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

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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

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Overview: Process

1. *Evaluate Materials and Opportunities*
   - Surplus Property Reuse
   - Deconstruction: Recover and Reuse
   - Recycle
2. *Plan*
3. *Train*
4. *Implement*

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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

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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

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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

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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

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Recyclable Materials:

New Construction

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

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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

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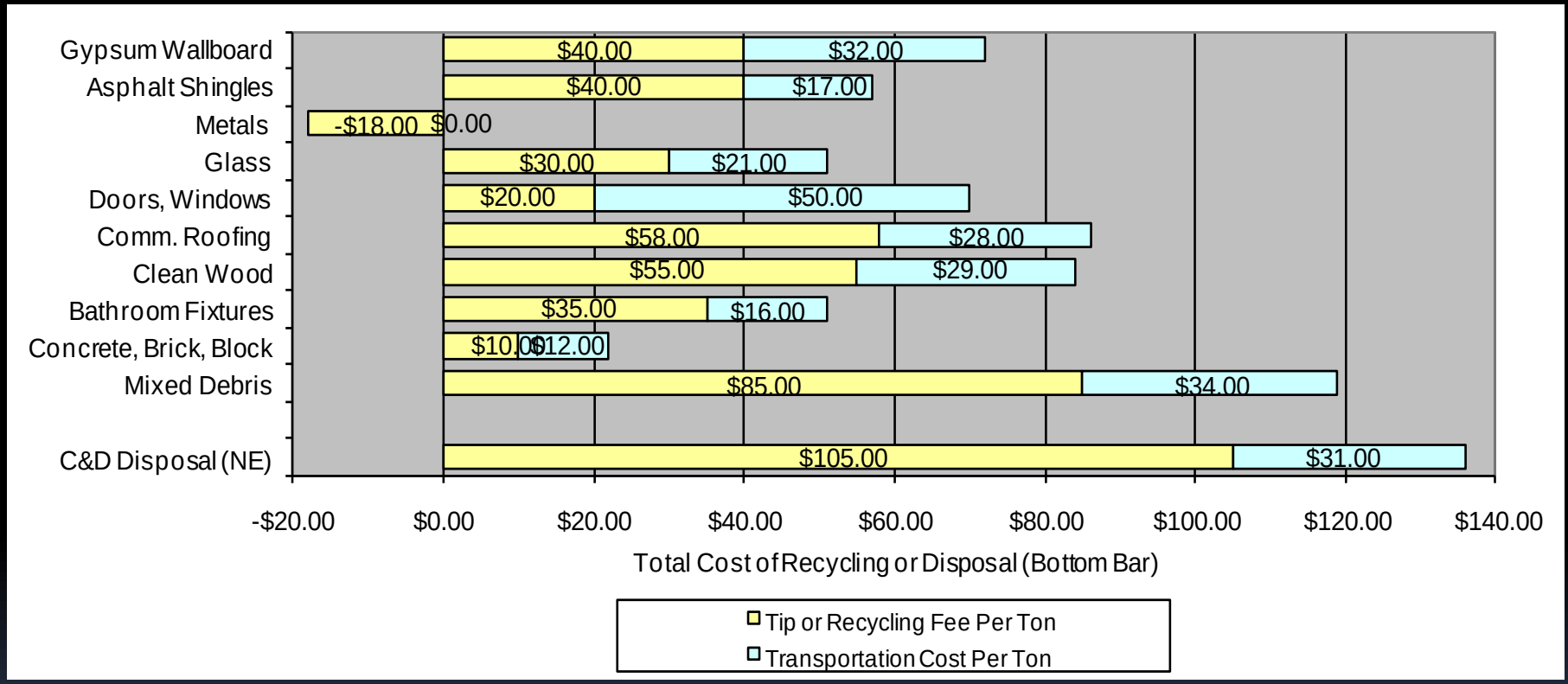
Will Recycling Cost More?



Compared to disposal (bottom bars), recycling costs much less for nearly all materials.

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Will Recycling Cost More?
(Liberty Mutual, Boston)

		Recycling, IRN		Flat Fee Cost	
Material	**Tons**	**Total $**	**$$/Ton**	**Total $**	**$$/Ton**
Aggregate	138	$4,958	$36.02	$12,586	$91.43
Brick	22	$938	$41.85	$2,126	$94.81
Gypsum	2.2	$667	$306.01	$400	$183.49
Mixed Metals	9.5	$394	$41.72	$900	$95.14
Mixed Debris	24	$2,766	$115.70	$2,257	$94.41
Totals	**196**	**$9,725**	**$49.71**	**$18,270**	**$93.39**
Savings			$43.68	$8,544	
% Savings				47%	

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Source Separation vs Mixed Debris

- *"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 < or << than rates achievable with separation.*
- *Mixed debris costs are = or > than disposal costs.*

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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

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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. .

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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)

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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

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Materials Recycled

Furnishings (Reuse)	9	Brick	15
Fixed Assets (Reuse)	10	Concrete	395
HVAC Equipt	7	Asphalt	461
Metal	73	Gypsum Wallboard	25
Wood	61	Mixed C&D (Net at 70%)	6
Total Reuse and Recycling			1,061
Total Disposed			4
Project Recycling Rate			99.6%

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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

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Smith College Science Center

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

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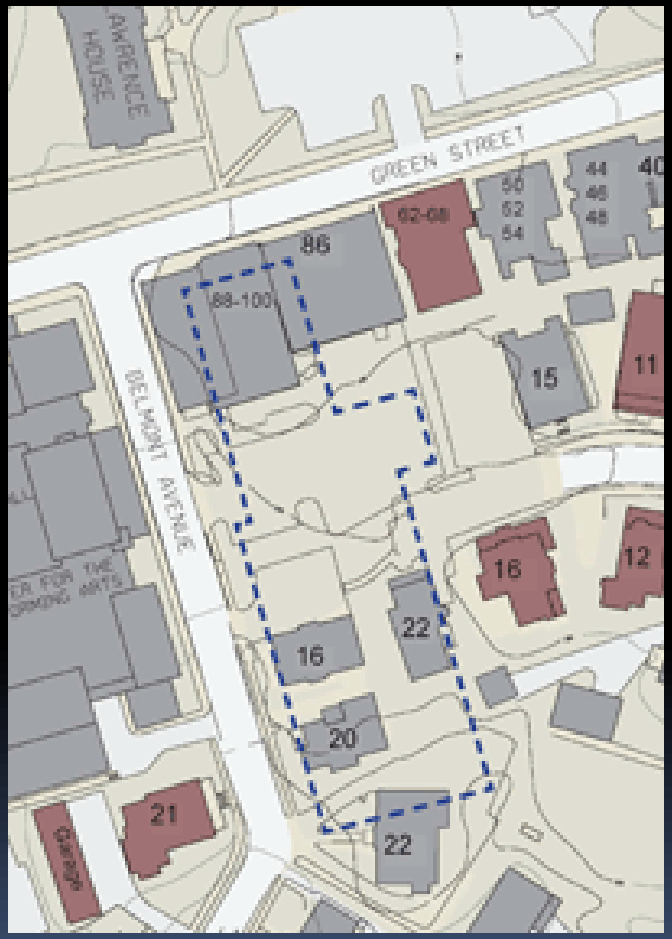
Challenges

- 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

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

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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.

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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%

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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)

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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 Engrng 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)

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