboard	USG	\$6,749.00	5.00	9.00	USG Letter
Sheet Metalwork / Metal Flashings	Metal Sales	\$8,286.00	23.00	7.30	Letter
Metal Roofing	Metal Sales	\$67,167.00	23.00	7.30	Letter
Metal Doors & Frames	Curries	\$2,151.00	22.90	6.40	Curries LEED Rating Statement
Aluminum Assemblies	Arcadia	\$42,100.00	8.00	30.70	Letter
Glass	SB Glass	\$29,540.00	0.00	35.00	Letter
Acoustical Ceilings	Capual	\$21,722.00	0.00	25.00	CertainTeed LEED Summary Table
Carpet	Shaw	\$23,324.00	0.00	38.10	Certification Letter
Toilet Partitions (Employee)	Hadrian Metal	\$5,701.00	36.00	14.00	LEED Information Letter
Concrete	Palomar Transit Mix	\$253,153.00	0.00	2.86	Mix Design Sheet
Building Insulation	Owens Corning	\$3,435.00	9.00	26.00	Technical Data Sheet

Sample Documentation

Recycled Content Calculations

Total value (\$) of post-consumer content	\$109,247.90
Total value (\$) of pre-consumer content	\$65,752.49
Total combined recycled content value (\$) post-consumer + 1/2 pre-consumer	\$142,124.15
Combined Recycled Content Value as a percentage of Total Materials Cost**	20.161 %

**To qualify for the credit the percentage of recycled content (post-consumer + 1/2 pre-consumer) must be at least 10% of the total materials cost

- Licensed Professional Exemption Path
 - Registered Architect or Registered Interior Designer
 - Upload cutsheets for 20% of materials (by cost) to support pre and post-consumer content claims

MR Cr 4: Recycled Content

Resources:

- Recycled-Content Product Database: www.ciwm.ca.gov/RCP/
- U.S. EPA's Comprehensive Procurement Guidelines (CPG): www.epa.gov/cpg/
- GreenSpec: The Environmental Building News Product Directory: www.greenspec.com/
- Oikos Green Product Information: www.oikos.com/products/

Other Resource:

- CA EPP Best Practices Manual www.green.ca.gov/EPP

MR Cr 5: Regional Materials

1. Credits for NC, Schools & CS
2. Construction Phase Credit
3. Intent

- Increase demand for building materials and products that are extracted and manufactured within the region, thereby supporting the use of indigenous resources and reducing the environmental impacts resulting from transportation.





MR Cr 5: Regional Materials

4. Requirements

- Use building materials or products **extracted, harvested or recovered**, as well as **manufactured**, within 500 miles of project site for **≥ 10% or 20%** (based on cost) of the total materials value.
- If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.

Regional Materials	Points
10%	1
20%	2
30%	Exemplary Performance

MR Cr 5: Regional Materials

4. Requirements (cont.)

- Mechanical, electrical, plumbing and specialty items (i.e. elevators & equip.) not included in this calculation
- Only include mat'ls permanently installed in the project.
- Furniture may be included, providing it is included consistently in MR Credits 3–7.



MR Cr 5: Regional Materials

5. Strategies & Implementation

- Establish project goal for locally sourced materials, identify materials and suppliers that can achieve goal.
- During construction, ensure that the specified local materials are installed and quantify the total percentage of local materials installed.
- Consider environmental, economic and performance attributes when selecting products and materials.
- Typically available regional materials:
 - Concrete (batch, concrete masonry units)
 - Wood (trusses, framing, some sheathing)
 - Steel (rebar, some structural)
 - Some finishes

MR Cr 5: Regional Materials

6. Documentation

- Select method for determining total mat'ls cost
 - **Default materials value**
 - **Actual materials value**
- Enter material data:
 - Percent compliant (% of product meeting both extraction & manuf. location info.
 - Harvest & manuf. distances
 - Calculates combined recycled content value as % of total materials costs
- Licensed Professional Exemption Path
 - Registered Architect or Registered Interior Designer
 - Upload cutsheets for 20% of materials (by cost) to support extraction/harvest/recovery & manufacture distance claims
- See sample tables pages 382, 383 & 385

MR Cr 6: Rapidly Renewable Materials

- Credit for NC & Schools, not CS
- Construction Phase Credit
- Intent

- Reduce the use and depletion of finite raw materials and long-cycle renewable materials by replacing them with rapidly renewable materials.



MR Cr 6: Rapidly Renewable Materials

4. Requirements

- **Definition - Rapidly Renewable:** Made from plants typically harvested within 10-year cycle or less
- Use rapidly renewable building materials and products for **2.5%** of the total building materials and product value (based on cost.)
- ★ Innovation credit for exemplary performance **≥ 5%**



MR Cr 6: Rapidly Renewable Materials

5. Strategies & Implementation

- Establish project goal for rapidly renewable materials
 - Identify material suppliers who can support achieving this goal.
 - See figure 1, page 389 for harvest rates
- Consider materials such as bamboo, wool, cotton insulation, agrifiber, linoleum, wheatboard, strawboard and cork.
 - Also poplar & aspen OSB
- During construction, ensure that the specified renewable materials are installed.



MR Cr 6: Rapidly Renewable Materials

6. Documentation

- Select method for determining total materials cost & enter corresponding value
- Enter material data:
 - Material description,
 - Manufacturer, cost
 - Percentage of product meeting rapidly renewable criteria (by weight)
 - Calculates rapidly renewable material value as a percentage of total materials cost
- Licensed Professional Exemption Path
 - Registered Architect or Registered Interior Designer
 - Upload cutsheets for 20% of materials (by cost) to support the rapidly renewable content claims
- See sample calculation table page 391

MR Cr 7: Certified Wood

1. Credit for NC, Schools & CS (MR Cr. 6)
2. Construction Phase Credit
3. Intent

- Encourage environmentally responsible forest management.



MR Cr 7: Certified Wood

4. Requirements

- **Definition – Certified Wood:** Wood-based materials and products certified in accordance with Forest Stewardship Council (FSC) Principles and Criteria, for wood building components.
- **Use ≥ 50% FSC certified** wood-based materials and products
- Includes, but not limited to:
 - Structural framing
 - General dimensional framing,
 - Flooring, sub-flooring,
 - Wood doors and finishes
 - Permanent materials only, except wood products used for temp. use may be included, if all are included (scaffolding, bracing, formwork, sidewalk protection, guardrails)
 - Furniture can be included, if consistent for Cr. 3-7
- ★ Innovation credit for exemplary performance **≥ 95%**



MR Cr 7: Certified Wood

5. Strategies & Implementation

- Establish project goal for FSC certified wood products
 - Identify material suppliers who can achieve this goal.
- During construction, ensure that the certified wood products are installed and quantify the total percentage of FSC-certified wood products installed.
- See Figure 1, Page 396 to describe Chain of Custody (CoC) requirements
 - a) Identify each wood item
 - b) Identify FSC products
 - c) Include dollar values for each line item
 - d) Include CoC certificate number on any invoice



MR Cr 7: Certified Wood

6. Documentation

- Enter data for wood-based components:
 - Material description,
 - Manufacturer, cost
 - Wood component percentage
 - FSC certified wood % of wood component
 - FSC chain-of-custody certificate number
 - Calculates FSC certified wood value as a percentage of total wood-based cost
- See Table 1, Page 398 for sample calculation table demonstrating assembly wood-based content

MR Cr 7: Certified Wood

6. Documentation

- Sample Specification Language

"Provide a list of items (and/or components of products) claimed as FSC certified, including product type, manufacturer, and the appropriate entity's COC certification number. Provide certificates of chain-of-custody signed by manufacturers certifying that products specified to be made from certified wood were made from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria."

Study for Next Class:

LEED-NC Reference Guide

- Read Indoor Environmental Quality section pages 401-590

Construction & Demolition (C&D) Waste Diversion in California



Dan Burgoyne
Sustainability Manager
State of California
Department of General Services (DGS)

C & D Waste Classification

20% of Landfill Composition in California
Over 100 Million Tons Annually Nationwide
Over 4 Million Tons Annually in California



There is More than One Way to Recycle C&D Waste



Methods of C&D Recycling

On-site separation, recycling, storage & reuse



- Great savings potential
- Concrete, asphalt, greenwaste

Methods of C&D Recycling

On-site separation, segregated recycling



- Salvage value for some materials
- Lower tipping fees – reduces off-site sorting



Methods of C&D Recycling

Mixed waste on-site, off-site separation



- When there are site constraints
- Still cheaper than landfill

C&D Strategy:

When do you Start C&D Waste Diversion?



C&D Strategy

Feasibility Study/Conceptual Phase

- Establish C&D diversion goals (50-75 % recommended)

Budget/Programming Phase

- Preliminary C&D economic evaluation

Prelim./Schematic Design Phase

- Consider waste management in building systems selection
- Modular design

C&D Strategy

Design Development Phase

- Full C&D Economic Feasibility Study
- Consider salvaged material use

Working Drawings Phase

- Specify recyclable and recycled content materials

Bidding Phase

- Develop waste management plan
- C&D diversion requirements in bid specs

C&D Strategy

Demolition Phase

- Contractor to submit C&D plan (incl. list of permitted facilities)
- Assign project waste coordinator

Construction Phase

- Continuous coordination, monitoring & outreach

Project Closeout Phase

- Summarize & document results
- Complete contractual & LEED documentation

Construction Types Benefiting from C&D Waste Diversion

Sitework

Demolition

New Construction or Renovation



1. Sitework



Asphalt grinding/removal

Used as road base

~\$5.72/ton saved (x 13,776 tons = \$78,800)

1. Sitework

Concrete into road base



~\$13.23/ton saved (x 1,000 tons = \$13,230)

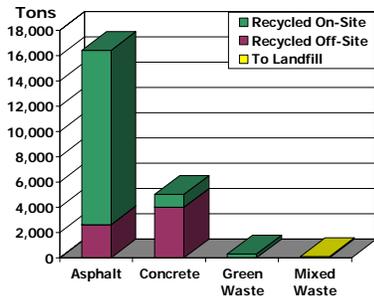
1. Sitework

Greenwaste into mulch



~\$29.60/ton saved
(x 300 tons = \$8,880)

Sitework Case Study: Franchise Tax Board - Sacramento



- 99.6% recycled (21,700 tons)
- 69% on-site
- **\$104K saved**

2. Demolition

Concrete



- Crushed for road base, inert fill
- Aggregate recycled
- Rebar salvaged

Steel



- High salvage value
- Segregate for higher return
- East End – closed loop

2. Demolition

Wood



- Salvage larger members
- Mulch, WTE

Brick



- Salvage value (~\$400/ton)
- Inert fill

2. Demolition

Gypsum Board



- Soil amendment
- Cat litter

Carpet



- Carpet, backing
- Railroad ties
- Landscaping

2. Demolition

Roofing



- Asphalt pavement
- Aggregate base

Glass



- Fiberglass
- Aggregate

Demolition Case Study: Cal Trans District 7 Office Building - LA

Brick buildings



- 2,770 tons of brick
- Salvaged / inert fill

Concrete buildings



- 7,510 tons of concrete & asphalt
- Rebar

Cal Trans District 7 Office Building

Asphalt Pavement



- Parking lot removed
- 100% recycled/diverted

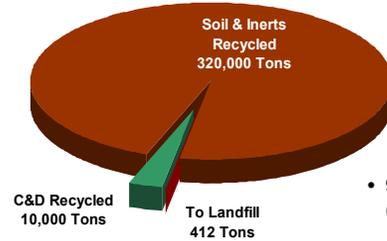
Excavation



- 320,000 tons recycled
- Soil & inerts

Cal Trans District 7 Office Building

Recycling During Demolition & Excavation



- 96% C&D recycled (10,000 tons)

3. Construction

Steel



- Cold rolled vs. light gauge

Wood



- New wood cleaner than demolition wood
- Salvage or recycle

3. Construction - Packaging

Cardboard



- Reduced or no tipping fees

Plastics



- Plastic or composite lumber
- Injection molding

Construction Case Study: Capital Area East End Complex - Sacramento



- 1.5 million square foot office complex
- 91% C&D recycled (18,000 tons)
- Also recycled excavated soil & rock (300,000 tons)

Capital Area East End Complex

Modified sub-grade construction



- Shotcrete eliminated 45 tons of plywood forming
- Eliminated overexcavation

Saved \$84K using mixed C&D waste carrier



- Separated asphalt & steel
- 38% savings over mass landfill

Capital Area East End Complex

- Relocated 8-unit apartment building



Reused 265 tons of salvaged marble



Conclusion

High C&D diversion rate is possible

C&D waste diversion can save \$

Early integration can further reduce materials & waste

C&D Resources

- C&D Debris Recyclers Database **
www.ciwmb.ca.gov/Condemo/Recyclers/RecyclerSearch.aspx
- California Integrated Waste Management Board (CIWMB) – tools, model ordinances, databases
www.ciwmb.ca.gov/Condemo
- C&D Recycling Toolkit for Contractors
www.ciwmb.ca.gov/Condemo/Toolkit
- Construction Materials Recycling Association
www.cdrecycling.org
- Construction & Demolition Waste Diversion in CA
www.ciwmb.ca.gov/condemo/CaseStudies/DGS_Diversion.pdf