Innovation in Reuse and Recycling

May 4, 2016

Michigan Recycling Coalition Annual Conference

CCED’s Mission:

To advance MSU’s land-grant mission by creating, applying, and disseminating valued knowledge through responsive engagement, strategic partnerships, and collaborative learning.

WMSRDC’s Mission:

To promote and foster regional development in West Michigan through cooperation amongst local governments and other regional partners.

Structural Abandonment in the United States

Residential Properties Vacancy

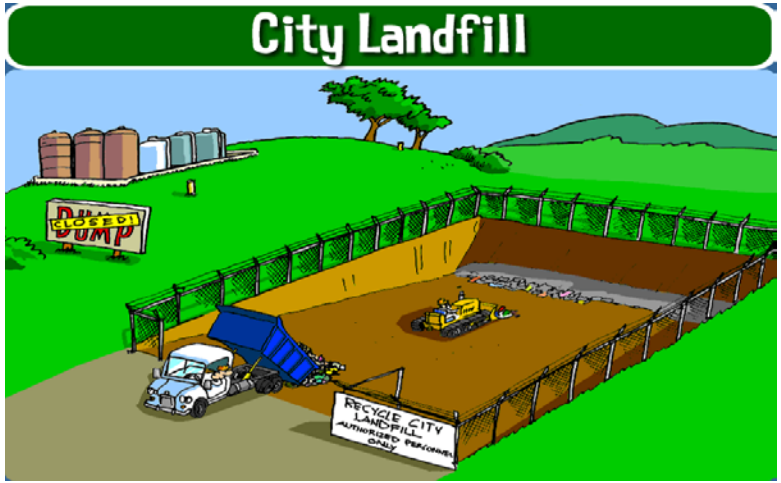
In 2012, there were 7.4 million vacant houses that were not being marketed for sale or rent (*the Joint Center for Housing Studies of Harvard University*).

Nearly 40 percent of the nation's vacant homes are located in just 10 percent of all census tracts (Duke 2012).

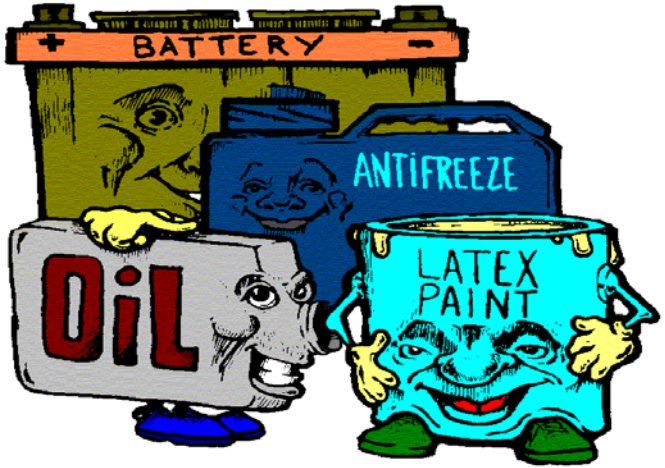
Source: http://articles.chicagotribune.com/2013-07-24/news/sns-rt-us-usa-detroit-blight-20130724_1_blight-removal-blight-problem-urban-blight

Environmental Impact of Blight

The US Environmental Protection Agency estimates that 136 million tons of construction and demolition waste are generated each year. This volume of waste constitutes approximately ¼ of all landfill waste.



Hazardous materials increase the potential for public health concerns and substantially increase the public costs of demolition and clean up.



Policy Issues

- Homes are designed and built for demolition, not for deconstruction.
- Private property owners can abandon their homes with few consequences.
- Unlike cellular towers or wind turbines, there are no performance bonds required by local governments for residential structures.
- Tipping fees in Michigan. As of 2014, the average tipping fee in Michigan was only $46.82 per ton of trash, with some areas in Michigan as low as $25.*(Source: Clean Energy Projects, Inc.)*

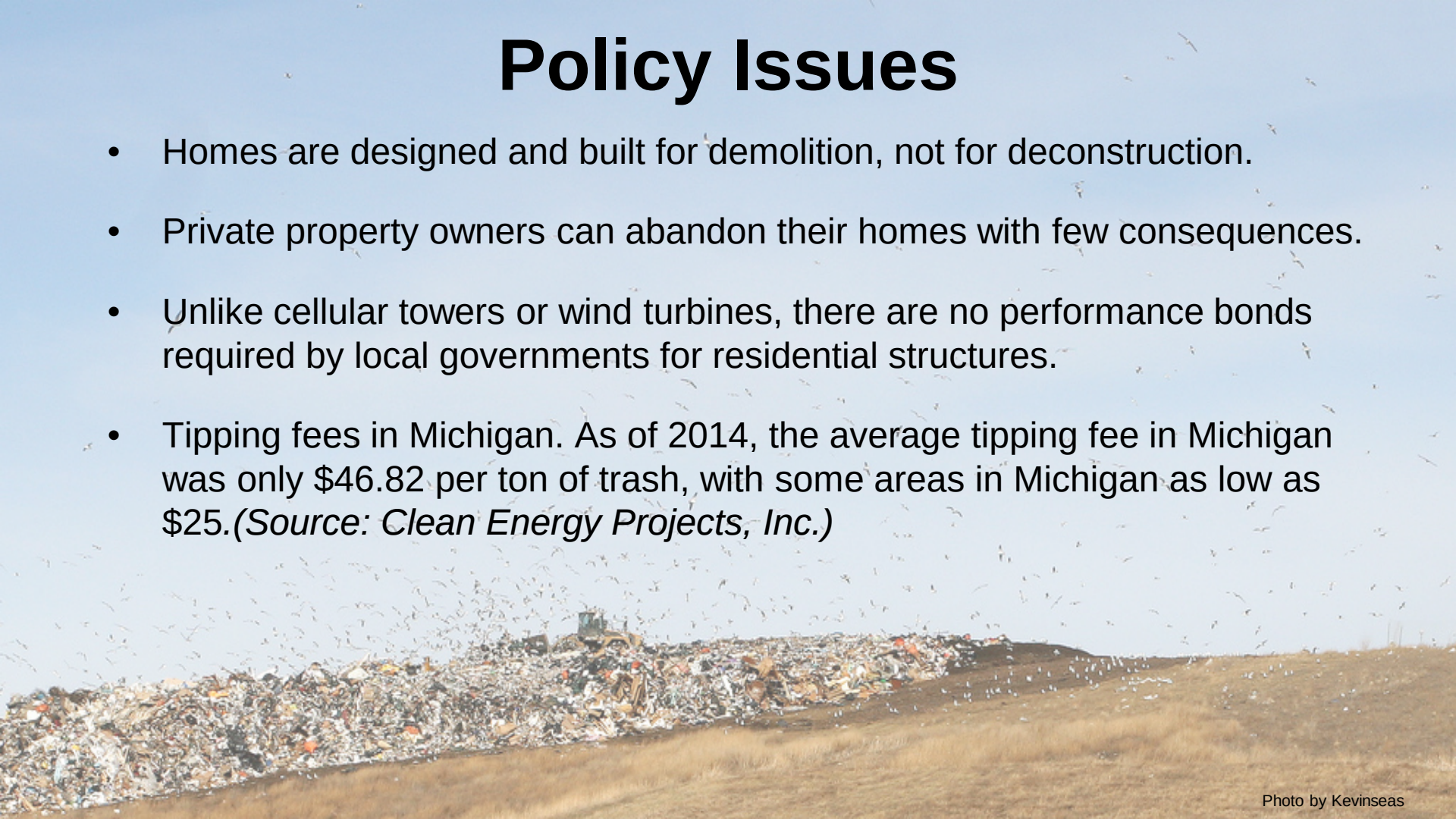


Photo by Kevinseas

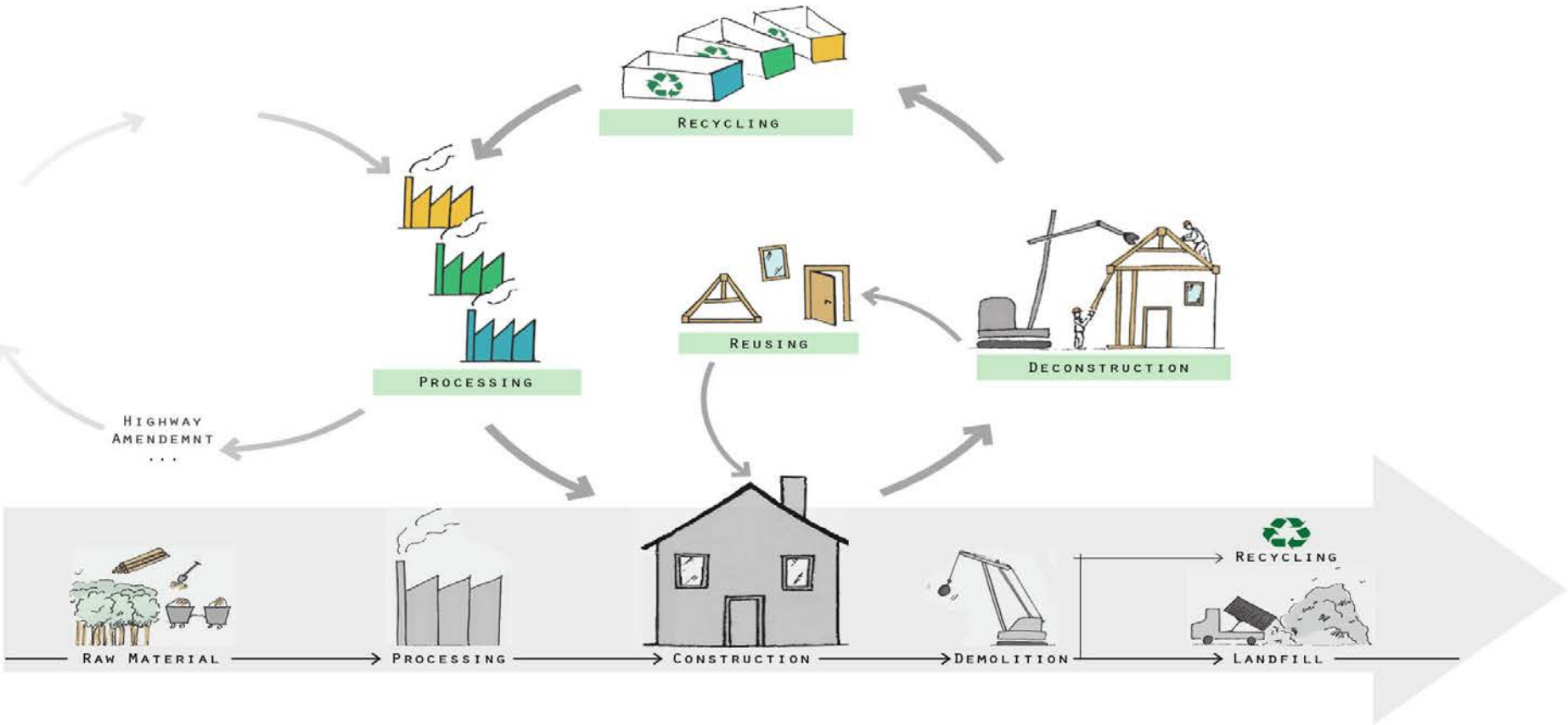
Tipping Fees and C+D Recycling Policy

- Policy changes: Can we increase tipping fees to de-incentivize the dumping of C+D debris? If the average 1,500 sq. ft. home produces 3-4 tons of waste, this is only $141-$188 in tipping fees per home. Maine has highest average tipping fees at ~$91 per ton.

- Policy changes: Can local Michigan governments implement C+D recycling ordinances?

Community	Required C+D Debris Recycled
Madison, WI	70% (>$20,000)
Chicago, IL	50% (of recyclable material)
Austin, TX	50% (>5,000 sq. ft.)
Malibu, CA	50% (all new, demo if >500 sq. ft.)

MATERIALS RECYCLING PROCESS



Port of Muskegon Deconstruction Feasibility Study Purpose/Objective:

- Assess the feasibility of **collecting** debris from abandoned residential structures in the Great Lakes region, and **repurposing/recycling** them in Muskegon into new marketable products, via **the Port of Muskegon.**

Geographic Span of Study

The following port cities could play a role in the creation of a deconstruction sector:

- Muskegon, MI
- Bay City, MI
- Buffalo, NY
- Chicago, IL
- Cleveland, OH
- Detroit, MI
- Erie, PA
- Gary/Portage, IN
- Milwaukee, WI
- Toledo, OH
- EUROPE????

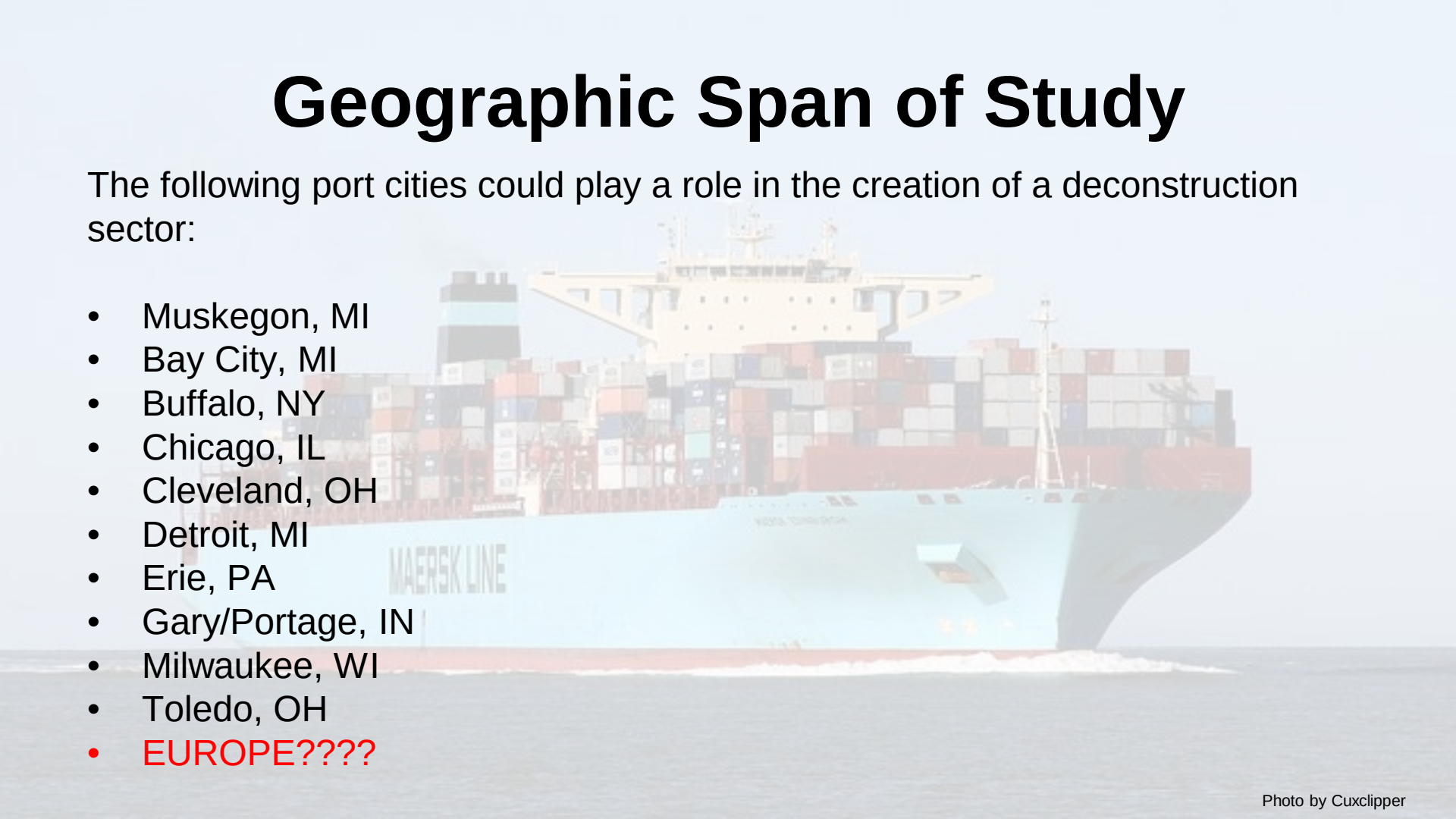


Photo by Cuxclipper

3rd Skim Extraction Process

- 3 Skim Paradigm
- 1st skim: copper wire
- 2nd skim: architectural features (doors, molding, mantles, fixtures, etc.)
- 3rd skim: flooring, dimensional lumber, shingles, glass, gypsum, bricks

Gross deconstruction costs are higher than demolition costs, but the net cost of deconstruction with salvage is lower than demolition using retail salvage values or wholesale prices for the salvaged material. (Zahir, 2015)

Photo by regan76

3rd Skim Material List

Materials available after 3 skims:

Dimensional Lumber
Plywood
Bricks/Masonry clay
Blocks
Concrete
Drywall
Asphalt Shingles
Wood Sheathing
Structural Steel
Wood Flooring
Barn Wood Siding
Wood Panels
Foundation Stones

*Items in red can be reused or repurposed

FINDINGS

POTENTIAL VOLUME OF SALVAGEABLE LUMBER

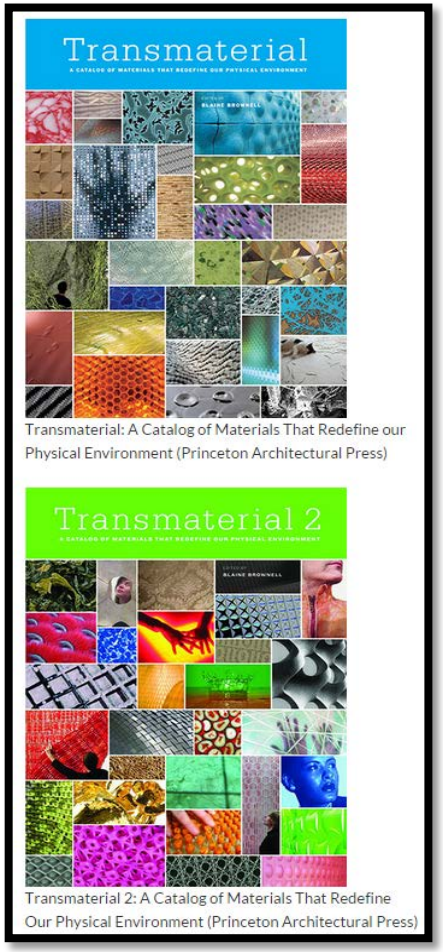
- NO. of 'other vacant' houses (assuming abandoned) = 264,660
- Volume of lumber potentially available in the preliminary catchment area
  = 264,660 * 6000 BF (avg. volume of lumber per house)
  = approx. **1.5 billion BF**
- Estimated value of salvageable lumber
  = 1.5 billion BF * $2.30 (avg. cost per BF of lumber)
  = **$3.45 billion**

SOURCES:
Literature Reviews, Industry Information; Google Images

Repurposing of Salvaged Materials

- Recycled Insulating Concrete Forms
- Biomorphically Derived Chair (Wood)
- Pre-assembled, Moveable, Full-height Partitions (Wood)
- Fused Stone and Glass Composite
- Vessels made from Repurposed Metal
- Panels Crafted from OSB
- Bio-based Structural Insulated Panel
- Set of Legs to make an Instant Table Tops
- Glass-Stone Tiles and Slabs

(Material ideas sourced from the Transmaterial catalogs)



Repurposing of Salvaged Materials

Other uses:

❑**WOOD:**
Formwork boards, Wooden ties
Furniture, architectural and landscaping features
Fuel for energy generation (linoleum and wood)
Framing

❑**ASPHALT SHINGLES**:
Paving for roads
Tiling for unfinished attic, garden path and winter walkway aide
Household items such as doormat, sink liner, weed stopper

❑**CONCRETE**:
Gravel for construction
Base material for roadways
Revetments, Drainage in terraced gardens

Repurposing of Salvaged Materials

Other uses:

❑**BRICKS AND BLOCKS:**
Aggregate or sub base fill for roadways
Landscaping, pavers
New construction

❑**DRYWALL:**
Soil amendment, water treatment
Grease absorbent for industrial use
Cement production (drywall gypsum)

❑**STONE:**
Paving, cladding and masonry work
Gabion retaining walls

Design for Deconstruction

- **Materials:** Avoid composites, and use as few materials as possible.
- **Assemblies:** Avoid adhesives and sealants, and use bolts, screws and mechanical connections. Use fewer components but increase their size.
- **Building Systems:** Separate/disentangle building systems and utilities such as HVAC, plumbing, electricity, et cetera from each other and interior walls.
- **Building Information:** Document building systems and details with drawings and photos and maintain document record throughout building's life cycle.

Partial Project Case Study

- Detroit Future City and Reclaim Detroit ran a pilot project in the autumn of 2013 to partially deconstruct 10 homes with varying degrees of deferred maintenance, and fire and water damage.
- Different time trials were used for each home to determine which deconstruction time period yielded the maximum value of materials relative to labor.
- Shorter time trials (1-3 days) yielded optimal results at scale compared to longer time trials (up to 7 days).
- Flooring and bricks were most in-demand materials.
- Salvaged lathe produced almost no net value.
- Over-scheduling of work crews is recommended.
- Crews preferred larger, fancier homes. There was resistance to deconstructing average homes, although they had the highest yields relative to hours of work.
- Abatement testing was done in advance.

Domicology Website

- Went live on Tuesday, April 5, 2016

- More content as project progresses

http://domicology.msu.edu

What is Domicology?

In the United States 136 million tons of waste per year, or nearly 40% of all construction/demolition and municipal solid waste, is generated by building related construction, demolition, and renovation projects. Harvard's Joint Center for Housing Studies reported that vacant homes that were not on the market for sale or rental, and could be classified as abandoned, reached a record high in 2012 at 7.4 million. Both studies point to the growing issue of property and structural abandonment for both commercial and residential parcels. With these growing abandonment issues come the issue of government intervention on abandoned properties, the funding of such operations, and then the high quantity waste stream generated from demolition. READ MORE

Presentations:

VIDEO

Rex LaMore: Advancing the Science of Domicology

AUDIO

How to Fight Blight

POWERPOINT

Policies to Eliminate Private Property Abandonment in the United States

Research

- Planning Policies and Regulations That Can Reduce the Practice of Private Property Abandonment in the United States: The Case for Michigan
- Building Deconstruction Policy as a Method to Address the Private Property Abandonment in the United States
- Approaches and Associated Costs of Building Demolition and Deconstruction

JOIN US

An Interdisciplinary Faculty Research Presentation: Advancing the Science of Domicology

Friday, April 22, 2016 | 3:00 pm
Riverside Room, Kellogg Center
219 S. Harrison Rd., East Lansing, MI

SEE PROMOTIONAL FLYER

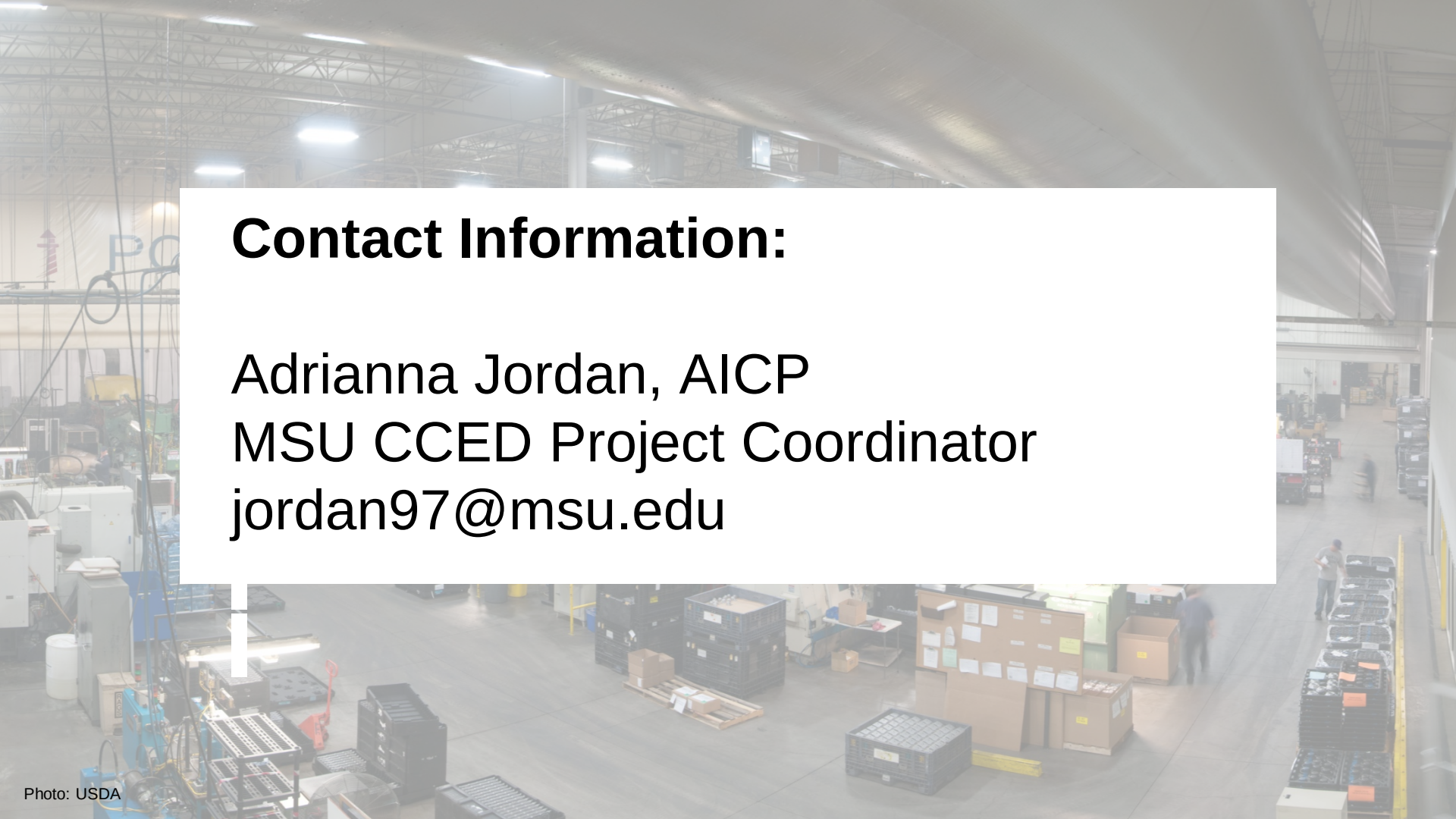


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Photo: USDA

THANK YOU!

Photo: Brandon Bartoszek