

Domicology: Closing the Loop on Salvaged Lumber – a Logistics Perspective

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Or...

I've Got 99 Problems, and Too Much Salvaged Wood Reuse Ain't One



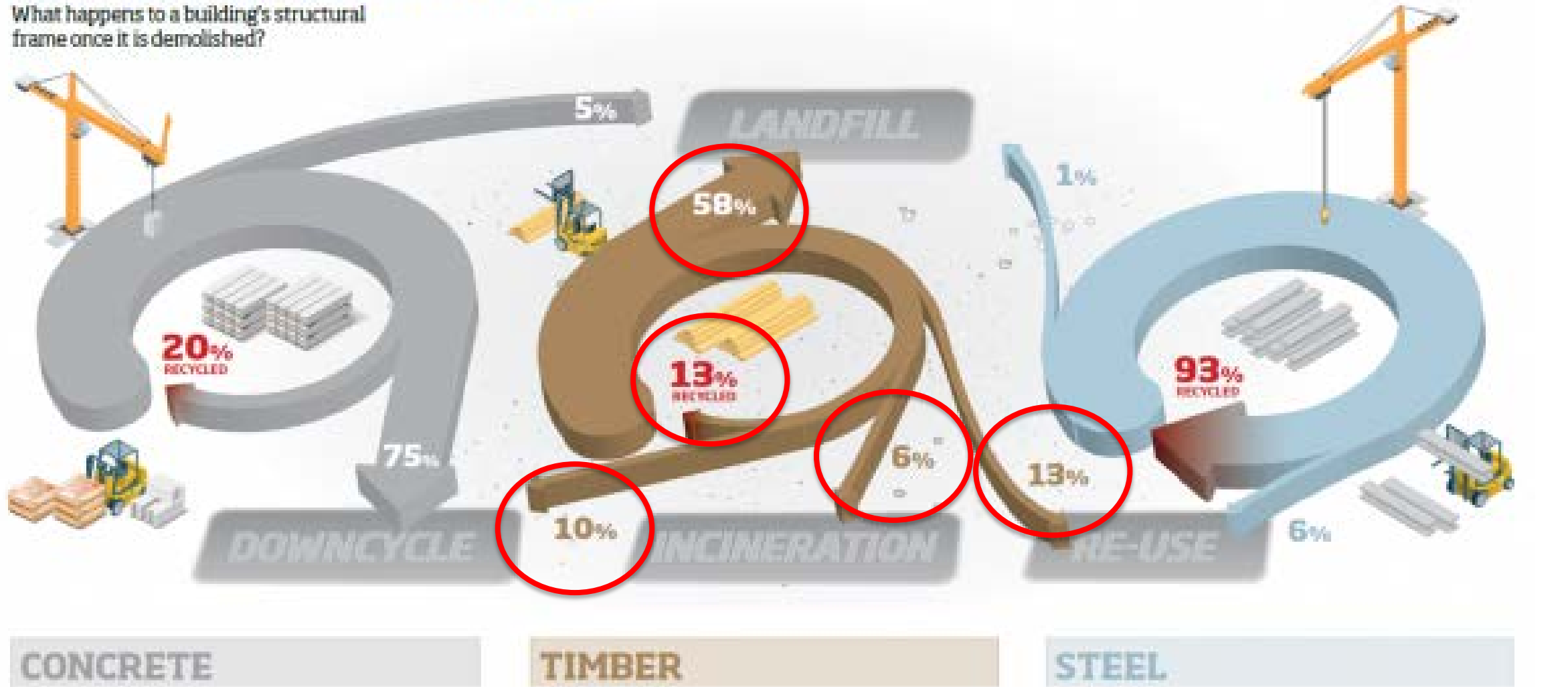
Welcome to the world of

Domicology

The study of the economic, social, and environmental characteristics relating to the life cycle of the built environment.

END-OF-LIFE SCENARIOS

What happens to a building's structural frame once it is demolished?



11.5+ million tons of wood in landfills annually - more than the amount of timber harvested from national forests each year



Source: <http://thegreenproject.org/our-story/landfill/>

The Structural Lumber Reuse Imperative

Focus on high-volume, low-value materials

That's about:

- 219 million end tables
- 11 million dining tables
- 5.4 million picnic tables
- 644 Brock Commons projects!

Location	Number of Abandoned Homes	Approximate Volume of Salvageable Lumber	Equivalent # of Trees
Michigan	225,946	1,096,552,000 BF	1,624,521
Midwestern US	1,379,720	6,694,401,000 BF	9,917,632
United States	5,813,286	28,205,676,000 BF	41,786,186

Data Sources and Notes:

- MSU Center for Community and Economic Development (2016). Muskegon, Michigan Deconstruction Economic Cluster Feasibility Study.
- US Census Bureau (2016). American Community Survey, Vacant Housing Units.
- BF=board foot = a piece of lumber 12"x12"x1"
- Tree equivalent is a tree of 24" diameter producing 4 16' logs (Scribner)

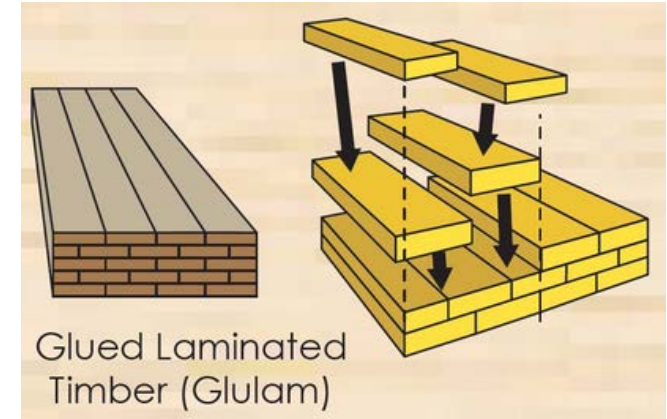
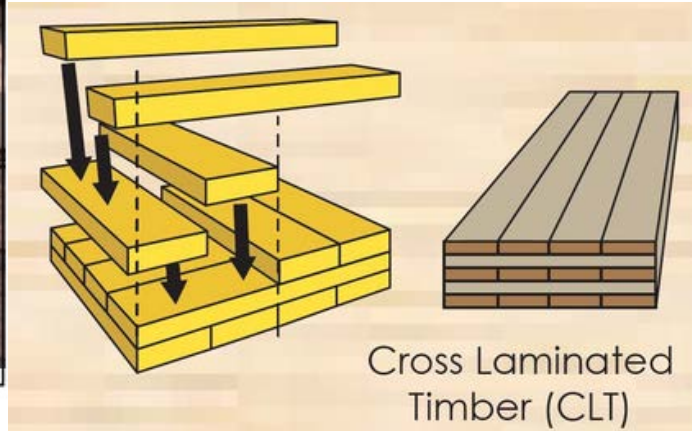


Images source:

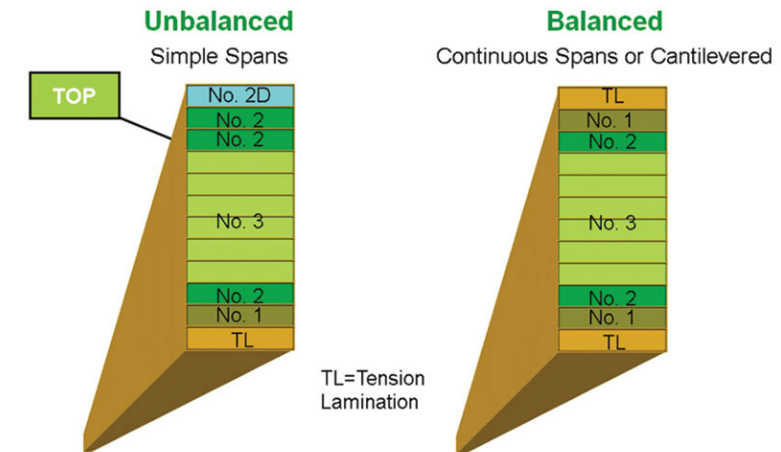
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Cross-laminated Timber (CLT)



Engineered Layups



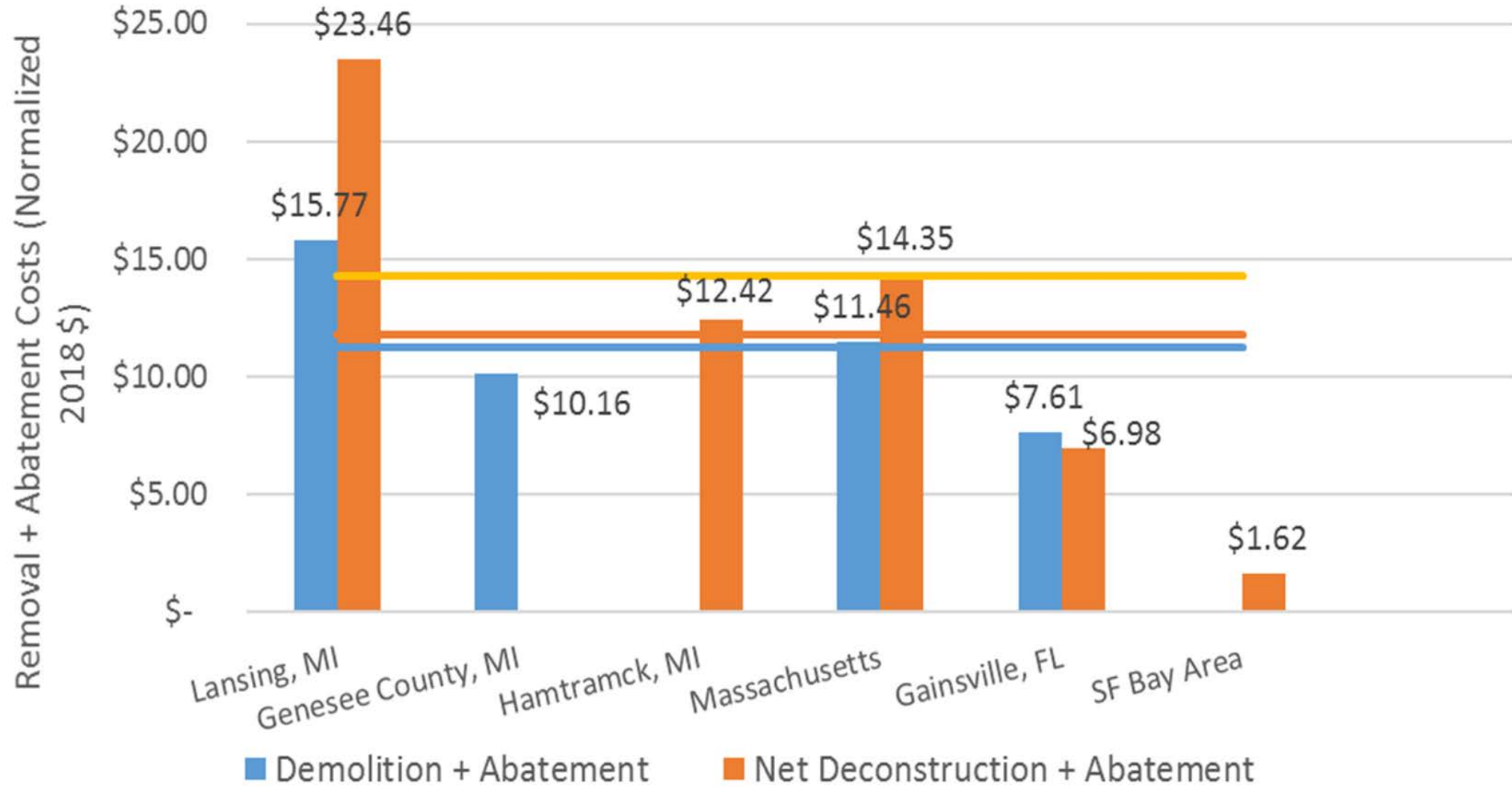
The \$64,000 (or more) question:

“This is cool, but how do you get to the material in a cost effective and efficient way?”

Challenge #1: Deconstruction (and Salvaged Wood) are Costly

- ~\$25,260 to deconstruct 1,250sf home - 16% lumber by weight
 - Total: \$4,041 for ~4,850 mbf structurally usable lumber
- **~\$833/mbf harvesting and transport cost**
- Current virgin material pricing
 - Stumpage - ~\$161/mbf
 - **Random length lumber futures at \$457/mbf in the Great Lakes states**
- What about salvage value of other materials? Economies of scale? Carbon markets and valuation?

Relative Demolition and Deconstruction Costs - 1996-2016

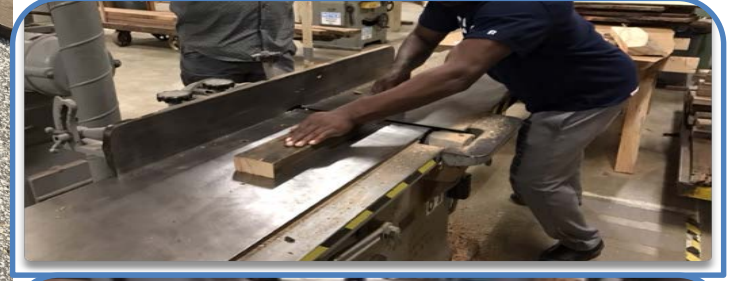




524 Baker St., Lansing - Demolition	
Floor Area:	1,100 SF
Labor:	4 workers (1 excavator operator, 1 ground person, 2 truck drivers)
Time:	40 worker hours - 4 ppl x 8 hours demolition: 32 hrs - 2 ppl x 4 hours restoration: 8 hrs
Unit Time:	0.036 worker hours/SF
Job Potential:	100 1,200 SF homes = 2.08 FT jobs

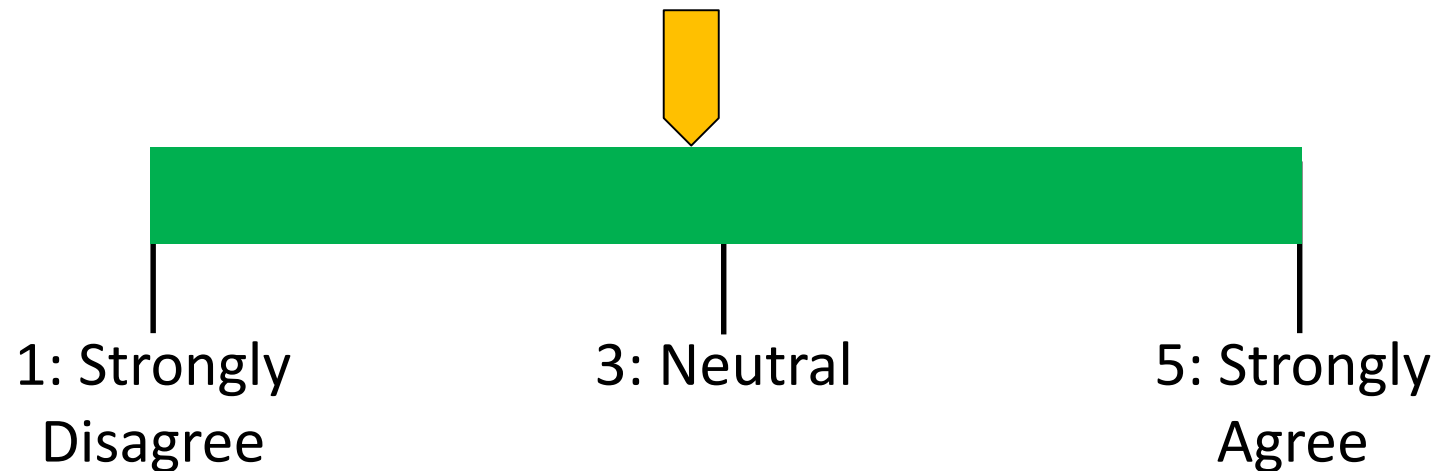
1214 Massachusetts Ave., Lansing - Deconstruction	
Floor Area:	1,232 SF
Labor:	6 workers (5 workers, 1 de-nailer)
Time:	260 worker hours - 5 ppl x 3-4 days deconstruction: 134 hrs - 1 ppl x 126 hours de-nailing
Unit Time:	0.211 worker hours/SF
Job Potential:	100 1,200 SF homes = 12.17 FT jobs

Source: Anuranjita, A. (2017). Life Cycle Assessment Framework for Demolition and Deconstruction of Buildings. MS Report, Michigan State University.

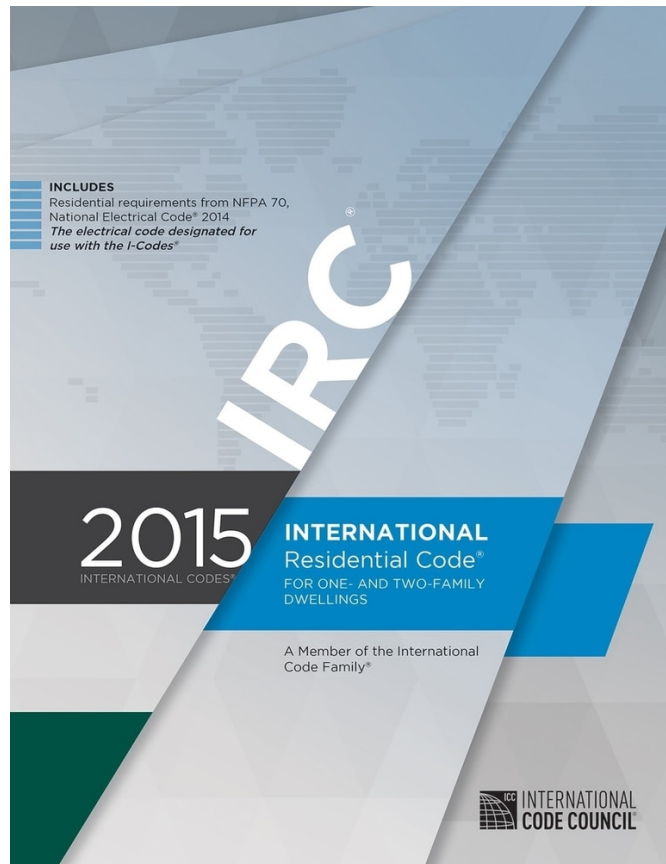


“The currently available tools for removing fasteners from lumber are adequate to perform this task safely, cost effectively, and efficiently.”

Average = 2.9



Challenge #2: Regulatory Barriers



Source:
<https://woodmizer.com/us/Portals/0/EasyDNNNews/thumbs/125/515LumberGradingH.jpg>

Challenge #3: Lack of Consistent Markets

Authentic American Barn Wood Planks - 10 sq.

Model Number: 438800 | [REDACTED]



EVERYDAY LOW PRICE Online Price **\$74.98**

SALE PRICE **\$69⁸⁹** each

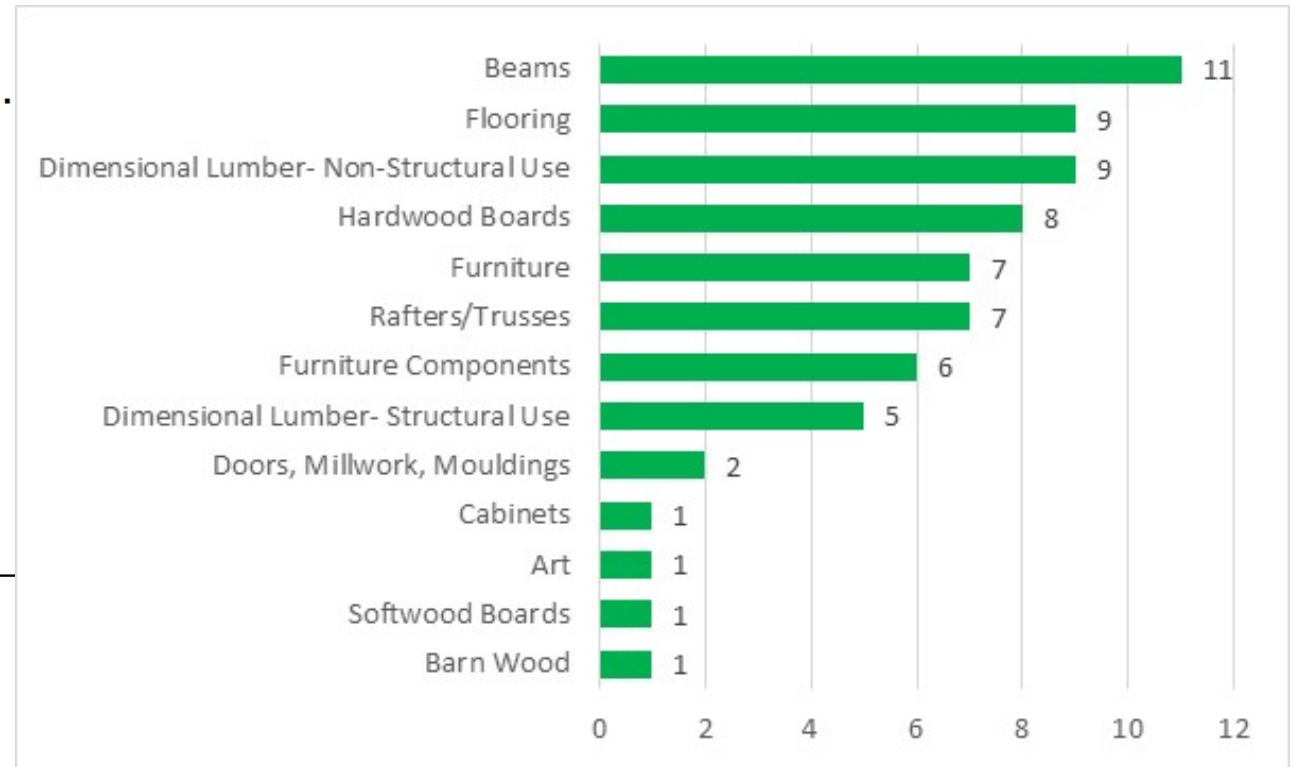
Valid Until 10/13/18

You Save: \$5.09 After Sale Price

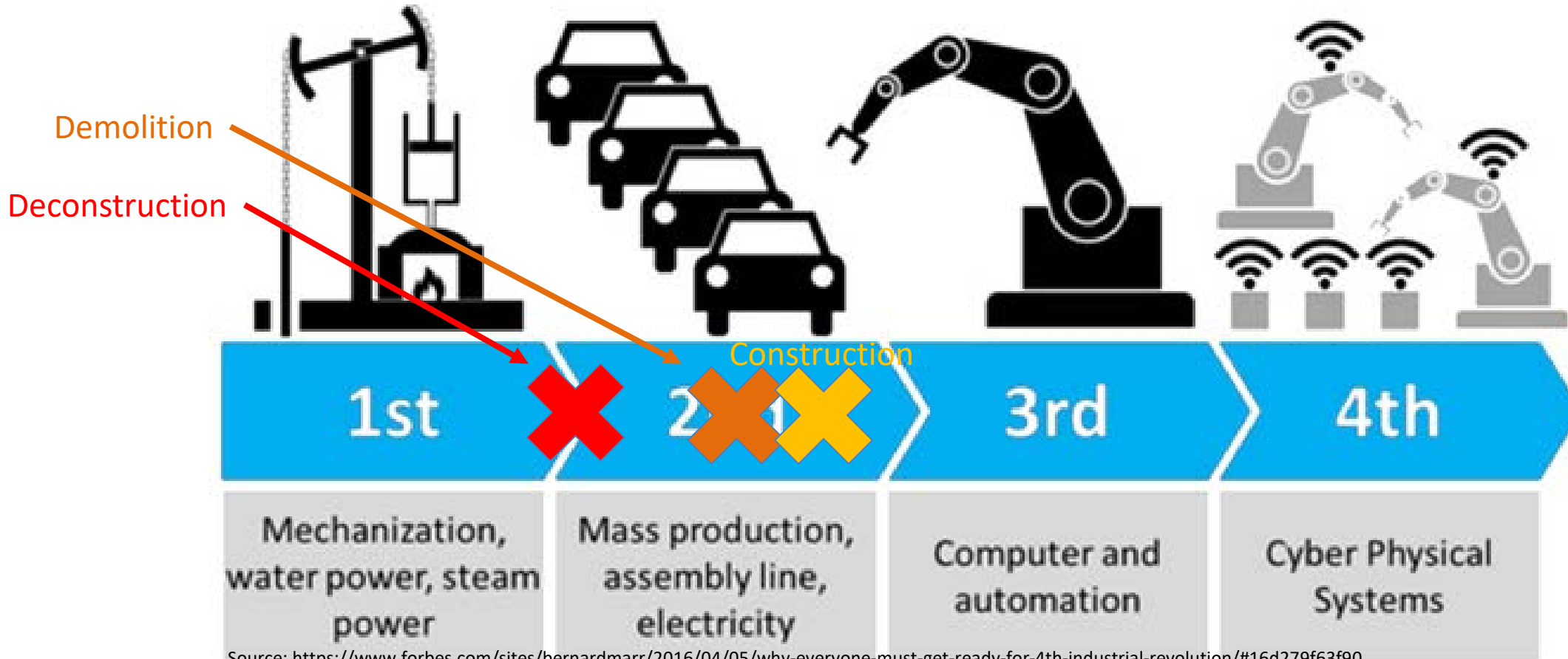
Description | Specifications

Add to Compare

\$18.67/bf!!!!!!



Is Construction in the 4th Industrial Revolution Yet?



The first last mile

Ph. 1: Assessment



BIM

Machine Learning/
Prediction

The new first mile

Ph. 2: Deconstruction



Hydraulic
Equipment

Robotic
Equipment

Ph. 3: Scan/Sort



Dimensions

Contaminants

Visual
Quality/
Grade

Denail/
Surface Prep

End-Use Algorithm

Ph. 4: Pre-Process/Ship



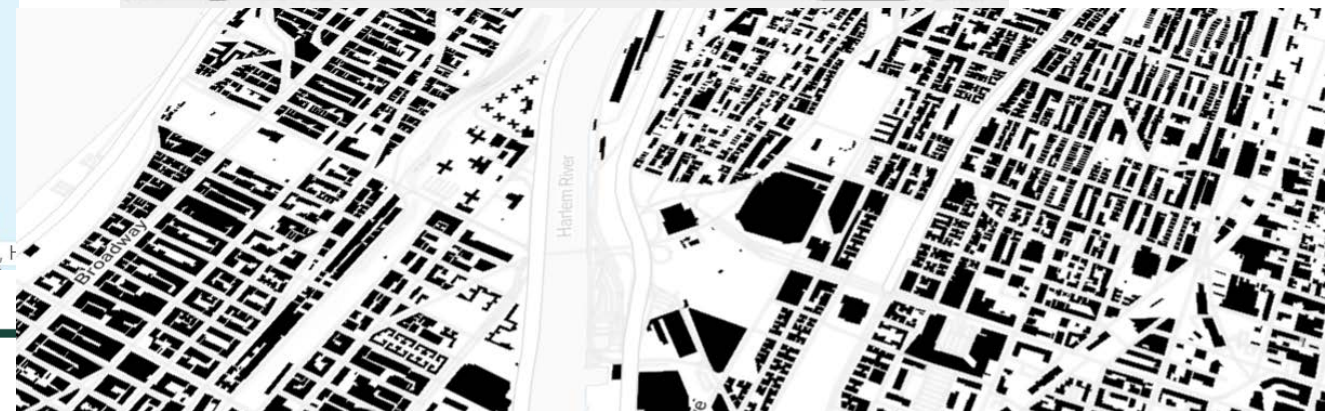
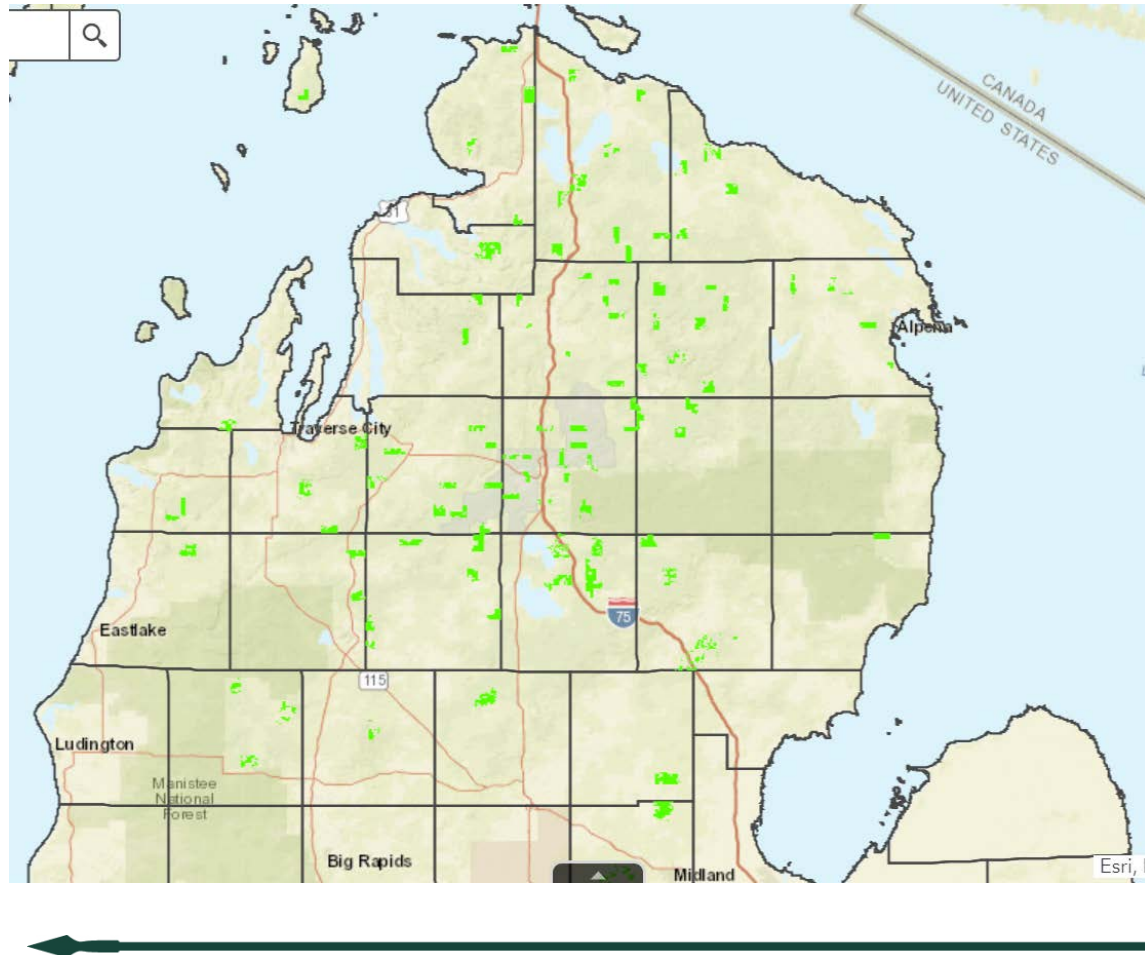
The new last mile

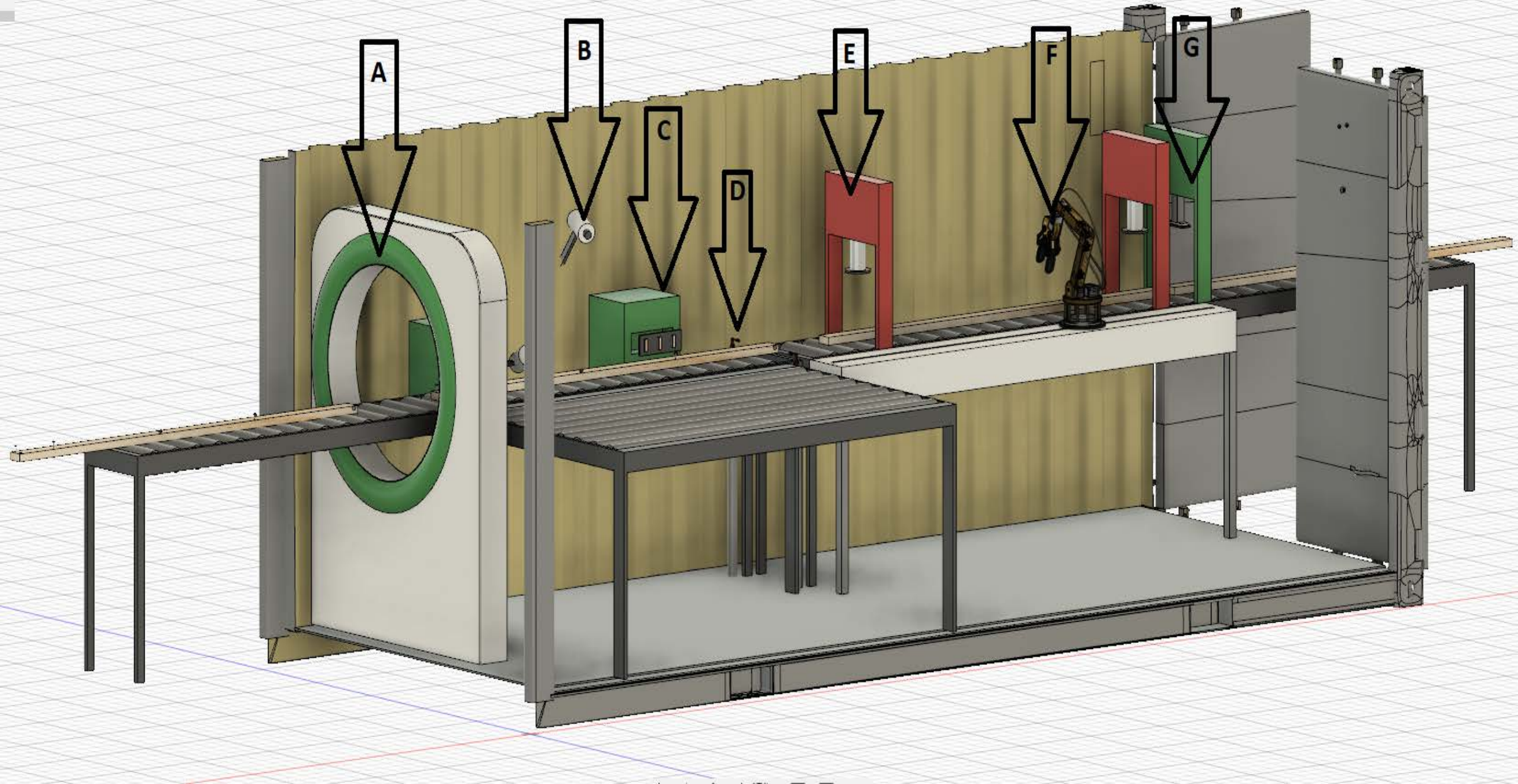
Physical Alteration

Optimized
Transportation

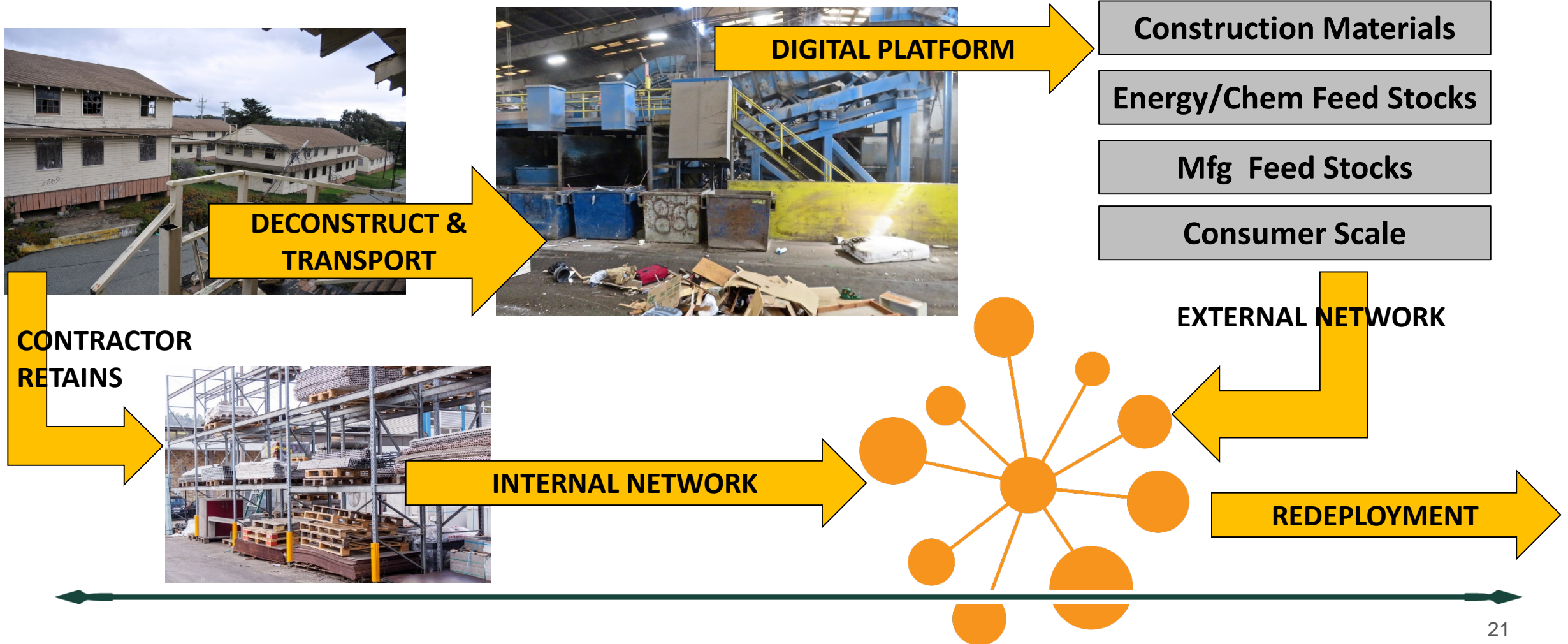
The Way Ahead: Assessment Automation

Where is it?
How much is there?
When can it be revisited?





The Way Ahead: Scan and Sort/Process & Ship



Thank You!

Questions?

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