Building Deconstruction: an Innovative Approach to Integrating Sustainability into Construction

Presented at: Innovations in Technical Education to Advance Sustainability – Alfred State College
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College of Environmental Science & Forestry

ESF
State University of New York
College of Environmental Science and Forestry

Department of Sustainable Construction Management and Engineering

Presentation Overview

I. **Introduction – Concepts of Sustainability and Inquiry-based Learning**

II. **Application of Concepts to Construction**

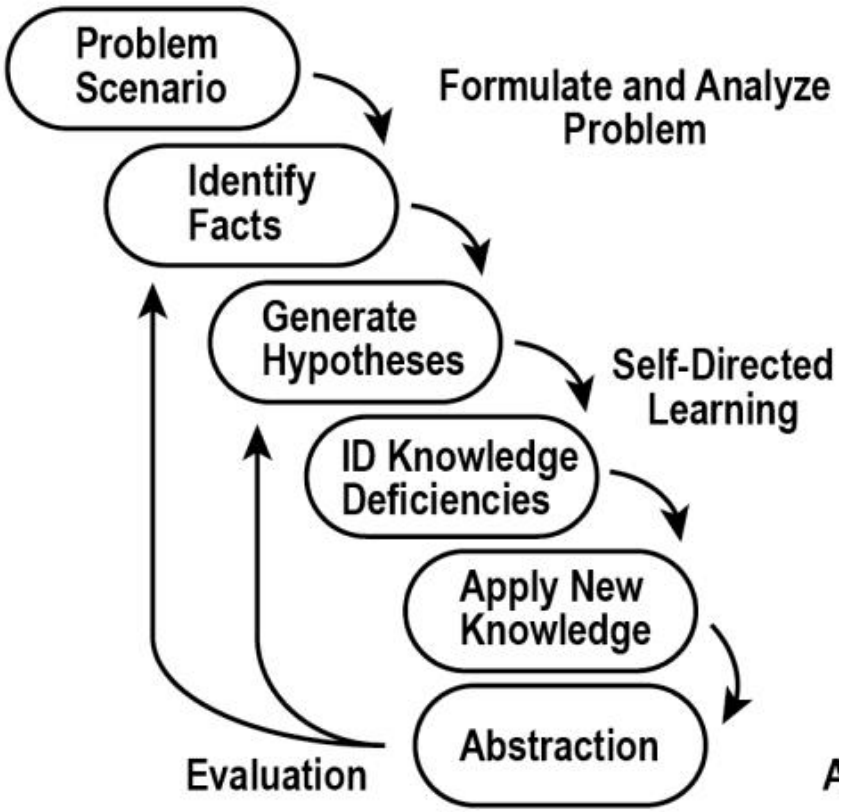
III. **Course Development and Implementation**

   a. Project Scenario
   b. Identify Facts
   c. Generate a Hypothesis
   d. Research Knowledge Deficiencies
   e. Apply New Knowledge
   f. Abstraction

IV. **Conclusions**

Inquiry-based Learning

- Why Inquiry-based Learning?
  - Student-centered vs. Teacher – centered experience
  - Student responsible for acquiring and immediately applying information
  - Recognition of need for collaborative problem resolution in AEC industry



Appropriate Problem Types for Inquiry-based Learning

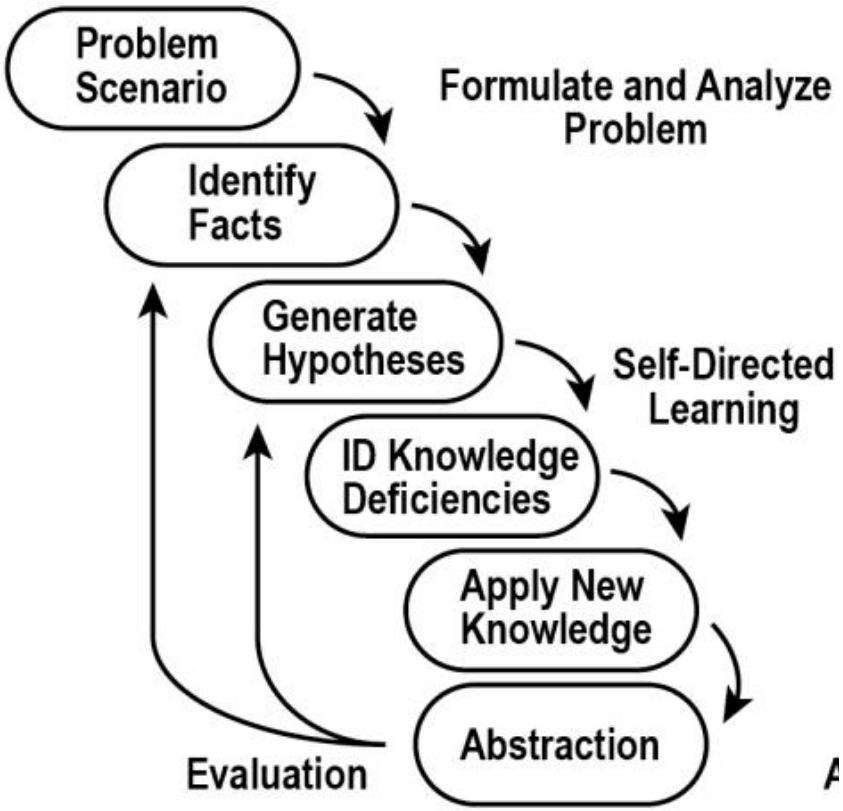
- Problems must be multi-faceted, and include aspects that are difficult to quantify
- Problems encountered in applying sustainable criteria are multi-variate, sometimes ambiguous, often require “design thinking”
- What definition to use for sustainability?
  - The “Triple Bottom Line” – simultaneous consideration of Social, Economic, and Environmental concerns
  - “People, Profits, and Planet” turned out to be useful form for student application

Applications of Sustainable Concepts to Construction

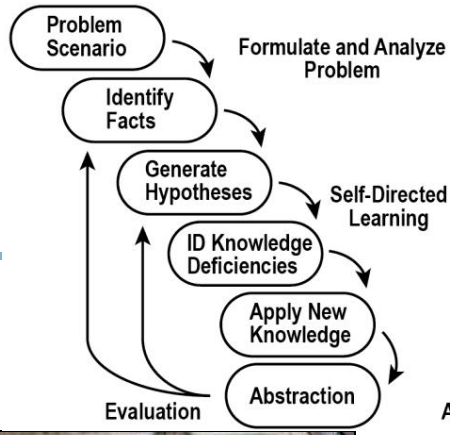
- Sustainable Construction requires consideration of production and final disposition of construction materials (LEED Materials and Resources)
- Life Cycle Assessment recognizes embodied energy in materials and cradle-to-cradle approach
- Construction and Demolition wastes form about 1/3 of landfill volume
- “Greenest Building is the One that is Already Built.” Carl Elefante

Course Design

- Name change: Sustainable Construction Management and Engineering
- Traditional teacher-centered courses in Sustainability
  - Intro to Sustainable Const.
  - Sustainable Energy System for Buildings
  - Environmental Metrics for Construction
- Fall 2010 – Student Centered - Seminar in Deconstruction



Project Scenario



- Syracuse, NY
- SU & ESF
- 2 blocks of houses
- Oakland - 18 houses
- Standart/ Raynor - 11 houses

Project Scenario – Block 1

- 18 houses
- Demolished summer 2010
- Lightly skimmed – 1%
- 1,008 tons landfilled; 1,102 hard fill

Project Scenario – Block 2

- 11 houses
- Student housing
- 1920-40s vintage
- 33 apartments
- 33,382 sf

Identify Facts

- No Instructor lectures
- Speakers –
  - Social - Local Habitat leader
  - Economic – Industrial designers
  - Environmental – Ecological Builder

Generate a Hypothesis

- Administration met to give reasons for demolishing Block 1
  - Schedule
  - Risk
  - Accountability
- What is the best use for next 11 houses?
  - Harvesting material
  - Harvesting information

- *If presented with a clear representation of the externalities (environmental and social impacts) as well as a well defined cost and schedule for deconstruction, the administration would select deconstruction over demolition for the block two homes.*

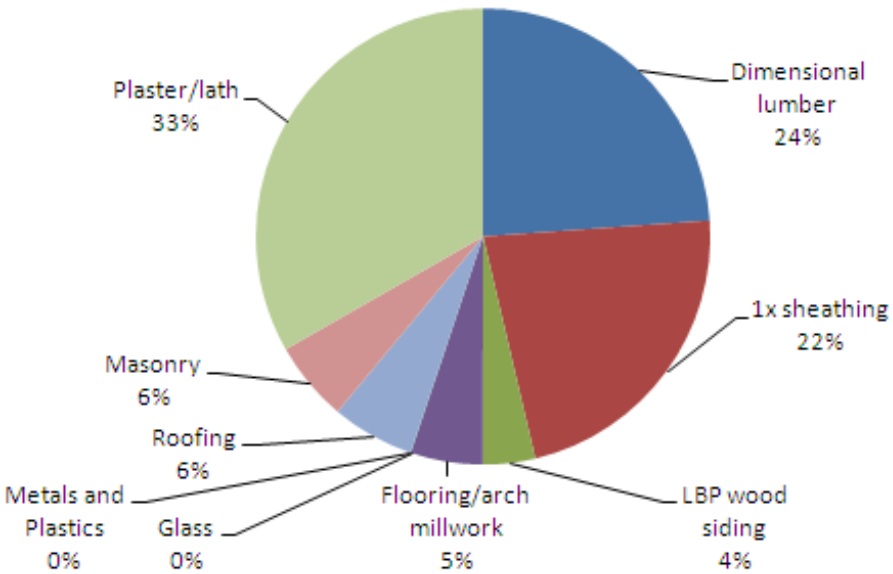
Research Knowledge Deficiencies -Inventory

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2		Property/	Survey D	Yr of Cons	GIS 1st flo	GIS 2nd floor area											
3		702 Rayn	8-Nov-10	1900	988	933											
4												External Inventory - bulk materials					
5		Architectural Salvage Inventory															
6															Perimete	# Window	# Doors
7		1st and Basement -											Ext walls	1st floor	154	14	3
8		Material	Item	Qty		Notes							Ext walls	2nd floor	154	14	1
9		Porch (wood)		1	1 = Full front porch. Any other number is in relation to that.												
10			Fan/light	combo									Building footprint		Length (ft	Width (ft)	
11			Switch/Ou	17		new gas stove, refrigerator, dishwasher							1x subfloor	1st floor	53	23	
12			Exterior D	3		asbestos wrapping in basement							1x subfloor	2nd floor	53	23	
13			Interior D	9													
14			Lighting Fi	7									Ceiling	1st floor	53	23	
15			Window	15									Ceiling	2nd floor	53	23	
16			Heat/Retu	6													
17			Cabinets	26									Roofing	# Layers	slope (on 12) e.g 8/12 = 8		
18			Sink - Bat	2										3	12		
19			Sink - Kitc	1													
20			Toilet	2	1.6gpf ?	no						Internal Inventory - bulk materials					
21			Tub	2									Joist size	width (in)	depth (in	Number	Length (ft
22			Furnace	2	Efficiency	old					basement ceiling		1st floor	2	8	36	24
23			Plumbing	lome coppe	(copper, Plastic, iron, etc.)								2nd floor	2	8	36	24
24		Exceptiona	7.5 ton monoposts (10), a lot of new ductwork, 54' of 6x8 timber beam,leaded glass transom window.										attic	2	6	36	24
25		2nd and Attic															
26		Material	Item	Qty	Notes						basement masonry			Length (in)	Width (in	Height (ft)	
27		Porch (wood)			1 = Full front porch. Any other number is in relation to that.								Chimney 1	26	17	43	
28			Switch/Ou	17									Chimney 2				

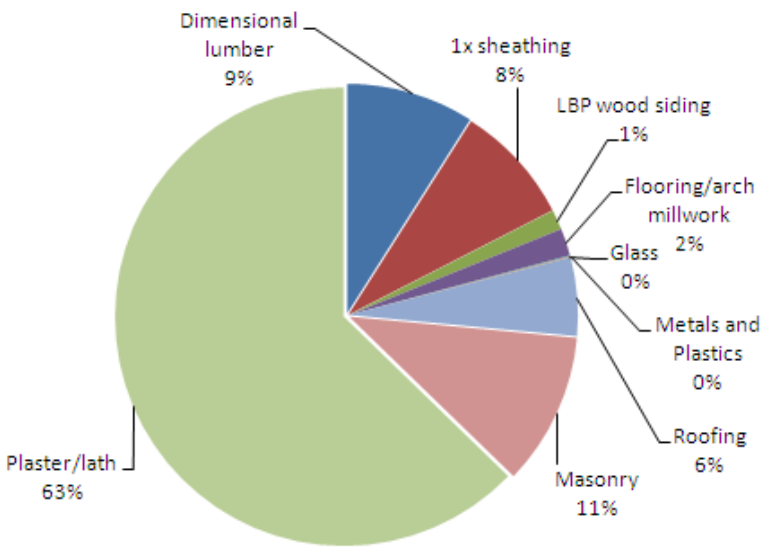
700 / 702 / 704 / 708 / 710 / 117 / 119-121 / 123 / 125 / 127-129 / 131-133 / Garages / 706 / Blank shel

Research Knowledge Deficiencies -Means and Methods

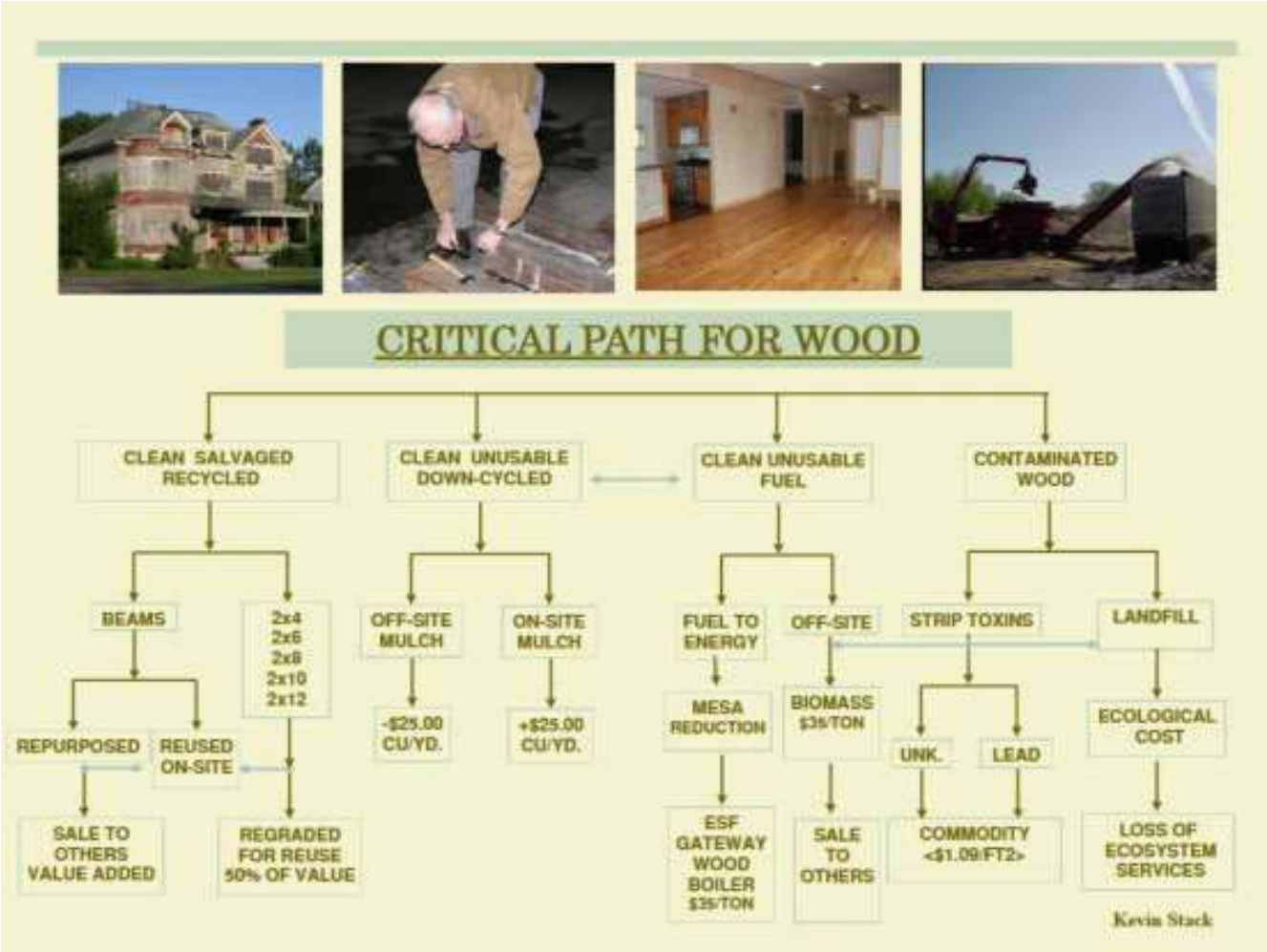
Material by Volume



Material by weight

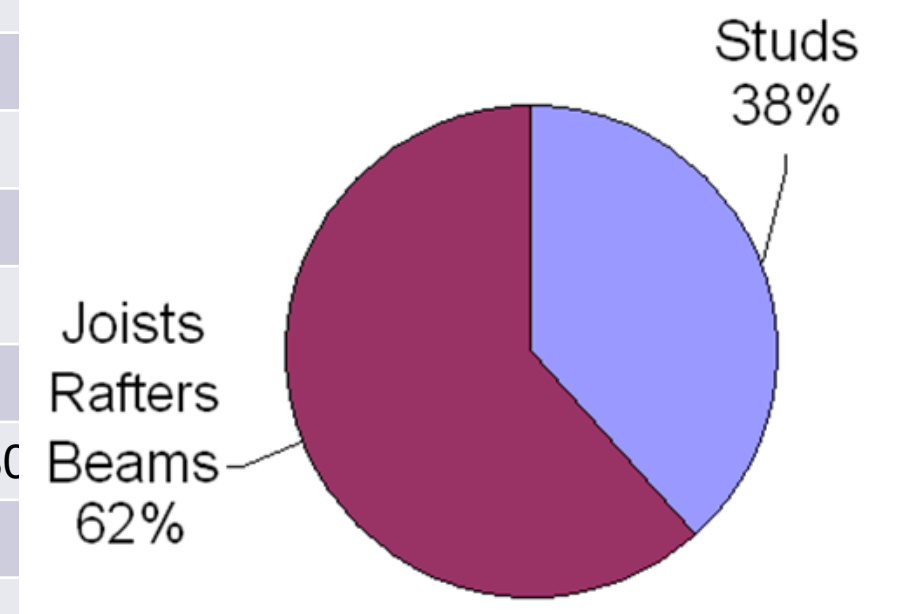


Research Knowledge Deficiencies - Markets



Apply New Knowledge

Landfill @ $44/Ton	Zero Diversion	Hybrid Diversion to Energy*	Hybrid Diversion to Reuse/ Recycle	Hybrid Diversion to Resale	Full Diversion to Resale
Demo/Decon	**±$88,000**	**$192,500**	**$192,500**	**$192,500**	**$330,000**
Roofing					
Sheath/Side					
Lumber/Floor					$19,819
Masonry					$14,350
Plaster/Lath					
Metals	$3,30				$3,300
Arch Items					$35,390
% Diversion	0	52	52	52	63
COST	**$84,700**	**$196,673**	**$199,505**	**$123,485**	**$257,141**



Abstraction

- One semester, one credit course, started one week late
- Building Materials Reuse Association developed curriculum for community colleges with Lead Renovation, Lead Abatement, Asbestos Abatement, OSHA 30hr

- **ESF students in Syracuse want neighboring buildings 'deconstructed'**
- **Published: Thursday, January 27, 2011, 6:45 AM Updated: Thursday, January 27, 2011, 2:04 PM**
- By Charles McChesney / The Post-Standard The Post-Standard

Conclusions – Student Evaluations

1. The course and subject matter were well organized.	3.9
2. The instructor communicated effectively.	4.3
3. The instructor was enthusiastic about teaching.	4.6
4. The instructor seemed knowledgeable about the subject matter.	4.3
5. The instructor conveyed a positive attitude toward students.	4.4
6. Tests, assignments, and projects were fair.	4.3
7. Grading was fair.	4.4
8. The instructional approach(es) used was (were) appropriate to the course.	4.1
9. The instructor motivated me to do my best work.	4.3
10. I gave my best effort in this course.	4.4

1-Strongly Disagree; 2-Disagree; 3-Neutral; 4-Agree; 5-Strongly Agree

Conclusions – Student Evaluations

- **What was the most effective part of this course?**
- Feel the entire class was motivated by the subject matter. Kind of a different scenario from when students enroll to meet a requirement.
- A basic understanding of how to take inventories and how it can be used lecture and class participation.
- Willingness of the group hands-on learning.
- seeing the. inventory for ourselves and documenting it
- Conducting Building Inventories and researching different options for various materials.
- The most effective part of this course was performing the inventories at the homes on Standart and Raynor Streets. These homes contain a variety of salvageable material, all of which would be a shame for it to go directly to a landfill. It was important to be able to see the material in person

Conclusions – Student Evaluations

- **Given all that you learned as a result of this course, what do you consider to be most important?**
- How hard it is to get the information necessary to convince a panel
- understanding markets for material.
- difficulties within these markets or lack of.
- Deconstruction of the Standart/Raynor block should be viewed as an opportunity for ESF to be a forefront leader in Sustainable Practices.
- If the College of Environmental Science & Forestry does not approve deconstruction over demolition, then there is no hope for others with equivalent or less knowledge to participate in deconstruction.

My Conclusions

- Lack of certainty that all students received an equivalent experience – student centered
- Students covered QTO, Estimating, Means and Methods, Safety, but hard to have confidence in treatment across curriculum
- Students developed great confidence to present material

Thank You - Innovations in Technical Education to Advance Sustainability

Questions….

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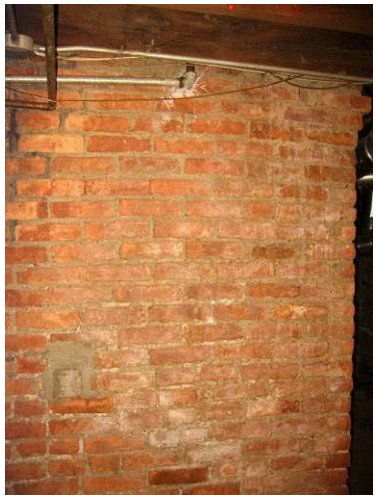
ESF State University of New York
College of Environmental Science and Forestry

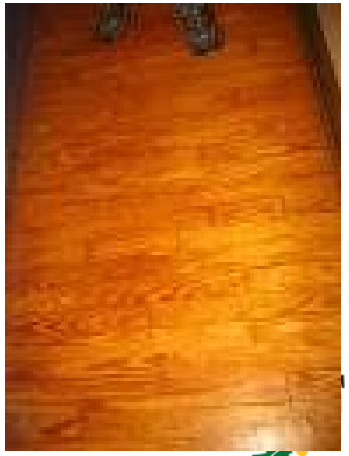
Potentially Salvageable

- 9,700 sf hardwood flooring
- 40,466 bf joists, rafters, beams (minus studs)
- 41,000 bricks
- 200,000 cf masonry
- Estimated $300 in recyclable metals/house

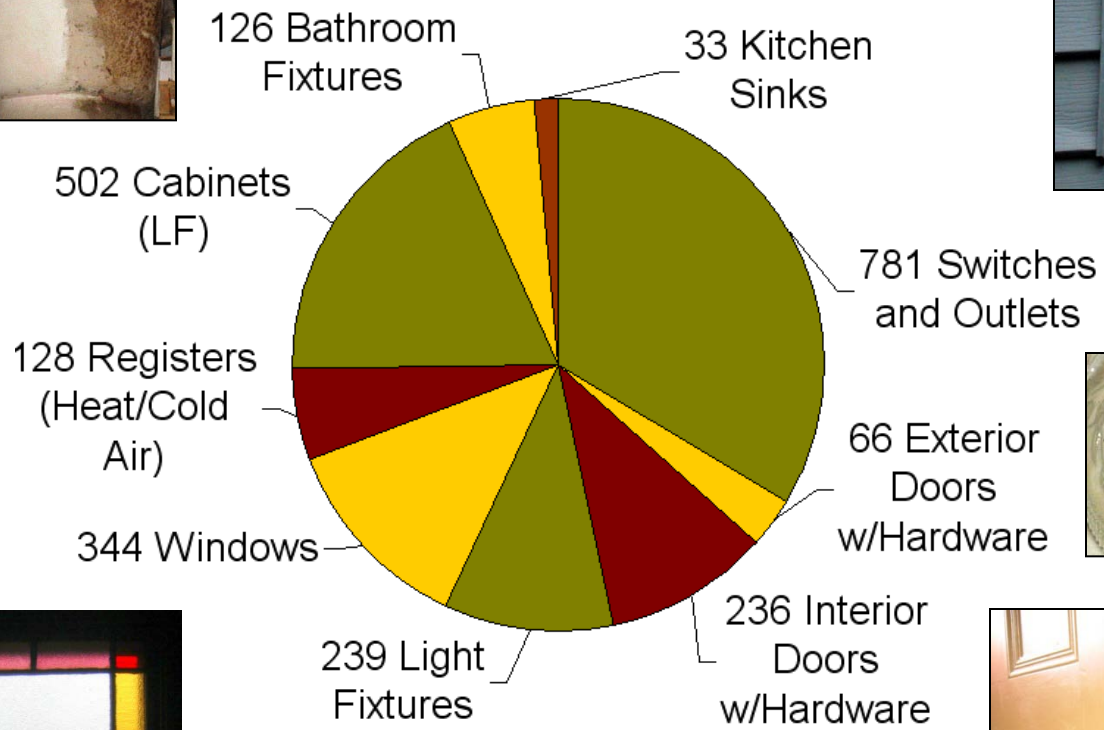
Resale or Recycling Value

• Bricks 41,000+ @ $0.35 ea	$14,350
• Lumber 40,466 bf @ 0.25 ea	$10,116
• Hardwood Flooring 9,703 SF @ $1/SF	$ 9,703
TOTAL	**$34,169**





Architectural Components



Waste to Energy

- Onondaga County Resource Recovery
- Power 30,000 homes
- 357,775 tons non-recyclable waste 2010
- 50,455 tons C&D waste (14%) 2010
- HHV C&D = increased electricity