AIA Upjohn Research Initiative

Final Report from 2016 Grant Recipient

1. Project name: TrashWalls/ DWB (Drywall Waste Block)

2. Individual in charge of the project: Taiji Miyasaka

3. Date this form is completed: 5/31/2018

The premise of this research is to create a high performance building material from low value construction and demolition waste products.

In this research, we focused on developing a building block material made from a high percentage of gypsum wallboard/drywall waste. The blocks we have developed show superior results compared to conventional and traditional masonry materials, with ten times the r-value of concrete masonry units, compression strength that exceeded earth blocks and approaches CMUs, and significantly lighter weight.

We have had discussions with people from the construction industry, building block manufacturers, gypsum wallboard companies, and waste management professionals to understand how this product would be applied as a building material.

A 3'x3'x3' mock-up constructed with full scale blocks will be exhibited as a part of the upcoming exhibition, *Make/Do,* scheduled from July 14 until December 3, 2018 at the Washington State History Museum in Tacoma, WA.

DWB:

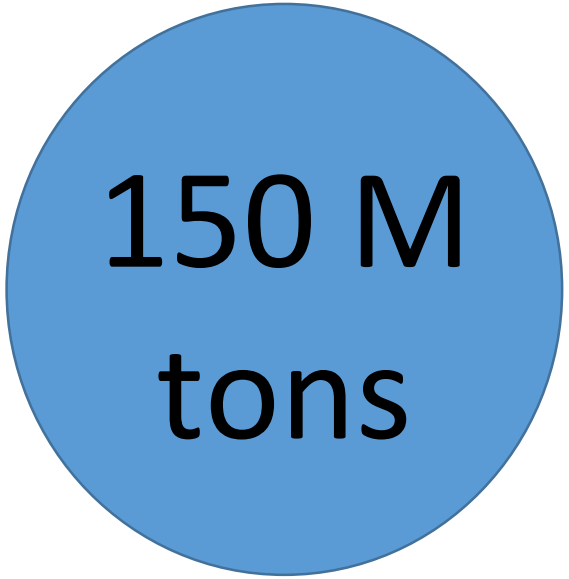
Drywall Waste Block

Turning low-value waste into a low-cost high performance building material

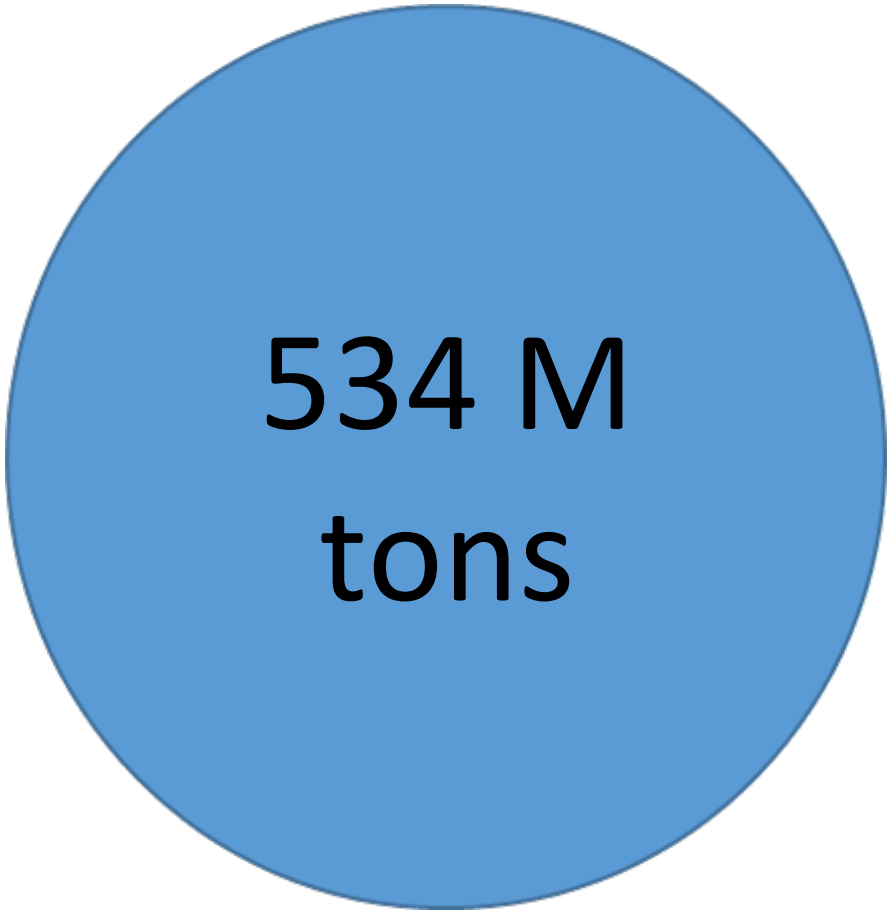
PROBLEM

Construction & Demolition Waste

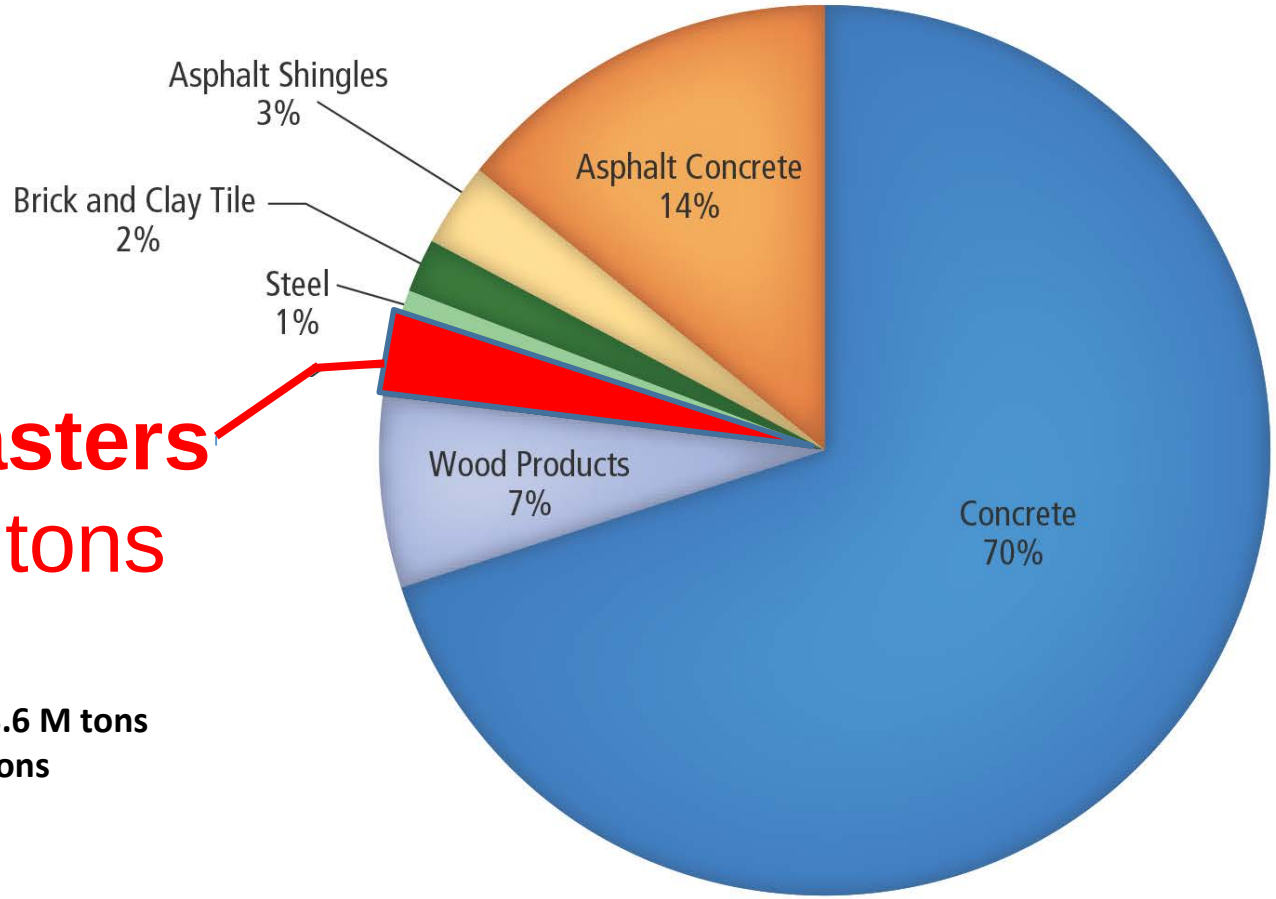
2003



2014



https://www.epa.gov/sites/production/files/2016-12/documents/construction_and_demolition_debris_generation_2014_11302016_508.pdf



Drywall and Plasters

3%=13.6 million tons

- Total C&D Drywall waste (2014): **13.6 M tons**
- Waste during construction: **3.3 M tons**
- Demolition Debris: **10.3 M tons**

https://www.epa.gov/sites/production/files/2016-11/documents/2014_smmfactsheet_508.pdf

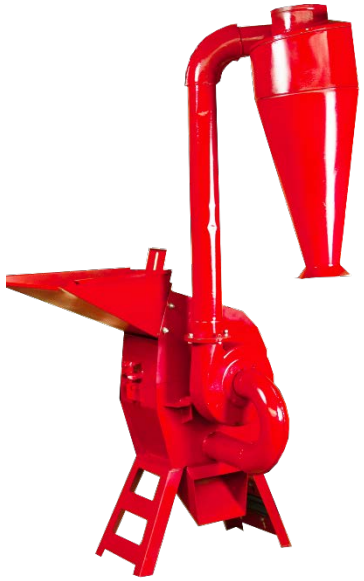
Landfilling drywall is banned in some states because of its possibility of producing hydrogen sulfide gas.

- US EPA

SOLUTION

COLLECT

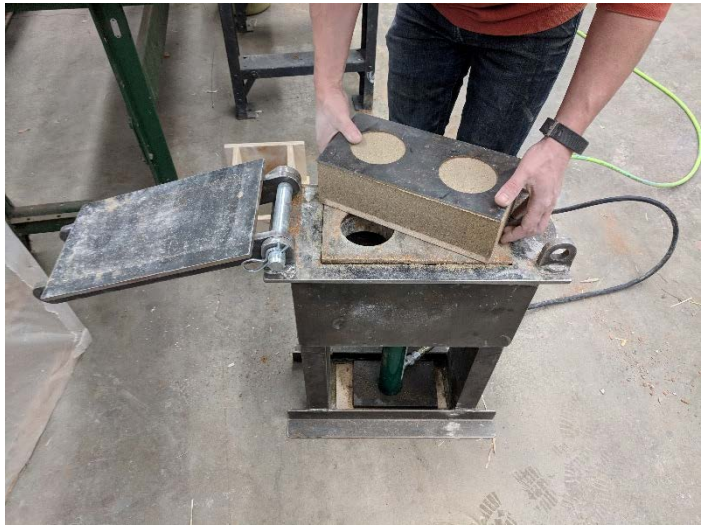
SHRED



MIX

PRESS

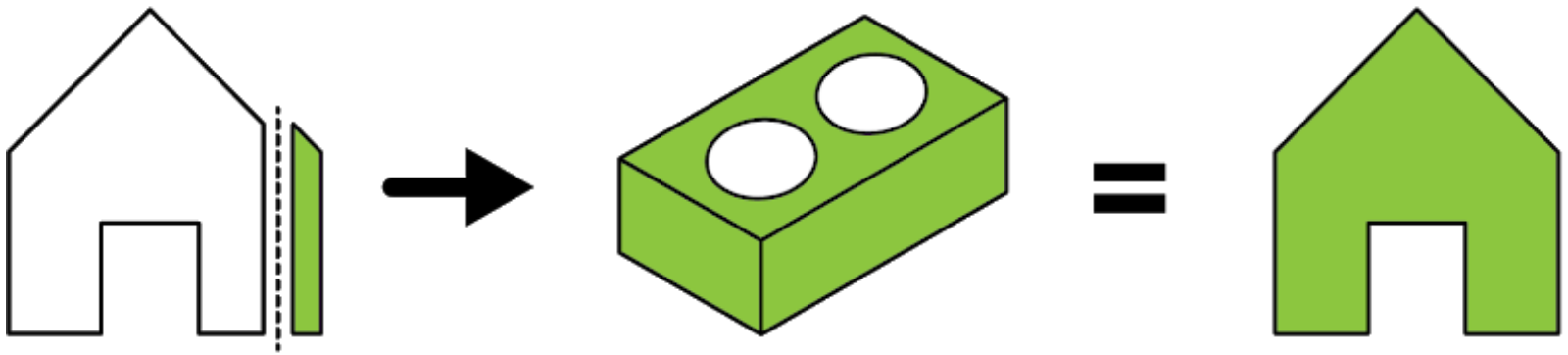
Pressing Process



10-12% waste from US construction

12” x 6” x 4” GWBs @ 8 lb./ each

Apx. 15,000 blocks/ 1500 SF living space



Apx. 3.3 million tons waste annually

Potential yield: 800 million blocks

50,000+ potential living spaces

https://www.epa.gov/sites/production/files/2016-11/documents/2014_smmfactsheet_508.pdf

VS

Compressed Earth Block

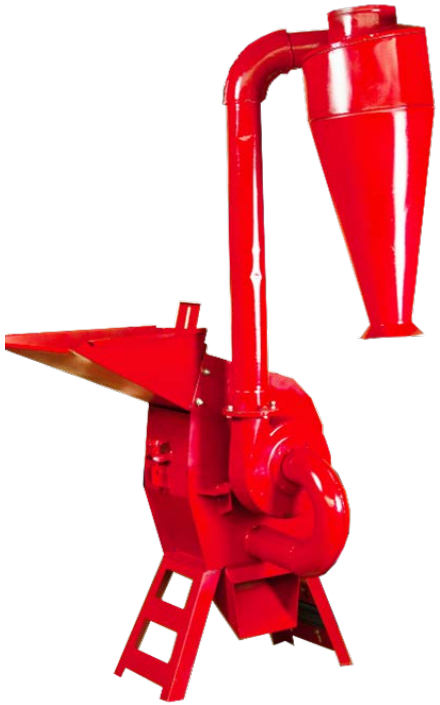
Concrete Masonry Unit

RePlast

Low carbon foot print
Load bearing walls
Energy efficient construction
High thermal insulation value

Off-the-shelf machines, various capacities and price-points:

Hammermills
Electric, Gas & Diesel



~$2000 - $8500+

Mixers
Pan & Ribbon types

~$1100 - $10,000+

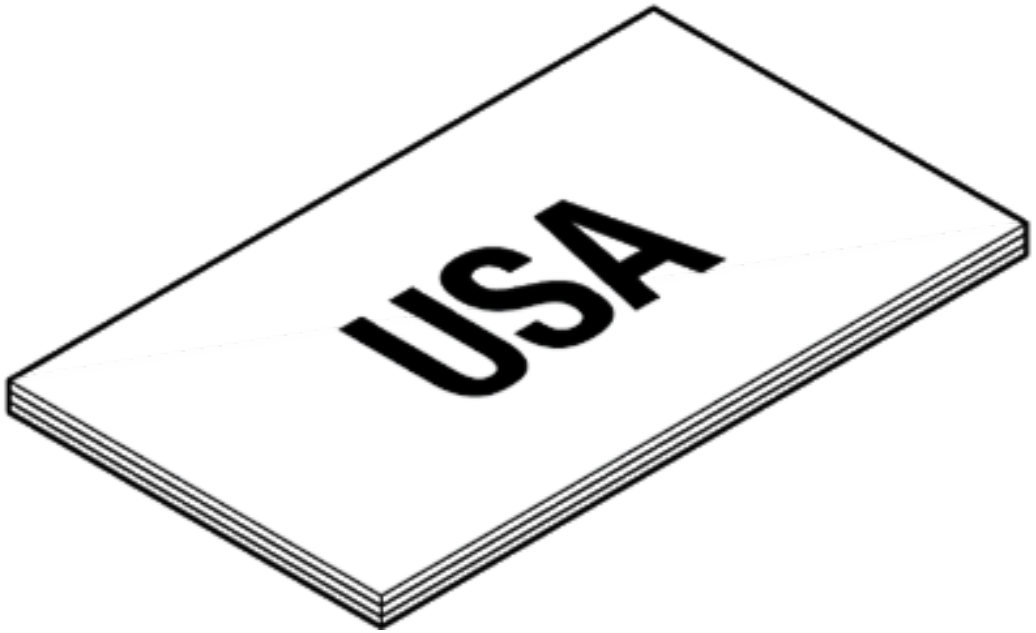
Presses
Manual & Automated

~$1000 - $20,000+

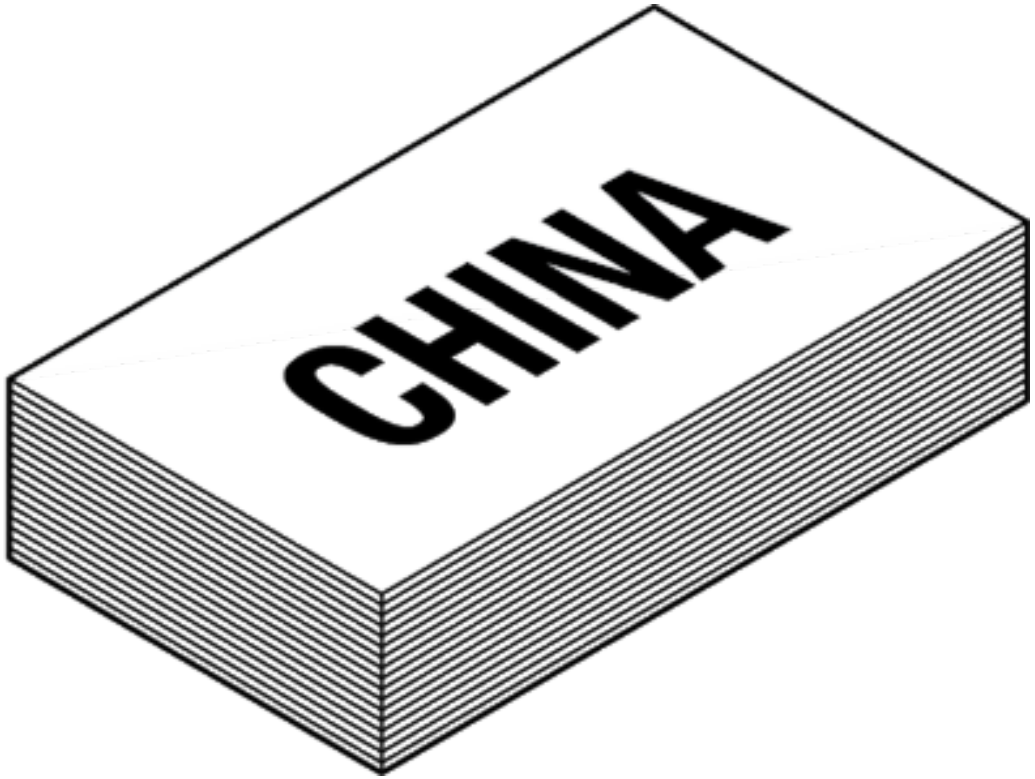
GLOBAL IMPACT & SCALABILITY

“Industry trends indicate...Asia, particularly China, India, and Thailand...will likely become leading gypsum wallboard markets.”

—USGS 2015 Minerals Yearbook: Gypsum



Drywall production:
3% increase/year



Drywall production:
17% increase/year

https://minerals.usgs.gov/minerals/pubs/commodity/gypsum/myb1-2015-gypsu.pdf

Precedent project

TrashWalls project

TrashWalls project is an interdisciplinary collaboration between Architecture and Materials Engineering (MME). 6 architecture graduate students and 6 engineering students worked on the project. This project uses recycled waste material such as cardboard, PET bottles, and magazines to design affordable, energy saving interior insulating wall systems for low income housing. The result of the project was exhibited at the National Sustainable Design Expo in Washington, DC in spring 2016 with the support of EPA grant.

Collaborator

- Collaboration with Composite Materials and Engineering Center at WSU

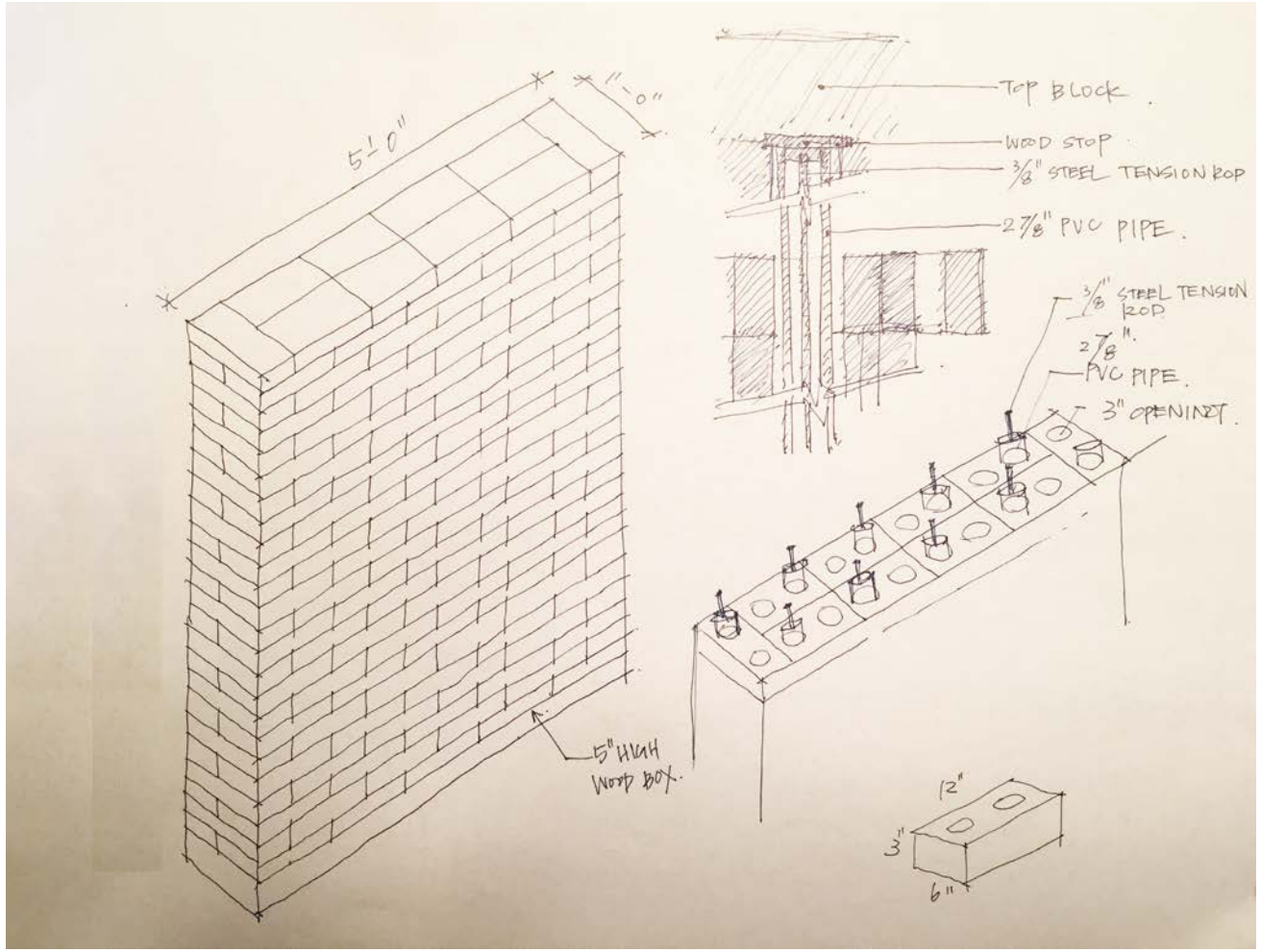
· R-value measuring test
· Compression strength test
· Lateral structure test

Public exhibition

Washington State Historical Society of Museum in Tacoma exhibition

The museum is currently in the process of planning for a major exhibition, *Make/Do*, scheduled from July 14 until December 3, 2018. This exhibit focuses on the history of creative reuse, looking at upcycling and reuse across Washington's history through items both big and small.

5'W x 6'H wall of DWB will be presented as a part of the exhibition.



Possible future application

Transitional Home/ Affordable Housing