WHEN THE WALLS COME TUMBLIN' DOWN...

Masonry Material Recovery Strategies for The Circular Economy

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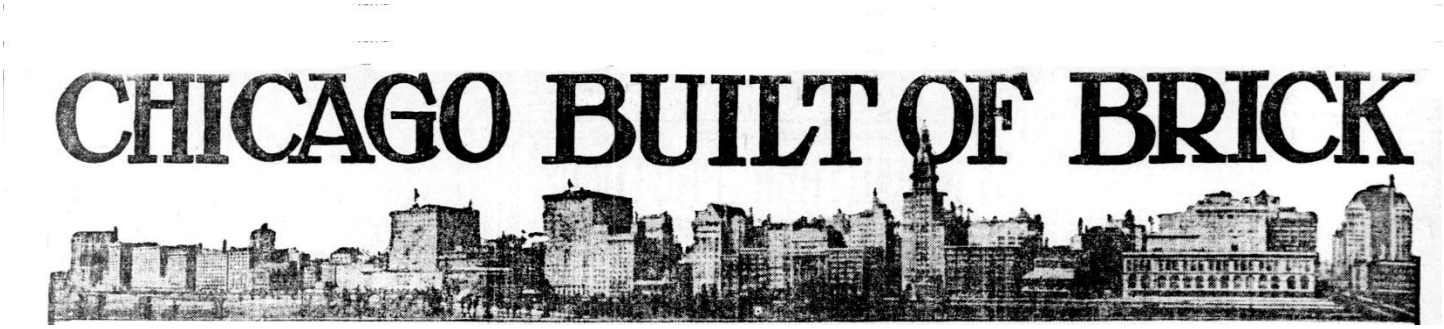


Context

The Great Chicago Fire of 1871 and the Second Chicago Fire of 1874 resulted in a combined destruction of more than 18,000 buildings across 3.3 square miles of the city[1]. Following the widespread destruction from the fires, citywide building codes were implemented to prevent another tragedy from happening by restricting the widespread use of wood in construction within city limits. In lieu of these events, the city turned to a more resilient building material and began to harvest the clay-rich deposits found in the Chicago River and surrounding areas to manufacture bricks. Over the course of the next century Chicago transformed itself from a city of wood to a city of brick. The surge in brick production resulted in an expansion of brickyards from the mere 5 that were present in Cook County in 1871 to more than 60 active yards by 1881. By 1915, 10% of all bricks made in America were made in Chicago[2].


BRICK

The World's Best Building Material

¶ There is no building material equal to good Chicago brick.

¶ They are cheap, easily handled, lasting and are the only building material tested by fire before delivery.

¶ For the home, the business block, the sky scraper, the factory and for sewer and other construction purposes brick are best and most enduring.

¶ There is no deterioration, no waste, no warping, checking or cracking of walls and brick are fire, acid and weather proof.

¶ Chicago eclipses the whole world on rapidity of brick making. Chicago leads the United States on the size and capacity of her brick factories and Chicago has a lower selling price on brick than any other city of consequence in the United States. The output of Chicago brick factories this year will be over a billion. This represents ten per cent of all the common brick made in all the United States. Of this billion brick the Illinois Brick Company will make over a half.

¶ New methods and new machinery are now being installed at all the plants of this company to meet the rapidly increasing demand for Illinois Brick Company brick.

¶ Chicago has the "brick habit." It is built of brick. More brick are used in building in Chicago than in any other American city.

¶ Note the result.

¶ The fire loss in the United States each year is, by government reports, $2.50 per capita.

¶ The fire loss in Chicago is about $1.75 per capita.

¶ Brick construction is therefore shown to be an insurance against fire as well as being cheaper and more sanitary.

¶ Brick in their making are burned for days at a temperature of 1700 degrees. This removes all combustible material and makes them impervious to fire.

¶ The use of brick in building is recommended by the U. S. Government—by the State fire and insurance departments—by the City fire and insurance departments and by all the insurance companies of the country. What better recommendation or testimonial could be given for brick as a building material.

¶ The Blackstone, on Michigan Avenue, is the most modern building in Chicago. It is built throughout, from foundation to ridgeroll of roof, from brick and other burned clay products. It is absolutely fire proof and there is no more handsome building in the west.

¶ Let us quote you on brick—the best, safest and cheapest building material in the world.

THE ILLINOIS BRICK COMPANY

Telephone Main 17 Chamber of Commerce Building. Chicago

THE ILLINOIS BRICK CO., MAKES ONE TWENTIETH OF ALL THE COMMON BRICK MADE IN THE UNITED STATES.

Chicago Tribune Advertisement, November 16, 1910

While these materials now cover the city, many of these brickyards have shuttered their doors with the last Chicago Common brick maker closing in 1981. As these buildings, now over a century old, continue to age and are becoming replaced by faster and cheaper contemporary methods of construction this leaves us to question: what happens to these valuable masonry materials after the building's initial lifecycle has concluded?

Course Description

Building deconstruction is poised to revolutionize the construction industry. A growing number of deconstruction policies are being put in place to support this effort, however, when it comes to implementation, knowledge gaps surrounding cost, labor force training, application, assembly methods, and performance often deter industry professionals from considering reclaimed materials as a viable building source. With over 70% of the built environment relying on masonry construction[3], this studio is focused on developing novel approaches to the reclamation of demolished masonry elements, specifically brick material.

The studio's overarching goal is to challenge students (the future generation of architects) to develop a more resilient and sustainable future through a paradigm shift in our approach to building from a linear path of consumption (take, make, waste) to that of a circular economy (take, make, repeat). In doing so, the process of material recovery has attracted significant interest due to its potential to reduce our industry's reliance on virgin resources while offering additional benefits of decreased energy and carbon emissions associated with the manufacture of new

[1] Rayfield, Jo Ann. "Tragedy in the Chicago Fire and Triumph in the Architectural Response". Illinois History Teacher.

[2] Quam, William. "What is Chicago Common Brick". Brick of Chicago.

[3] Masonry Contractors Association of America. "Masonry Facts."

Various Chicago sites of abandoned brick that have fallen into disrepair. (photos by author)

materials. While irregularities in shape, geometry, or unknown structural capacity often leads to the downcycling of demolished masonry materials into aggregates through energy intensive recycling processes, the course believes these materials are still a viable building resource in need only of appropriate design strategies to harness them.

With experts contributing to each module (see work plan below) of the course, the studio will begin by considering a brick's lifecycle from inception to demolition. The first module of the studio will involve a series of workshops with visits to brick manufacturers and trade industry facilities located in the Chicagoland area to better understand the beginning of a brick's lifecycle, typical methods of fabrication, and masonry construction. Following these workshops, the studio will shift its lens to the end of a brick's lifecycle. Module 2 will involve on-site observations of a typical building demolition process and local C&D waste material 'recycling'[4]. Through this initial research students will begin to understand the economy and ecology of masonry construction, in order to then consider how we as architects can extend our understanding of potential building resources beyond raw material extraction from the earth and better design for the reuse of existing materials. Throughout these first two modules students will be asked to collect, record, and document both digital and physical material samples to further explore formal, physical, temporal, and ecological properties of their material objects. Through careful research and representation, we will seek to look more closely at these material objects and understand design and making as tools for innovation within the field of architecture.

Module 3 will synthesize and apply the student's knowledge of a typical masonry material's lifecycle learned to date. Working with a newfound understanding of this process, each student will be tasked with designing a single-story structure using reclaimed brick as both load-bearing and non-load-bearing elements throughout the project. During this process simulation and desktop-scale fabrication tests conducted in collaboration with the Department of Civil, Architectural, and Environmental Engineering (CAEE) will be used to evaluate and refine workflows for designing both digitally and physically with recovered masonry materials.

Goals + Outcomes

This process seeks to address current gaps and challenges in the deconstruction-to-reuse value chain. Through doing so additional outcomes of the course include spurring market demand for recovered masonry materials, enabling better recovery methods and application of salvaged materials, and assisting industry partners with new strategies for applying these materials to future construction. Additional outcomes include equipping students with the skills necessary to recoup value from existing deadstock material while providing them with the training and tools necessary to develop the emerging field of building deconstruction while offering access to a previously untapped material resource for future building construction. The proposed course has the potential to set a new standard for how we not only view existing building stock as future material resources, but how to successfully identify, deconstruct, evaluate, and recover material for future reuse.

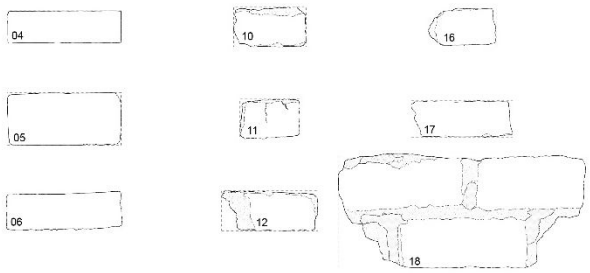
Industry Collaboration and Academic Partners

The need for new and sustainable strategies for building material reuse is of great importance to not only the architecture and construction industry, but imperative to society as a whole. This course attempts to expose the problem of waste and discarded building materials through convening experts involved in each phase of the recovery, design, and construction process. Industry partners will provide crucial access to physical building materials and a deeper understanding of challenges associated with building deconstruction and existing reclaimed material assembly methods for the studio to further explore.

With an emphasis on design and cross-disciplinary collaboration, the course aims to collectively move towards a truly circular economy by rethinking the way we recover and reuse materials, while also increasing energy efficiency as a result of avoiding intensive remanufacturing or, worse, the landfill.

[4] In this instance recycling actually refers downcycling.

Reclaimed brick inventory. (photos by author)



Reclaimed brick documentation. (photos by author)

Industry Partners:

Scott Conwell, International Masonry Institute	Module 1
Luke Kisielewski, Bricks Incorporated Chicago	Module 1
Steve Filyo, BlueEarth Deconstruction	Module 2
Mark Sredin, Lakeshore Recycling Services	Module 2

Institutional Partners/Consultants:

Matthew Gombeda, PE (CAEE faculty @ IIT)	Module 3

Work Plan

Module 01. Beginning of Lifecycle Analysis (2 weeks)
Week 1 visit to Bricks Incorporated Chicago
Week 2 visit to International Masonry Institute

Outcomes: Analysis and research into the production of brick materials. Students will understand local, regional, and global material production and typical brick construction methods through a series of lectures and hands-on workshops.

Module 02. End of Lifecycle Analysis (2 weeks)
Week 3 visit to BlueEarth Deconstruction + The Reuse Depot
Week 4 visit to Lakeshore Recycling Services

Outcomes: Analysis and research into the demolition and C&D waste material flows of masonry. Students will understand the impact of C&D waste and material consumption on our environment, specifically brick masonry.

Module 03. Design, Prototyping, & Fabrication (10 weeks)
Week 5-6 unit prototyping and testing (w/ CAEE consultation)
Week 7-12 design development
Week 13-14 design delivery

Outcomes: Design, develop, and represent using reclaimed brick. Physical unit prototypes will be assembled and tested in collaboration with the Department of Civil, Architectural & Environmental Engineering based on recovered material geometry, strength/durability, design potential, and future reapplication.

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