CONGRESSIONAL BRIEFING
Building Materials: From Production to Reuse
Briefing Series: Reduce and Reuse
How to Cut Greenhouse Gas Emissions of Building Materials, Plastics, and Food

Wednesday, December 08, 2021
About EESI...

- **NON-PROFIT**
  Founded in 1984 by a bipartisan Congressional caucus as an independent (i.e., not federally-funded) non-profit organization

- **NON-PARTISAN**
  Source of non-partisan information on environmental, energy, and climate policies

- **DIRECT ASSISTANCE**
  In addition to a full portfolio of federal policy work, EESI provides direct assistance to utilities to develop “on-bill financing” programs

- **SUSTAINABLE SOCIETIES**
  Focused on win-win solutions to make our energy, buildings, and transportation sectors sustainable, resilient, and more equitable
Policymaker Education

**Briefings and Webcasts**
Live, in-person and online public briefings, archived webcasts, and written summaries

**Climate Change Solutions**
Bi-weekly newsletter with everything policymakers and concerned citizens need to know, including a legislation and hearings tracker

**Fact Sheets and Issue Briefs**
Timely, objective coverage of environmental, clean energy, and climate change topics

**Social Media (@EESIOnline)**
Active engagement on Twitter, Facebook, LinkedIn, and YouTube
Other Relevant 2021 Briefings

April 20, 2021  Rethinking Reduce, Reuse, and Recycle: Policies and Programs to Address Waste

[Link](eesi.org/042021waste)

February 26, 2021  Congressional Climate Camp #2: Federal Policies for High Emitting Sectors

[Link](eesi.org/022621camp)
“Reduce and Reuse” Briefing Series

December 08 Building Materials: From Production to Reuse
December 09 The Climate Consequences of Plastics
December 10 Reducing Emissions by Reducing Food Waste

Sign up for the Full Series: https://www.eesi.org/1221waste
Outline

1. Carbon impacts of building materials

2. Short term – carbon reduction opportunities

3. Long term – moving towards circular building material sector
Carbon impacts of building materials
Product lifecycle – embodied carbon focus areas
CO2 emissions

Global

- Industry: 30%
- Transportation: 22%
- Building Materials and Construction: 11%
- Other: 9%
- Building Operations: 28%

Source: Architecture 2030, DEQ 2018

Oregon consumption-based

- Building Operations: 22%
- Embodied Carbon of Building Materials: 8%
- Other emissions: 71%

Source: Architecture 2030, DEQ 2018
Embodied vs. Operational Carbon

Source: AIA / CLF Embodied Carbon Toolkit
Strategies to reduce embodied carbon

• Build less
• Reuse existing buildings
• Build smaller
  — occupancy matters
• Reuse materials
• Optimize building
  — whole building LCA
• Optimize materials
  — EPDs
  — other certifications
• Minimize waste
• Recover waste
Reduction strategies – short term
City of Portland - Zoning Code

Example: 5,000 square foot lots
Policy

• Requires reporting of embodied emissions for all rezoned buildings
• Equivalent annual embodied emissions values must be reported alongside operational emissions in kgCO2e/m2/year
• Data collected by city to understand scale of embodied emissions

City of Portland – Deconstruction requirement
Environmental Product Declarations (EPDs) for public purchasing

Other State Efforts:
- Oregon
- New York
- Washington
- Minnesota

Federal Efforts:
- Buy clean Procurement Requirements
What is an Environmental Product Declarations (EPD)?

- Disclosure label that reports the environmental impacts of products
- Typically include impacts of raw material extraction, transportation, and manufacturing
- Third party certified against ISO standards

### Environmental Impacts

<table>
<thead>
<tr>
<th>Declared Product:</th>
<th>Mix 45SS420A • Bend Plant Exterior SOG Compressive strength: 4000 PSI at 28 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Declared Unit:</td>
<td>1 m³ of concrete</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Impact</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Warming Potential (kg CO₂-eq)</td>
<td>387</td>
</tr>
<tr>
<td>Ozone Depletion Potential (kg CFC-11-eq)</td>
<td>9.8E-6</td>
</tr>
<tr>
<td>Acidification Potential (kg SO₂-eq)</td>
<td>2.42</td>
</tr>
<tr>
<td>Eutrophication Potential (kg N-eq)</td>
<td>0.47</td>
</tr>
<tr>
<td>Photochemical Ozone Creation Potential (kg O₃-eq)</td>
<td>58.0</td>
</tr>
<tr>
<td>Abiotic Depletion, non-fossil (kg Sb-eq)</td>
<td>1.26E-6</td>
</tr>
<tr>
<td>Abiotic Depletion, fossil (MJ)</td>
<td>1,229</td>
</tr>
<tr>
<td>Total Waste Disposed (kg)</td>
<td>2.76</td>
</tr>
<tr>
<td>Consumption of Freshwater (m³)</td>
<td>2.89</td>
</tr>
</tbody>
</table>

**Product Components:** natural aggregate (ASTM C33), Portland cement (ASTM C150), batch water (ASTM C1602), slag cement (ASTM C989), admixture (ASTM C260)

Additional detail and impacts are reported on page three of this EPD.
Oregon Concrete EPDs

Program stats:
• 10 companies
• 21 central batch plants
• 4 mobile mix plants
• Over 1500 EPDs produced
City of Portland Concrete Procurement Policy

- **Jan 1, 2020**
  - EPDs required on all City projects
- **Jan 1, 2022**
  - City publishes GWP threshold
- **~ June 1, 2022**
  - All EPDs must be below threshold

Policy: [https://www.portlandoregon.gov/brfs/article/731696](https://www.portlandoregon.gov/brfs/article/731696)
Concrete – policy + pilots

Published EPDs in the Portland Area

2020 Low Carbon Concrete Sidewalk Pilot
This case study provides information on the City of Portland’s first round of low carbon concrete pilot projects, featuring sidewalk ramps within the City’s Bureau of Transportation.

October 2020
Additional City of Portland Pilot Projects

Traffic signal pole footing

Driveways

Pavement and ADA ramps

Stormwater + Playground
## Table 19.07.050 Cement and Embodied Carbon Limit Pathways

<table>
<thead>
<tr>
<th>Cement limits for use with any compliance method 19.07.050.2 through 19.07.050.5</th>
<th>Embodied Carbon limits for use with any compliance method 19.07.050.2 through 19.07.050.5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Minimum specified compressive strength $f'_c$, psi (1)</strong></td>
<td><strong>Maximum ordinary Portland cement content, lbs/yd$^3$ (2)</strong></td>
</tr>
<tr>
<td>up to 2500</td>
<td>362</td>
</tr>
<tr>
<td>3000</td>
<td>410</td>
</tr>
<tr>
<td>4000</td>
<td>456</td>
</tr>
<tr>
<td>5000</td>
<td>503</td>
</tr>
<tr>
<td>6000</td>
<td>531</td>
</tr>
<tr>
<td>7000</td>
<td>594</td>
</tr>
<tr>
<td>7001 and higher</td>
<td>657</td>
</tr>
<tr>
<td>up to 3000 light weight</td>
<td>512</td>
</tr>
<tr>
<td>4000 light weight</td>
<td>571</td>
</tr>
<tr>
<td>5000 light weight</td>
<td>629</td>
</tr>
</tbody>
</table>

**Notes**

(1) For concrete strengths between the stated values, use linear interpolation to determine cement and/or embodied carbon limits.

(2) Portland cement of any type per ASTM C150.

Long term – moving towards circular building material sector
GWP 20 impacts per ton of waste (kg CO2 eq.)

- Production
- IncinerationNoER
- Landfilling
- RecyclingPozzolan
- RecyclingToAggregate
- RecyclingToContainer
- RecyclingToFiberglass
- ReuseContainer

LCstage: production, endOfLifeTransport, endOfLife
materials management

conserving resources · protecting the environment · living well

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Enabling the Circular Economy in the Built Environment

The role of policymakers
How does a **circular built environment** look like?
Urban mining
Circular business models
How can policymakers enable the circular economy in the built environment?
Creating national and regional **circular economy action plans** to guide states and cities in their own programs and regulations.
Creating **educational campaigns** to raise public and stakeholders' awareness about the circular economy

Circular economy educational campaigns in Italian schools. Source: https://circulareconomy.europa.eu/

Circular economy illustration to educate stakeholders. Source: https://www.cisco.com/
Creating landfill diversion targets and zero waste policies that differentiate between reuse and recycling

Source: Amsterdam Circular Strategy

Source: Ellen MacArthur Foundation

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Incorporating circular economy principles into public procurement

CIRCULAR PROCUREMENT MODELS

1. System level

→ Product service system
→ Public Private Partnership
→ Cooperation with other organisations on sharing and reuse

→ Rent/lease
→ Supplier take-back systems including reuse, recycling, refurbishment and remanufacturing

2. Supplier Level

→ Supplier take-back system
→ Design to disassembly
→ Reparability of standard products
→ External reuse/sale of products
→ Internal reuse of products

3. Product

→ Materials in the product can be identified
→ Products can be disassembled after use
→ Recyclable materials
→ Resource efficiency and Total Cost of Ownership
→ Recycled materials

(Source: SPP Regions Best Practice Report)

Source: Public Procurement for a Circular Economy (European Commission)

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Establishing **targets for salvaged components** in new construction

10 building materials and products that can be reused. Source: ArchDaily

Resource Rows building in Copenhagen, Denmark. Source: ArchDaily
Allocating federal funding to research and development initiatives focused on circular economy

- Improving current **environmental assessment methodologies** to better address closed-loop systems
- Innovative **biobased materials**
- Innovative technologies to **disassemble** buildings
- **Material passports** technology
- Technologies and processes for **testing salvaged materials**
- Development of **metrics and indicators**
- Circular economy **pilot projects**
- Mapping **material flows and building components stocks**

Source: https://beta.nsf.gov/
Allocating federal funding for research and development initiatives focused on circular economy

Current estimated material stock for the City of Melbourne, for selected materials.
Promoting a **construction regulation reform** to incorporate circular economy strategies and eliminate burdens to material reuse

Source: https://archinect.com/
Creating fiscal incentives for circular economy

Other examples:

- Creating subsidies for companies engaging in circular economy practices
- Raising taxes on new construction
- Creating tax relief for building adaptive reuse
- Creating polluter-pays taxes for building’s embodied energy

Circular economy taxation framework
A final word: economies are for the people

Thank you!
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What did you think of the briefing?

Please take 2 minutes to let us know at:
www.eesi.org/survey

Materials will be available at:
www.eesi.org/120821waste

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