The Contractor’s Role in Reducing Upfront Embodied Carbon

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About Webcor

- $2.1 B revenue in 2019
- 1,800+ employees
- >100 million s.f. projects built to date
01 Lay the Groundwork
Understanding Carbon Emissions – Over Time

Carbon produced by a building over time:

PRESENT

OPERATIONAL CARBON

EMBODIED CARBON

YEAR 1

YEAR 60

REDUCED OPERATIONAL CARBON

Reduced by industry / technology.
Driven by LEED, CALGreen, and more efficient systems.
Understanding Carbon Emissions – Opportunity

Carbon produced by a building over time:

- **Embodied Carbon**: Initial amount of carbon produced during the construction phase.
- **Operational Carbon**: Carbon produced over the operational life of the building.

**Opportunity**

**Industry Shift / WEBCOR Opportunity**

YEAR 1

YEAR 60
How do we source low carbon materials for our buildings?

Embodied Carbon in Construction Calculator
EC3 – *What is it?*

- Carbon footprinting tool
- Utilizes product database for carbon benchmarking and product comparison
- Contractor-friendly and streamlined for quick use

[www.buildingtransparency.org](http://www.buildingtransparency.org)
Carbon Smart Estimating

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>QUANTITY</th>
<th>ESTIMATE</th>
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</thead>
</table>

EMBODIED CARBON
PER MATERIAL EPDs

BUILDING EMBODIED CARBON (EC) ESTIMATE

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**Life Cycle Impact Results (per m²)**

Declared Unit: 1 m² of 10,000 psi concrete at 28 days

<table>
<thead>
<tr>
<th>OPERATIONAL IMPACTS</th>
<th>PerformX™ Per CC 99K</th>
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</thead>
<tbody>
<tr>
<td>Plant Operating Energy (MJ)</td>
<td>38.6</td>
</tr>
<tr>
<td>On-Site Plant Fuel Consumption (MJ)</td>
<td>11.1</td>
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<tr>
<td>Concrete Batch Water (m³)</td>
<td>1.68E-01</td>
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<tr>
<td>Concrete Wash Water (m³)</td>
<td>1.91E-02</td>
</tr>
<tr>
<td>On-Site Waste Disposal (kg)</td>
<td>0.0</td>
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</table>

<table>
<thead>
<tr>
<th>ENVIRONMENTAL IMPACTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Primary Energy (MJ)</td>
</tr>
<tr>
<td>Climate Change (kg CO₂ eq)</td>
</tr>
<tr>
<td>Ozone Depletion (kg CFC 11 eq)</td>
</tr>
<tr>
<td>Acidification Air (kg SO₂ eq)</td>
</tr>
<tr>
<td>Eutrophication (kg N eq)</td>
</tr>
<tr>
<td>Photochemical Ozone Creation (kg O₃ eq)</td>
</tr>
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</table>
Using the Tool

Concrete Assessment Example – Concrete Mix Range

Search Terms: Jurisdiction: US  Plant Straight-line Distance ≤ 5 miles  Valid after: 2019-

kgCO2e embodied per 1 yd³

Selected Material

Tour

Boxplot Diagram - Selected Material

1557388, Pier 92 Amador, 4000 psi, 316 kgCO2e, 2.95 miles

--T-- My Target
Diagram Highlights Opportunities

Possible Reduction based on Database Materials
02 Upon “Mastering” the Tool
Taking it to the Next Level

- Insight into EC3 allowed us to think bigger
- Development of our corporate carbon commitment

What new norms could we directly influence as a GC?

What needed more focus within our industry?

What were local jurisdictions doing that we could build upon?
Find more info about Webcor’s implementation [here](#).

1. Employ the EC3 on all **new** projects to compare and reduce embodied carbon emissions from construction materials through informed materials selection.

2. Request and collect data on all concrete, structural steel, rebar, drywall and glass manufacturers to provide EPDs at time of bid for review as part of Webcor’s evaluation process.

3. Continue as a pilot partner of EC3 to provide tool updates based on our valuable industry expertise.

4. Go beyond the public project requirements set forth by California’s Article 5: Buy Clean California Act, establishing maximum allowable global warming potential (GWP) limits (beginning in January 2021).
03 Implementation
Critical Team

- EXECUTIVES
- SUSTAINABILITY DEPARTMENT
- CLIENTS
- DESIGN PARTNERS (STRUCTURAL ENGINEERS & ARCHITECTS)
- SELF-PERFORM GROUPS (CONCRETE & DRYWALL)
Process Roadmap

- Walk through this process for all self-perform groups (Concrete, Rebar, Drywall)
- Define decision/action points during design and construction to influence embodied carbon
  - Spec design
  - Solicitation of bids
  - Buyout and procurement of materials
Developed EPD request forms for:

- Carpet
- Ceiling Tile
- Concrete
- Rebar
- Drywall/Framing/Insulation
- Enclosure/Glazing
- Structural Steel/Metal Stairs
- Timber

**INTRODUCTION:**

Webcor Builders has partnered with the Carbon Leadership Forum and will be using the Embodied Carbon in Construction Calculator (EC3) on this project. The tool can be found and accessed online at [https://buildingtransparency.org/](https://buildingtransparency.org/).

EC3 allows users to measure the embodied carbon in specific products and materials through the use of Environmental Product Declarations (EDPs), please see example EPDs for partition assembly materials attached.

- Embodied carbon refers to carbon dioxide emitted during the manufacture, transport and construction of building materials, together with end of life emissions. An EPD is a report which lists the environmental impacts of a specific material based on a unit of measure (e.g. square foot, ton, cubic yard).

The embodied carbon measurement is to assist in reducing the embodied carbon in the project’s materials. Webcor understands this is accomplished through both the sourcing of the construction materials as well as the designer’s specifications.

When submitting your proposal, Webcor would like to evaluate the embodied carbon expected in the gage metal, stucco, wood, and other sheet goods to be installed based on the sourced products.

**ATTACHED (See Form on Next Page):**

Example EPDs for the light gauge framing, gypsum board, and other sheet goods anticipated. Please provide general information on products not yet specified. Please provide general information on products not yet specified, with what is anticipated to be installed in the project.
04 Case Studies
56-story, 1.4m sf mixed-use apartment tower
- Early coordination with GC, ready-mix supplier and design team
- Aggregate evaluation to increase compressive strength
  - Weaker option, local = > cement (OLD)
  - Premium option, Orca in BC = greater distance, < cement (NEW)

<table>
<thead>
<tr>
<th>Application</th>
<th>Description</th>
<th>Est. Project Quantity</th>
<th>Est. Project Quantity</th>
<th>GWP per unit</th>
<th>Total GWP</th>
<th>ODP</th>
<th>AP</th>
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<tr>
<td>OLD Mat Foundation</td>
<td>1” 6000PSI PU PL F’c @ 56 DAY</td>
<td>17,860</td>
<td>600</td>
<td>200</td>
<td>428</td>
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Total GWP Savings: 11,779,690
Private Client, Northern California

- Cost and schedule evaluation for two proposed designs
  - Reinforced concrete core walls
  - Composite steel/concrete plate shear walls
- Evaluated the embodied carbon impact via EC3
- Presented to client aligned with cost estimate

<table>
<thead>
<tr>
<th>OPTIONS</th>
<th>BASE ESTIMATE - CORE WALLS</th>
<th>DESIGN ALTERNATE - CORE WALLS</th>
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<tbody>
<tr>
<td>Core Walls</td>
<td>Reinforced Concrete Wall</td>
<td>Composite Plate Shear Wall</td>
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<td>Core Walls - Steel Surface Area (SF), Ext.</td>
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<tr>
<td>Core Walls - Steel Surface Area (SF), Int.</td>
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<td>Levels</td>
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<th>DESIGN ALTERNATE</th>
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<tr>
<td>Concrete w/ rebar &amp; formwork (inc. core fill, FOMD)</td>
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<td>Metal Deck</td>
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<td>Steel Core + framing</td>
<td>$44,916,237</td>
<td>$51,207,822</td>
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</table>

EMBODIED CARBON TOTAL: 110,704,964
EMBODIED CARBON DELTA: (12,991,853)

- The Composite Plate Shear Wall Design Alternate has less embodied carbon than the typical concrete core wall design included in the base estimate.
- This embodied carbon reduction is similar to removing 31.8 million miles driven by a passenger car;
- Removing 2,758 cars off the road for one year.
Private Client, Northern California

- Cost and schedule evaluation for two proposed designs
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### Options

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<tr>
<td>Metal Deck</td>
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<td>$</td>
<td></td>
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<tr>
<td>Steel Core + framing</td>
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<tr>
<td>Excavation Modifications</td>
<td>$</td>
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### Carbon Analysis - Estimate

- The Composite Plate Shear Wall Design Alternate has less embodied carbon than the typical concrete core wall design included in the base estimate. 
- This embodied carbon reduction is similar to removing 31.8 million miles driven by a passenger car or;
- Removing 2,758 cars off the road for one year.

### Design Alternate - Core Walls

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<tr>
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<th>Composite Plate Shear Wall</th>
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</thead>
<tbody>
<tr>
<td>B1-L33</td>
<td>262067</td>
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<tr>
<td></td>
<td>226404</td>
</tr>
<tr>
<td></td>
<td>B1-L33</td>
</tr>
</tbody>
</table>

### Embodied Carbon Analysis - Design Alternate

- Unit of Measure is kCO2e

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<tr>
<th>Embodied Carbon Analysis - Design Alternate</th>
<th>42,061,609</th>
<th>4,443,680</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>51,207,822</td>
<td></td>
</tr>
</tbody>
</table>
Continue Momentum

• Continuous Improvement
• Expand assessment portfolio
• Expand overall emissions impact considerations holistically
  • Collaborate with AEC network throughout lifecycle
  • Move the market upstream, leveraging relationship with suppliers/manufacturers

• Keep the conversation going!
Thank You!

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