The Dollars and Sense of the Deconstruction and Reuse Industry: A Look Through Spartan Green Colored Glasses

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The Dollars of Deconstruction and Reuse

Demolition + Abatement
• $15.20/sf (Lansing 2016)
• $9.67/sf (Genesee County 2015)
• $8.15/sf (Massachusetts early 2000s)
  o $11.46 in 2018
• $5.26/sf (Florida 2000)
  o $7.61 in 2018

Deconstruction + Abatement
• $22.61/sf (Lansing 2016)
• $10.21/sf (Massachusetts early 2000s)
  o $14.35 in 2018
• $11.82/sf (Hamtramck, 2015)
• $4.83/sf (Florida 2000)
  o $6.98 in 2018
• $1.02/sf (SF Bay Area 1996)
  o $1.62 in 2018

Sources: CalRecycle n.d.; NAHB Research Center n.d.; Guy and McLendon 2000; Dantata et al. 2005; Byers 2006; Genesee County Land Bank 2015; Tatiya et al. 2017; Anuranjita et al. 2018
Relative Demolition and Deconstruction Costs 1996-2016

Sources: CalRecycle n.d.; NAHB Research Center n.d.; Guy and McLendon 2000; Dantata et al. 2005; Byers 2006; Genesee County Land Bank 2015; Tatiya et al. 2017; Anuranjita et al. 2018

5/7/2018 Re-Imagining the Built Environment
The Dollars of Deconstruction and Reuse

Key lessons learned:

1. Experience counts!
2. Concentration/repetition helps
3. Skilled/trained workforce matters
4. Cost control and efficiencies change the outcome
5. Tipping fees can (dis)incentivize deconstruction
6. Markets drive success
The Sense of Deconstruction and Reuse
The Sense: Jobs

10,000 tons of waste
The Sense: Jobs

• Need to look beyond just the end-of-life disposal jobs

• Deconstruction process creates jobs at a rate of 6:1 compared to demolition

• California projections for lumber recycling – creation of 62.5 jobs per 10,000 tons
  • Currently ~100 jobs/10,000 tons
  • Includes collection, processing, manufacture, and recycle/re-manufacture – excludes deconstruction

Sources: NRDC (2014). From Waste to Jobs: What Achieving 75 Percent Recycling Means for California; ReBuilding Center, 2018
524 Baker St., Lansing - Demolition

<table>
<thead>
<tr>
<th>Floor Area:</th>
<th>1,100 SF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor:</td>
<td>4 workers (1 excavator operator, 1 ground person, 2 truck drivers)</td>
</tr>
<tr>
<td>Time:</td>
<td>40 worker hours</td>
</tr>
<tr>
<td></td>
<td>- 4 ppl x 8 hours demolition: 32 hrs</td>
</tr>
<tr>
<td></td>
<td>- 2 ppl x 4 hours restoration: 8 hrs</td>
</tr>
<tr>
<td>Unit Time:</td>
<td>0.036 worker hours/SF</td>
</tr>
<tr>
<td>Job Potential:</td>
<td>100 1,200 SF homes = 2.08 FT jobs</td>
</tr>
</tbody>
</table>

1214 Massachusetts Ave., Lansing - Deconstruction

<table>
<thead>
<tr>
<th>Floor Area:</th>
<th>1,232 SF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor:</td>
<td>6 workers (5 workers, 1 de-nailer)</td>
</tr>
<tr>
<td>Time:</td>
<td>260 worker hours</td>
</tr>
<tr>
<td></td>
<td>- 5 ppl x 3-4 days demolition: 134 hrs</td>
</tr>
<tr>
<td></td>
<td>- 1 ppl x 126 hours de-nailing</td>
</tr>
<tr>
<td>Unit Time:</td>
<td>0.211 worker hours/SF</td>
</tr>
<tr>
<td>Job Potential:</td>
<td>100 1,200 SF homes = 12.17 FT jobs</td>
</tr>
</tbody>
</table>
Direct deconstruction activity alone in a moderate-size market can sustain 12 FTE jobs/100 homes
The Sense: Jobs

Domicology: Deconstruction Management and Materials Management Pathway

Materials Management Cluster
- Deconstruction Depot Representative
- Deconstruction Depot Sales Supervisor
- Deconstruction Depot Manager
- Deconstruction Materials Buyer/Logistician
- Deconstruction Production Manager

Deconstruction Operations and Management Cluster
- Deconstruction Laborer
- General Laborer
- Deconstruction Team Lead
- Deconstruction Superintendent
- General Superintendent
- Deconstruction Estimator
- Project Manager
- Department Head
- Project Executive

Primary Focus of Project Pathways Research
- HS/OJT Transition Certificate/OJT Associate’s Degree Bachelor’s Degree Post-Grad

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The Sense: Jobs

• Efficiency, modernization, and automation are needed
  • Change deconstruction perception
  • Reduce deconstruction costs, increase deconstruction markets
  • Create high-skill, high-wage workforce

• California example – fewer workers per 10,000 tons in 2020 compared to 2014
The Sense: Automation + Jobs

Ph. 1: Assessment
- BIM
- Predictive Models

Ph. 2: Deconstruction
- Hydraulic Equipment
- Robotic Equipment

Ph. 3: Scan/Sort
- Contaminants
- Visual Quality/Grade
- Dimensions

Ph. 4: Pre-Process/Ship
- Physical Alteration
- Optimized Transportation

End-Use Algorithm
The Sense: Innovative Materials Re-Use

- MSU’s work focuses on increasing the yield of high-volume, low-value materials

<table>
<thead>
<tr>
<th>Location</th>
<th>Number of Abandoned Homes</th>
<th>Approximate Volume of Salvageable Lumber</th>
<th>Equivalent # of Trees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michigan</td>
<td>225,946</td>
<td>903,784,000 BF</td>
<td>1,246,598</td>
</tr>
<tr>
<td>Midwestern US</td>
<td>1,379,720</td>
<td>5,518,880,000 BF</td>
<td>7,612,248</td>
</tr>
<tr>
<td>United States</td>
<td>5,813,286</td>
<td>23,253,144,000 BF</td>
<td>32,073,302</td>
</tr>
</tbody>
</table>

- Data Sources and Notes:
  - BF=board foot = a piece of lumber 12”x12”x1”
  - Tree equivalent is a tree of 24” diameter producing 4 16’ logs
The Sense: Innovative Materials Re-Use

Key Question: Do the mechanical properties of salvaged lumber meet existing U.S. standards for inclusion in the manufacturing of cross laminated timber panels?
A structural panel consisting of three, five, or seven layers of dimensional lumber that are able to bear loads in and out of plane, which can be used as floor or wall system.
The Sense: Innovative Materials Re-Use

**MOE (KGF/CM²)**

- **SAMPLE #**
  - Pine
  - Larch
  - Reference Standard

**MOR (PSI)**

- **Larch Sample #**

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The Sense: Innovative Materials Re-Use

Short Term Work
- Increase the sample size and test other salvaged lumber species/times under load for bending and rupture properties
- Conduct a statistical analysis to determine what percentage of salvaged lumber may be used in the manufacturing of CLT panels

Long Term Work
- Manufacture a complete 3, 5, or 7 layer panel assembly with an applied resin for bonding between each layer
- Test bonding line of the applied resin
- Test physical and mechanical properties of the complete CLT panel assembly
Thank You!

Questions?

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