When buildings die and sink, a new city will be born.

An urban ecology system supported by Construction and Demolition (C&D) debris

2023
The universe of whale fall and its infinite layers of meaning depicts a mysterious and spontaneous system-ecosystem. Ecosystems are logical and dynamic entities—they are subject to periodic disturbances and are always in the process of recovering from some past disturbance. Architecture also has external and internal stimulus. It is recovered by humans and evolves periodically. We often define the lifespan of a building in terms of time. Some buildings are destroyed and toppled at the end of their mission. Some buildings, however, have extended their lives through renovation and remain to this day. Still other buildings are dismembered and used in other newly constructed buildings, at which point we cannot accurately define whether these buildings are surviving or dead. Ecosystem restoration can contribute to achieving the sustainable development goals. In architecture, renovation or reassembling also responds to sustainability.
When a whale dies, it becomes whale fall. Its body, an immense ecosystem, sinks slowly to the ocean floor. But that ecosystem changes. First come ratfish, hagfish and sharks — mobile scavengers who smell flesh and swim in to feed. For years, sometimes, the vast world sinks. When it reaches bottom, new colonizers, worms, crustaceans and mollusks, move in to feed on leftover blubber or burrow into the sediment beneath the remains. Finally there are only bones, and the last stage begins. Bacteria begin breaking down lipids inside the bones, generating sulfur, which attracts more bacteria and a huge community of strange mussels, worms, snails... The whale has left the upper world of light-sourced life and now supports a world based in sulfur.
According to the report of Advancing Sustainable Materials Management: 2018 Fact Sheet, approximately 600 million tons of Construction and Demolition (C&D) debris were generated in the United States in 2018, more than twice the amount of generated municipal solid waste. Disposal of C&D waste is one fraught with problems across the United States. Lack of supporting laws, regulations, and industrial policies, low market shares for C&D waste recycling products, ineffective coordination of crucial links in the industrial chain, and low benefits of recycling products are the main contributors to the low recycling rate of urban construction. C&D materials management solutions must be financially sustainable, environmentally friendly, technically available and legally acceptable. It is not the story of a resource that is being wasted but the ignorance of the city memory and building values. C&D waste has been pushed to the periphery of urban environments, severing the relationship between the urban environment we inhabit and the one that is required to support the way we live. A linear economy assumes waste as the end of the system. Thus, this notion, which starts with resource extraction and ends with disposal, is what underlies the mainstream understanding of capital. Current waste management forms a model of valuing trash as a linear system that separates input from output. The possibility and internal value of waste is severely underrated and even blindfolded. Therefore, this thesis will revalue the C&D waste and reconstruct the recycling system, preventing undue process in recycling and exploring the potential of adaptive reuse to develop a new standardized, systematic and flexible workflow.

During all ecosystem processes, energy and matter are conserved. As energy moves through an ecosystem, it changes form, but no new energy is created. A primary mechanism is that all necessities are provided from inside its physical borders. A whale fall is a micro ecosystem in the oceans. When whales die and sink, their carcasses provide abundant nutrients for deepwater creatures. There are 4 stages in the decomposition of a whale carcass supporting a succession of marine biological communities. Observing the process of whale fall, the internal logic of decomposition and re-function is similar to the workflow of deconstructing, recycling and reassembling in urban ecology. This thesis will pose the question of how a city can revitalize and renovate by itself.
The List of Criteria

This thesis reimagines a new C&D materials management paradigm and urban ecology system that a city can support itself, reusing the waste it generates, in a way that is sustainable into the future.

In this biomimetic urban mechanism, C&D materials management will be thoroughly and comprehensively planned. Abandoned and dilapidated buildings will act as ‘whales’ in the urban ecology, providing nutrients for new buildings and the city environment, called ‘building fall.’

First stage - Enclosure
In the first stage of ‘building fall’, the skin of the building, the enclosure, will be decomposed, reprocessed and used in the new building.

Second stage - Structural components
In the second stage, the skeleton of the building, the structural components, will be completely disassembled. Considering their strength and corrosion resistance, they can be reused in many ways.

Third stage - Non-recyclable and polluted components or materials
Based on the classification criteria of the university co-op materials resource center, this thesis will split the C&D materials into six main groups: ceramic, composite, glass, metal, natural materials and polymer and respectively discuss the recycling possibilities. Especially in the third stage, this thesis will focus mainly on the non-recyclable and polluted materials and explore their potential to be further reused.

Fourth stage - By-product of construction work and waste
In the final stage, the by-product of construction work, waste creates negative environmental impacts, which includes soil contamination, water contamination, energy and natural resources consumption, environmental degradation, and landscape deterioration. How to convert these disadvantages and challenges into opportunities will be a question worth thinking about and exploring.
Stage 1 - Enclosure

Door

The Circular Pavilion
Encore Heureux Architects, 2015
- Collect 180 wooden doors
- Form the facade

Recycled Materials Cottage
Juan Luis Martinez Nahuel, 2008
- Reuse glazed doors belong to a patio
- Became the main facade

Collage House
S+PS Architects, 2015
- Recycles old windows and doors of demolished houses in the city
- Make the wall
Stage 1 - Enclosure

Window

Vegan House
Wang Shu, Amateur Architecture Studio, 2014
- Reuse the windows and doors to make new facade

Collage House
S+PS Architects, 2015
- Recycles old windows and doors of demolished houses in the city
- Make the wall

Vault House
WilkinsonEyre, 2021
- Maintain
Stage 1 - Enclosure

Wall

Ningbo Historic Museum
- Collect debris from destruction sites around the region
- Combine debris and create new facade

SOS Children’s Villages Lavezzorio Community Center
Studio Gang, 2008
- Use broken stone pieces, old paving stones, wooden logs, and broken tiles
- Mix recycled and reclaimed materials

Vault House
WilkinsonEyre, 2021
- Collect local black basalt stones recovered from old demolished old bungalows/wadas
- Reuse as exterior paving and stairs
Stage 1 - enclosure

Roof

L House
Jmoomoo Architects, 2008
- Reuse plastic insulating material -Thermopian used only for roofing
- Become the elevation

The Circular Pavilion
Encore Heureux Architects, 2015
- Reuse extras from the construction site
- Form wooden frame

Vault House
WilkinsonEyre, 2021
- Maintain
Stage 1 - Enclosure
Stair

Neighborhood Design Studio
Studio Melee, 2021
- Reuse old steel stairs
Stage 2 - Structural components

Floor

Recycled Materials Cottage
Juan Luis Martínez Nahuel, 2008
- Reuse eucalyptus and native raíl parquet floors
- Became the main coating

Collage House
S+PS Architects, 2015
- Recycles carved wooden mouldings
- Remake as furniture and facade

Vault House
WilkinsonEyre, 2021
- Collect local black basalt stones recovered from old demolished old bungalows/wadis
- Reuse as exterior paving and stairs
Stage 2 - Structural components

Ceiling

Neighborhood Design Studio
Studio Melee, 2021
- Demolish existing old growth fir
- Repurpose as exposed accent framing throughout the interior

SOS Children’s Villages Lavezzorio Community Center
Studio Gang, 2008
- Reuse concrete from ceiling
- Form exterior wall

Vault House
WilkinsonEyre, 2021
- Maintain
Stage 2 - Structural components

Plinth/Column

Park Hill
Hawkins\Brown, 2013
- Strip the building back to its gridded concrete framework
- Add a new facade made of simple glazing and brightly coloured panels

Neighborhood Design Studio
Studio Melee, 2021
- Demolish existing old growth fir
- Repurpose as exposed accent framing throughout the interior

Battersea Power Station
WilkinsonEyre, 2022
- Maintain
Stage 3 - Non-recyclable and polluted components or materials
Stage 4 - By-product of construction work and waste
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