IS THE BUILDING WORLD READY FOR THE CIRCULAR ECONOMY?

CIRCULAR ECONOMY WORKING GROUP

JOËL ONORATO

SEPTEMBER 09, 2020
CIRCULAR ECONOMY: DEFINITION

Framework where materials are perpetually kept in use to achieve 3 goals:

- minimizing extraction of finite natural resources
- eliminating negative environmental and health impacts / having positive ones
- eliminating waste

3 Principles (Ellen McArthur Foundation):

- Design out waste and pollution
- Keep products and materials in use
- Regenerate natural systems
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SEPTEMBER 09, 2020
AN ECONOMY FOR THE 21ST CENTURY

DEPLETION OF FINITE NATURAL RESOURCES

PEOPLE’S INCREASING COMMITMENT TO SUSTAINABILITY
NEW BUSINESS MODELS

KEEPING OWNERSHIP

+

SELLING EXPERIENCE/SERVICE

INTENSIFICATION OF MANUFACTURER’S RELATIONSHIP WITH THEIR CONSUMERS

PHILIPS LIGHTING, ENGIE, SCHIPHOL INTERNATIONAL AIRPORT

TU DELFT - FACADE LEASING PILOT PROGRAM
WHAT IS THE BUILDING INDUSTRY DOING?

INCINERATION OF CONSTRUCTION

“Adding an entire New York City every month for 40 years” - Architecture 2030

LARGE VARIETY OF PRODUCTS AND SCALES

CONTRIBUTION TO WASTE

548 million tons in 2015, US = 2 x Municipal Solid Waste (EPA)
(169 million for buildings alone)

Concrete 70%
Asphalt C. 15%
Wood 7%
Other 8%
THE MATERIAL ASPECT IS AS IMPORTANT AS ENERGY EFFICIENCY

CONTRIBUTION TO GhG EMISSIONS

11% of Global GHG emissions

(Other impacts to be considered as well)

EMBODIED CARBON: THE SAVINGS ARE NOW - “TIME VALUE OF CARBON”

Global GHG emissions by sector. Source: Architecture 2030

Source: Global Alliance for Buildings and Construction, 2018 GLOBAL STATUS REPORT

Cumulated GHG emissions

embodied

operational

Cumulated GHG emissions

construction

occupancy

time (building life)
WHY THEN IS CIRCULARITY NOT IN PLACE?

deviation from the dominant linear model → increase in risk and cost
variety and complexity of real estate projects

+ opportunities on a case-by-case basis

circular economy looks at unexplored value

LEED CREDITS
REDUCED CONSTRUCTION COSTS
HIGHER FLEXIBILITY
EASE OF MAINTENANCE

+ IMAGE BENEFIT: TANGIBLE SUSTAINABILITY STATEMENT
### BUILDING CHOICES - PRINCIPLES

**CIRCULAR COMPONENTS ATTITUDE**

**DISPOSING - CONSIDER DECONSTRUCTION**

<table>
<thead>
<tr>
<th>REUSE / DONATE &gt;</th>
<th>REPAIR &gt;</th>
<th>REMANUFACTURE &gt;</th>
<th>RECYCLE COMPOST &gt;</th>
<th>WASTE TO ENERGY</th>
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</table>

**SOURCING CRITERIA -**

| EXISTING > | SALVAGED > | REPAIRED/ REMANUFACTURED > | RECYCLED RENEWABLE > | MADE WITH VIRGIN RAW MATERIALS |

**SOURCING CRITERIA - END-OF-LIFE -**

| DURABLE + | REUSABLE + | REPAIRABLE UPGRADEABLE + | TRULY RECYCLABLE COMPOSTABLE |

**DESIGN FOR ADAPTABILITY**

Changes require minimal modifications. Easy to disassemble to allow cost-effective circularity.

**KEEP IT SIMPLE**

- When possible avoid composites, coatings, finishes.
- Limit the number of different materials.
- Privilege low tech and passive systems.
“CRADLE TO CRADLE” AS A TOOL TO REACH TRUE CRADLE TO CRADLE
WOOD

REUSE

HIGH QUALITY OLD TIMBER

CARBON STORAGE EXTENDED

SALVAGED WOOD BOARDS AS NON STRUCTURAL SPACERS

KENDEDA BUILDING CENTER - GEORGIA TECH, SKANSKA, LORD AECK SARGENT

SALVAGED WOOD BOARDS AS ACOUSTIC PANELS AND CLADDING

DPR RESTON OFFICE - SMITHGROUP
W O O D

1701 RHODE ISLAND AVENUE FITNESS CENTER - HICKOK COLE, AKRIDGE

SALVAGED WOOD FLOOR BOARDS FROM FORMER BASKETBALL COURT ON SITE

THEASTER GATES - DORCHESTER PROJECT, CHICAGO

THEASTER GATES - SANCTUM, BRISTOL 2015

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STEEL

REUSED STEEL COMPONENTS HAVE “LESS THAN A QUARTER THAN THE [CARBON] IMPACT OF NEW MATERIALS (EVEN FROM RECYCLED SOURCES)”

STRUCTURE AND CARBON, ASCE, 2012

ASSEMBLY: NOT JUST BOLTS...

CLAMPING CONNECTIONS

REVERSIBLE MOMENT FRAMES

LINDAPTER CLAMPING SYSTEM AT AMERICAN COPPER BUILDING, SHOP ARCHITECTS

CONXTECH - CONXL 300 SYSTEM

CBU ENGINEERING FACILITY STRUCTURE - CONXTECH, GENSLEER

RECYCLE

RECYCLING RATE (BUILDING STEEL)

85%

SPECIFY THIS RATE?

ROLLED SHAPES

HSS

IS THE BUILDING WORLD READY FOR THE CIRCULAR ECONOMY?

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DESIGN - CONCRETE

REUSE

REUSE EXISTING STRUCTURES

RECYCLE

CRUSHED AND:
• USED IN SITE/ROAD FILL
• USED AS RECYCLED AGGREGATES IN ROAD CONSTRUCTION (UP TO 30 %)
• NOT YET IN REINFORCED CONCRETE

REDUCE - EMBODIED CARBON

REDUCE CEMENT CONTENT:
• BY DESIGN
• BY PERFORMANCE BASED SPECIFICATIONS
• BY PARTLY REPLACING WITH SCM
• BY USING PORTLAND-LIMESTONE CEMENT

CARBON CAPTURE TECHNOLOGIES
• CARBON CURE
• SOLIDIA (ONLY PRECAST ELEMENTS)
• ...

1701 RHODE ISLAND EXISTING CONCRETE STRUCTURE - HICKOK COLE, AKRIDGE

PORTOLA VALLEY TOWN CENTER, CA - SIEGEL STRAIN
ENVELOPE

FACADE GLASS

THERMAL PERFORMANCES

THINK REUSE:
• AS INTERIOR ELEMENTS
• AS OUTDOOR GLASS

REUSE

RECYCLE

RECYCLED CHEAPER THAN RAW MATERIALS

AVOID CONTAMINATION OF GLASS IN THE RECYCLING STREAM

IS THE BUILDING WORLD READY FOR THE CIRCULAR ECONOMY?

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ENVELOPE

BRICKS

REUSE

BRICK SORTING - BE CIRCULAR BRUSSELS PLATFORM

RECYCLE

70-85% INDUSTRIAL WASTE
15-30% POST-CONSUMER

GREEN LEAF BRICK

INSULATION

COMPOST - RENEWABLE

WOOL INSULATION - HAVELOCK WOOL

STRAW BALE INSULATION - ARKIN TILT ARCHITECTS

MAHONIA MIXED-USE BUILDING - ARKIN TILT ARCHITECTS

CARBON IMPACTS OF INSULATION

<table>
<thead>
<tr>
<th>Material</th>
<th>CO₂ eq. per 100m² wall panel</th>
<th>CO₂ eq.</th>
<th>CO₂ eq.</th>
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<tbody>
<tr>
<td>HIGH DENSITY FOAM</td>
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<td>11.4</td>
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<tr>
<td>MED. DENSITY FOAM</td>
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<td>EXTRUDED POLYSTYRENE</td>
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<tr>
<td>MINERAL WOOL</td>
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<td>11.4</td>
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<tr>
<td>FIBERGLASS</td>
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<tr>
<td>DENIM</td>
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<tr>
<td>FOAM</td>
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<tr>
<td>DENSE PACK CELLULOSE</td>
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<td>11.4</td>
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<tr>
<td>CORN</td>
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<tr>
<td>HEMP</td>
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<td>STRAW</td>
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</table>

70-85% INDUSTRIAL WASTE
15-30% POST-CONSUMER
PARTITION WALLS

MODULAR WALLS

REUSE

REPAIR

REMANUFACTURE

RECYCLE

DRYWALL

RECYCLE

CONTAMINATION (PAPER, PAINT, NAILS, TAPE, PLASTER...)

DOORS: DOORS UNHINGED

LOW RECYCLING RATES

V.I.A. not only defines space, but redefines the role vertical real estate plays in today's workplace. V.I.A. augments human interaction by providing true acoustical privacy and hosting technology. It provides a sense of permanence with the speed and design flexibility of a relocatable wall, allowing the creation of a range of applications.

VERTICAL.
INTELLIGENT.
ARCHITECTURE.

SKINS
Separate from the structure, enabling segmentation to differ from one side to the other.

ACOUSTICAL SEALS
At all points within V.I.A., and between V.I.A. and the building architecture, acoustical seals provide superior privacy.

MODULAR POWER BLOCK
includes an acoustical enclosure to maintain the highest levels of acoustic performance with power and data.

MONITOR SHROUD
Features an acoustical enclosure to maintain a high level of acoustic performance.

STEEL FRAME STRUCTURE
Supports solid and glass skins, enabling the flexibility to easily change between single- or double-glazed glass frames or solid skins as the needs of the space change.

ATTACHMENT & ALIGNMENT BRACKETS
Ensure alignment and securely lock skins to the frame.

V.I.A. MODULAR WALL SYSTEM, STEELCASE

DRYWALL SCRAPs ON SITE - GYPSUM ASSOCIATION

DRYWALL SCRAPs SORTING FOR RECYCLING - USA GYPSUM
FURNITURE

REUSE

FIRST USE DONATED TO RE-USE CENTERS SOLD / DONATED TO ANY BUSINESS NON-PROFILE BUSINESS END OF SECOND LIFE

REPAIR

REMANUFACTURE

RECYCLE

TYPICAL MANUFACTURERS

ON A PRODUCT BY PRODUCT BASIS:
- RECYCLED CONTENT
- PARTLY RECYCLABLE
- REPAIR- REMANUFACTURE PROGRAMS
- TAKE-BACK PROGRAMS
- ...

IS THE BUILDING WORLD READY FOR THE CIRCULAR ECONOMY? JOEL O'NEIL

CIRCULAR ECONOMY WORKING GROUP SEPTEMBER 09, 2020
SOURCING (AND GIVING) - SALVAGED MATERIALS
SOURCING (AND GIVING) - OFFICE FURNITURE

- PVIPVI.COM/USED-OFFICE-FURNITURE
- ETHOSOURCE/WASHINGTON-DC-USED-OFFICE-FURNITURE
- GERSTELOFFICEFURNITURE.COM
- MAMMOTHOFFICEFURNITURE.COM/WAREHOUSE-NORTHERN-VIRGINIA
- FURNITUREFINDERS.COM/OFFICE/STATES/OFFICE-FURNITURE-DISTRICT-OF-COLUMBIA.HTML
- RE-FORM.COM/ABOUT/
- ANDYSTERNS.COM/FAIRFAX-USED-OFFICE-FURNITURE
AVOID THE USUAL PITFALL

WASTE

FINITE RAW MATERIALS

HEALTH AND ENVIRONMENTAL IMPACT

CIRCULATE THINGS AND RESPECT ALL THREE CRITERIA

LIFE CYCLE ANALYSIS FOR DECISION MAKING

CIRCULATING IS NOT ENOUGH: REDUCE IMPACT IN THE FIRST PLACE

EMBODIED CARBON, ....
A POWERFUL FRAMEWORK - MAKING IT HAPPEN

- UNDERSTANDING, BEING AWARE OF THE ISSUE, AND MOTIVATED TO ACT
- LIGHT CHANGES IN DAILY OPERATIONS
- EXPERIMENT CIRCULARITY IN PROJECTS
- DEMONSTRATE THE POSSIBILITY AND BENEFITS OF CIRCULAR BUILDING
- DEVELOP AWARENESS AND COMMITMENT IN THE PROFESSION
- INNOVATE: IMPLEMENT FULLER CIRCULARITY
- POLICIES TO GET THERE FAST ENOUGH
QUESTIONS?

BRICKS?

RENEWABLE BETTER THAN TECHNOLOGICAL CYCLE?

COST PREMIUM?

THAT’S TOO EXPENSIVE!

STOP BEING LESS BAD?

EUROPE?

CASE STUDIES?

POSSIBLE POLICIES?

WOOD END OF LIFE?

IS RECYCLING NOT ENOUGH?

WHAT’S NEXT?

WHAT WOULD YOU LIKE TO KNOW MORE ABOUT?
REFERENCES

• Ellen McArthur Foundation


• Public Architecture, *Design for Reuse Primer 2.0.*, 2010

• B. Guy, G. Ciarimboli, *Design for Disassembly in the built environment: a guide to closed-loop design and building*, prepared for King County, WA., available online

• Webster, Mark D., Helena Meryman, Adam Slivers, Tonatiuh Rodriguez-Nikl, Lionel Lemay, Kathrina Simonen, Harinee Trivedi, Lindsey Maclise, Dirk Kestner, Kenneth Bland, Won Lee and Emily Lorenz. “Structure and Carbon – How Materials Affect the Climate.” SEI Sustainability Committee; Carbon Working Group, November 2012. ASCE.

• Arup, Graeme DeBrincat, Eva Babic, *Re-thinking the life-cycle of architectural glass*
GOOD FOR THE BOTTOM LINE - COMMUNITY OUTREACH

REDUCTION OF NOISE AND DUST FROM CONSTRUCTION SITE

INVITING THE COMMUNITY TO PARTICIPATE IN THE TRANSFORMATION OF THE URBAN FABRIC

→ TRAINING LOCAL WORKFORCE IN DECONSTRUCTION

→ CATALYZING THE CREATION OF A REUSE CENTER

→ INVOLVING THE COMMUNITY IN REUSE STRATEGIES
THE CIRCULAR CITIES OF TOMORROW

RENEWABLE RESOURCES

FINITE MATERIALS

REUSED-ABLE COMPONENTS

RECYCLED MATERIALS

NO LANDFILL

HARMFUL MATERIALS PHASED OUT

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BUILD IT CIRCULAR

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CIRCULAR ECONOMY WORKING GROUP
SEPTEMBER 09, 2020

CONSIDER REUSING EXISTING
PROJECT SCHEDULE: FACTOR IN TIME
IDENTIFY CIRCULAR GOALS

SPECIFICATIONS: BE PRECISE AND FLEXIBLE
ABOUT DECONSTRUCTION, REUSE, TAKE BACK
PROGRAMS, RECYCLING

DESIGN

TEAM ON BOARD
CIRCULAR CHAMPION

CHOOSE ‘CIRCULAR’
MATERIALS

DESIGN FOR FLEXIBILITY
DESIGN FOR
DISASSEMBLY

CONSTRUCTION

COMMUNICATE AND
MONITOR

CONTRACT STRATEGY:
FIXED TENDER / MULTIPLE
PRIME CONTRACTS

USE

SHARE THE
STORY
SHOW IT
OFF

DESIGN FOR REUSE PRIMER

LONG CENTER FOR THE PERFORMING ARTS, TX - ZEIDLER

AGU, DC - HICKOK COLE
GOOD FOR THE BOTTOM LINE - DECONSTRUCTION

- processing / storage cost
- extra time
- extra labor costs

+ avoided disposal cost
(saved time)
tax deduction

- type of deconstruction
- extent of salvage
- materials value

RESIDENTIAL

DONATION
Tax deduction for a Non Cash Charitable Contribution to non-profit Reuse Centers
1,200 sf deconstructed house:
130 k$ fair market value
51 k$ tax benefits

COMMERCIAL INTERIORS REFURBISHMENT

RECYCLING - TAKE BACK PROGRAMS
220,000 sf of ceiling tiles
3 weeks saved on schedule (faster trade coordination)

‘DESTRUCTION CAN BE A TAX-SAVY ALTERNATIVE TO DEMOLITION’, WASHINGTON POST - 8/25/2016, HUMANIM, DOUG KAPUSTIN PH.

101 EAST ERIE STREET, CHICAGO - OFFICE INTO HOTEL CONVERSION PROJECT, 2016 - CBRE, CLAYCO, ARMSTRONG CEILING