Deconstruction, Reuse, and Construction/Demolition Recycling To Achieve >90% Reuse+Recycling

CT Solid Waste Advisory Committee
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Overview: Making R+R Work

Don’t believe people who say it can’t be done

Early planning

Strong, clear specification

- Materials; Responsibilities; Waste Management Plan; Reporting & Documentation

Owner/architect commitment

Communications, training

Thoroughness – Don’t miss a waste

Reporting
Overview: Getting Started

Early planning and good specifications are key. Issues if contractor is “forced” to recycle, or recycling is added on after bid award.

Strong, Clear Specification
- Materials (including fixed assets)
- Prime & subcontractor responsibilities
- Waste Management Plan
- Regular reporting & documentation

Be Thorough - Don’t Miss a Waste
- Example: Furnishings, landclearing
Overview: Process

1. Evaluate Materials and Opportunities
   - Surplus Property Reuse
   - Deconstruction: Recover and Reuse
   - Recycle

2. Plan

3. Train

4. Implement

   Troubleshoot

   Track
Surplus Property

**What?** Furniture, seating, kitchen & cafeteria equipment, libraries, conference rooms, lab equipment, hospital rooms, built-in cabinets, windows & doors, partitions

**Options:** IRN is the best

**Goal (Reality):** ~100% reuse, a small amount recycled, 0% disposed
Deconstruction

Deconstruction = Dismantling of structure to recover reusable materials

- Most Common: Wood (2x, beams, flooring), windows, doors, porcelain fixtures, partitions
- Requires: Planning, time, expertise
- Deconstruction contractors are becoming more common, more experienced
Recoverable Materials:
Deconstruction

- Architectural Salvage
- Casework
- Wood & metal framing, beams
- Ceiling Tiles
- HVAC Equipment

- Flooring
- Metal, slate roofing
- Lighting (bulbs, ballasts, fixtures)
- Doors and Windows
- Wiring and Cable
- Bathroom Fixtures
Recyclable Materials:

Demolition / Renovation

- Landclearing debris
- Asphalt paving
- Concrete, brick, block
- Wood (incl. treated & painted, plywood, OSB)
- Metals (ferrous & nonferrous)
- Glass
- Asphalt shingles
- Commercial roofing
- Slate, other roofs
- Mixed debris
Recyclable Materials:

New Construction

- Concrete, brick, block
- Wood (dimensional, OSB, plywood, etc.)
- Metals (HVAC, plumbing, elec.)
- Gypsum wallboard
- Cardboard, other packaging
- Mixed debris
Markets: Where It All Goes

Concrete, Brick, Block
St. Paul’s School, NH

Gypsum Wallboard
Cambridge City Hall, MA

Ceiling Tile, Wood
Ceiling Tile to Ceiling Tile

Aggregate for Roads

New Wallboard

Mulch or Biomass Fuel
Bottom Line

There is hardly anything in a building or on a jobsite that cannot be reused or recycled.

90%-98% reuse and recycling is possible on ANY project.
Will Recycling Cost More?

Compared to disposal (bottom bars), recycling costs much less for nearly all materials.
## Will Recycling Cost More?  
*(Liberty Mutual, Boston)*

<table>
<thead>
<tr>
<th>Material</th>
<th>Tons</th>
<th>Total $</th>
<th>$$/Ton</th>
<th>Total $</th>
<th>$$/Ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate</td>
<td>138</td>
<td>$4,958</td>
<td>$36.02</td>
<td>$12,586</td>
<td>$91.43</td>
</tr>
<tr>
<td>Brick</td>
<td>22</td>
<td>$938</td>
<td>$41.85</td>
<td>$2,126</td>
<td>$94.81</td>
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<tr>
<td>Gypsum</td>
<td>2.2</td>
<td>$667</td>
<td>$306.01</td>
<td>$400</td>
<td>$183.49</td>
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<tr>
<td>Mixed Metals</td>
<td>9.5</td>
<td>$394</td>
<td>$41.72</td>
<td>$900</td>
<td>$95.14</td>
</tr>
<tr>
<td>Mixed Debris</td>
<td>24</td>
<td>$2,766</td>
<td>$115.70</td>
<td>$2,257</td>
<td>$94.41</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>196</td>
<td>$9,725</td>
<td>$49.71</td>
<td>$18,270</td>
<td>$93.39</td>
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<tr>
<td><strong>Savings</strong></td>
<td></td>
<td>$43.68</td>
<td></td>
<td>$8,544</td>
<td></td>
</tr>
<tr>
<td><strong>% Savings</strong></td>
<td></td>
<td></td>
<td></td>
<td>47%</td>
<td></td>
</tr>
</tbody>
</table>
“Waste” is an asset. Treat it like one.

Separation captures the full economic value of the asset.

Mixing together creates a waste.

Mixed debris recycling rates are $< \text{ or } <<$ than rates achievable with separation.

Mixed debris costs are $= \text{ or } >$ than disposal costs.
Will Recycling Slow Down the Job?

- **Not because of labor.** Workers train easily, learn quickly, and support recycling.
- **Waste containers are closer to the work.**
- **Not because of service.** Hauling recyclables is the same as hauling waste.
- **Not because of logistics.** Recycling is coordinated specifically to the job site, to fit in the project schedule.

**A Cleaner, Safer Jobsite**
Other “Barriers” & Solutions

“We don’t have room to recycle.” Planning and choreography, not a line of containers

“My hauler won’t go along.” Find another hauler. Good haulers know this is their future.

“This is a union job.” Planning, specification, and communication. Let them know expectations and requirements; make them a partner.

“I don’t believe it’s realistic.” Case Studies.
Case Studies

**Harvard University**: Blackstone Steam Plant, Interior Gut and Renovation (LEED Platinum)

**Smith College**: Ford Hall Engineering and Science Building (Deconstruction, Demolition, New Construction) (LEED Silver)
Harvard Blackstone Steam Plant

**Description:** Complete interior gut, interior reconstruction (office), exterior renovation. 40,000 sq ft in three buildings (1890s). Structural brick, concrete, wood beams.

**Size/Duration:** $10M, 9 months

**Location:** Cambridge (urban, tight)

**Contractor:** Consigli

**Architect:** Bruner-Cott
Challenges

- Tight site; Site work during construction
- Two projects on same site
- Hazardous materials (working around abatement)
- Identifying reuse options
# Materials Recycled

<table>
<thead>
<tr>
<th>Category</th>
<th>Quantity</th>
<th>Material</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Furnishings (Reuse)</td>
<td>9</td>
<td>Brick</td>
<td>15</td>
</tr>
<tr>
<td>Fixed Assets (Reuse)</td>
<td>10</td>
<td>Concrete</td>
<td>395</td>
</tr>
<tr>
<td>HVAC Equipt</td>
<td>7</td>
<td>Asphalt</td>
<td>461</td>
</tr>
<tr>
<td>Metal</td>
<td>73</td>
<td>Gypsum Wallboard</td>
<td>25</td>
</tr>
<tr>
<td>Wood</td>
<td>61</td>
<td>Mixed C&amp;D (Net at 70%)</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total Reuse and Recycling</strong></td>
<td></td>
<td></td>
<td><strong>1,061</strong></td>
</tr>
<tr>
<td><strong>Total Disposed</strong></td>
<td></td>
<td></td>
<td><strong>4</strong></td>
</tr>
<tr>
<td><strong>Project Recycling Rate</strong></td>
<td></td>
<td></td>
<td><strong>99.6%</strong></td>
</tr>
</tbody>
</table>
Keys To Success

- Early involvement
- Recycling requirements inserted into each section of specifications
- Good waste mgmt spec
- Use selection process to identify committed contractor
- Committed owner
- Lots of concrete and asphalt
Description: Deconstruction and demolition of existing wood/brick structures. Construction of 140,000 sq ft lab/classroom building, poured-in-place concrete

Size/Duration: $73M, 22 months

Location: Western Mass. (rural college campus)

Contractor: W.A. Berry

Architect: Bohlin Cywinski Jackson
Challenges

- Congested site
- Large volumes of multiple materials throughout project
- Deconstruction of 100 year-old buildings
- Owner & contractor had no recycling experience; expected high cost and delays
# Materials Recycled

<table>
<thead>
<tr>
<th>Material</th>
<th>Decon/Demo</th>
<th>New Constr.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deconstruction</td>
<td>42.6</td>
<td>--</td>
<td>42.6</td>
</tr>
<tr>
<td>Trees, Chips, Wood</td>
<td>13.5</td>
<td>177.3</td>
<td>190.8</td>
</tr>
<tr>
<td>Metal</td>
<td>38.7</td>
<td>67.7</td>
<td>106.4</td>
</tr>
<tr>
<td>Asphalt, Brick, Concrete</td>
<td>646.2</td>
<td>775.0</td>
<td>1,421.2</td>
</tr>
<tr>
<td>Surplus</td>
<td>--</td>
<td>17.1</td>
<td>17.1</td>
</tr>
<tr>
<td>Gypsum Wallboard</td>
<td>--</td>
<td>58.6</td>
<td>58.6</td>
</tr>
<tr>
<td>Cardboard</td>
<td>--</td>
<td>18.2</td>
<td>18.2</td>
</tr>
<tr>
<td>Mixed Debris Recycled</td>
<td>403.4</td>
<td>191.0</td>
<td>594.4</td>
</tr>
<tr>
<td>Recycling Totals</td>
<td>1,144.4</td>
<td>1,304.9</td>
<td>2,449.3</td>
</tr>
<tr>
<td>Mixed Debris Disposed</td>
<td>41.5</td>
<td>47.0</td>
<td>88.5</td>
</tr>
<tr>
<td>Project Reuse+Recycling Rate</td>
<td>96.5%</td>
<td>96.5%</td>
<td>96.5%</td>
</tr>
</tbody>
</table>
Keys To Success

- Strong specification
- Support from owner and contractor senior mgmt.
- Planning and service to assure zero interference with project work
- Timely tracking and reporting to facilitate support
- Account for ALL wastes: land-clearing, asphalt pavement, deconstruction, etc.
Recycling and LEED

50% Recycling = 1 Credit
75% Recycling = 1 Credit

Innovation Possibilities

✓ 95%+ Recycling Rate
✓ Return materials to the project

Examples: Aggregate or wood returned to the jobsite, “waste-to-art”
For Real?

Aircuity, Inc. (Waltham, MA), Corporate Headquarters, Renovation: Recycling Rate: 97% (LEED)
A. T. Kearney, Inc., Home Office (Cambridge, MA), New Construction: Recycling Rate: 75% (final) (LEED)
AVA Gallery and Art Center (Lebanon, NH), Renovation (Historic Structure): Recycling Rate: 97% (final) (LEED)
Boston College, Renovation Projects: Barat House, 85%; Brighton Gym, 89%; Fulton Hall, 94%; Higgins Hall Electrical Shop, 85%; Higgins Hall 1st Floor Labs, 85%; Lyons Hall, 85%; McGuinn Hall, 87%; Merkert Hall, 100%; Modular Housing, 85%; O’Neill Library, 94%; Walsh Hall Player’s Club, 86%
Boston Scientific Corporation, Marlborough Campus Renovation: Recycling Rate: 95.4%
BSC Group, Mass. Div of Capital Asset Mgmt, Danvers State Hosptl House Demolition: Recycling Rate: 90% (final)
Chinatown (Boston) Community Education Center, New Construction: Recycling Rate: 85% (final) (LEED)
Community College of Vermont, Winooski Academic Building, Winooski, VT. Recycling Rate: TBD
Dartmouth College, Brewster and Clement Hall Demolition: Recycling Rate: 98%
Dartmouth College, Thayer School Renovations and Expansion Recycling Rate: 93% (final) (LEED)
DMP 40/60 Developer LLC, 40 Danbury Road (Wilton, CT), New Construction: Recycling Rate: 85% (final) (LEED)
DMP 40/60 Developer LLC, 60 Danbury Road (Wilton, CT), New Construction: Recycling Rate: 97.9% (final) (LEED)
EMD Serono Inc. (Billerica, MA), Construction of Biopharmaceutical Research Facility: Recycling Rate: 90%
Eastman Village (NH) Community Center, Demolition and New Construction: Recycling Rate: 98.4% (Final) (LEED)
Eggleston Square Renovation/Repurposing of Electric Substation: Recycling Rate: 92% (final)
Emerson College Piano Row Residence Hall, New Construction: Recycling Rate: 83% (final)
FH Perry Builder, Multiple Projects, Residential Renovation & New Construction
Fairfield Development, Fairfield Green LEED Condominiums, Recycling Rate: 94.5%
First Church of Christ Scientist, CSPS Build-Out and Renovation, Recycling Rate: 91.81% (final) (LEED)
Four Points Sheraton, Norwood, MA, Interior Renovation, Recycling Rate: 97% (final)
Freeport Village Station, LL Bean Factory Store Outlet Fit Out, Recycling Rate: 94%
For Real?

Freeport Village Station Project, Recycling Rate: 92% (Final)
Gensler Architects, New Home Office (Boston, MA), Fit-out, Recycling Rate: 91.08% (final) (LEED)
Gloucester, MA, Cooperative Bank, New Bank Branch, Recycling Rate: 93%
Governor’s Island (NY) Preservation & Education Corporation, South Island Demolition
Hannaford Brothers, Uxbridge (MA) Store Renovation, Recycling Rate: 100% (furnishings)
Hanover, NH, Cooperative Society, Food Retail Demolition and New Construction, Recycling Rate: 90% (Final)
Harvard Univ, 10 Akron Street, Graduate Student Housing, New Construction, Recycling Rate: 98.96 (final)
Harvard Univ, 46 Blackstone UOS Renovation, Recycling Rate: 99.6% (final) (LEED and audited)
Harvard Univ, 90 Mt. Auburn St. Rare Document Facility, New Construction, Recycling Rate: 96.3% (final) (LEED)
Harvard Univ Allston Science Center I, Recycling Rate: 98.53%
Harvard Univ, Dunster-Mather Serveries, Renovation, Recycling Rate: 95.4% (final) (LEED and audited)
Harvard Univ Radcliffe Ctr for Advanced Education, Schlesinger Library Renovation, Recycling Rate: 99.1% (LEED)
Harvard School of Business, Gallatin Hall, Renovation, Recycling Rate: 99.37%
Harvard School of Business, Hamilton Hall, Renovation, Recycling Rate: 97.1% (LEED and audited)
Harvard School of Business, Wyss Hall, Renovation, Recycling Rate: 96.25% (LEED)
Liberty Mutual Group, Office Expansion and Renovation, Recycling Rate: 98% (Final) (LEED)
Maine General Hospital Cancer Treatment Center, New Construction, Recycling Rate: 95.24% (Final) (LEED)
Mass. DHCD, Salem Housing Authority Rainbow Terrace, Renovation, Recycling Rate: 94.97% (Final)
Montserrat College of Art, Beverly, MA, New Dormitory, Recycling Rate: 100%
Mount Desert Island Biological Laboratory New Construction, Recycling Rate: 95% (Final) (LEED)
Mount Vernon House (Winchester, MA), Addition and Renovation, Recycling Rate: 86% (Final)
Mt Washington Valley Technology and Education Center, New Construction, Recycling Rate: 75% (Final)
For Real?

Norwich University, Wise Student Center, Renovation and New Construction, **Recycling Rate:** 91.74% (Final)
Olin College of Engineering, East Residence Hall New Construction, **Recycling Rate:** 92.5% (Final)
Perkins & Will Architects (Boston, MA), Renovation and Interior Construction, **Recycling Rate:** 93% (Final) *(LEED)*
Phillips Exeter Academy (Exeter, NH), Thompson House Renovations, **Recycling Rate:** 93%
Proctor Academy (Andover, NH) Morton Hall Dormitory, New Construction, **Recycling Rate:** 96% (Final)

Residential Project, Moultonborough, NH, **Recycling Rate:** 90%
Residential Project, Bedford, NH, **Recycling Rate:** 95%
St. Gobain, Northboro Expansion Project, **Recycling Rate:** 97%
Smith College Cogeneration Project Renovation, **Recycling Rate:** 98% (Final)

Smith College, Ford Hall Engnrng Bldg, Deconstruction, Demolition, New Construction, **Recycling Rate:** 97% (Final)
St. Paul’s School, Athletic and Fitness Center Demolition and New Construction, **Recycling Rate:** 86% *(LEED)*

Union College (Schenectady, NY), Wold Science & Engineering Building, **Recycling Rate:** 90%
University of Connecticut, Gentry Building Renovation, **Recycling Rate:** 95%
University of New Hampshire, DeMerritt Hall, Demolition and New Construction, **Recycling Rate:** 98% (Final)
University of Rhode Island, New Student Housing Buildings A, B, and C, **Recycling Rate:** 86% (Final)
Univ of Southern Maine, Abromson Community Ed Center, New Construction, **Recycling Rate:** 90% (Final) *(LEED)*

Vermont Agency of Transportation, Bennington Bypass Deconstruction Pilot Project
Vermont Law School, Debevoise Hall Renovation, **Recycling Rate:** 80.3% (Final) *(LEED)*

Westbrook, ME, Middle School New Construction, **Recycling Rate:** 95%
Yale University, Stoeckel Hall Renovation and New Construction, **Recycling Rate:** 85.8% (Final) *(LEED)*
Yale School of Medicine, C-Wing Renovation, **Recycling Rate:** 91.4% (final) *(LEED)*
Yale School of Medicine, Brady Memorial Labs 1, 3, Renovation, **Recycling Rate:** 87.5% (final)
YWCA (Manchester, NH), Renovation, **Recycling Rate:** 97% (Final)
Contacts

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