Whole Building Life Cycle Assessment of a mass timber office structure

including & excluding biogenic carbon

Whole Building Life Cycle Assessment

Several whole building life cycle assessment (WBLCA) were carried out for the District Office using two different WBLCA tools, with carbon accounting focused on the building's end-of-life, and the Altus Impact Estimator for Buildings from Athena Sustainable Materials Institute. This poster details the results calculated using Tally's Tally® software, with a results module including and excluding biogenic carbon.

Scope is limited to the building's structure and foundations:

- CLT roof structure
- CLT panel cores
- CLT columns and beams
- CLT floor systems
- concrete foundations
- one level of underground parking

Scope includes:

- building envelope, finishes, mechanical, electrical, lighting, plumbing connections, territories, concrete framework and network

This WBLCA includes

- this WBLCA excludes

DISTRICT OFFICE

Location: Portland, OR
Architects: Hacker Architects
Structural Engineer: USDA
Gross Area: 3,925 ft² (362 m²)
Height: 2 stories
Use: commercial offices, retail, parking
Reference Service Life for WBLCA: 75 years

Embodied Carbon

**Excluding biogenic carbon**

<table>
<thead>
<tr>
<th>Material Type</th>
<th>GWP per Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLU &amp; CLT</td>
<td>24%</td>
</tr>
<tr>
<td>Concrete &amp; CMU</td>
<td>35%</td>
</tr>
<tr>
<td>Metals</td>
<td>4%</td>
</tr>
</tbody>
</table>

**Including biogenic carbon**

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<th>Material Type</th>
<th>GWP per Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLU &amp; CLT</td>
<td>-7%</td>
</tr>
<tr>
<td>Concrete &amp; CMU</td>
<td>58%</td>
</tr>
<tr>
<td>Metals</td>
<td>3%</td>
</tr>
</tbody>
</table>

**Embodied Carbon**

<table>
<thead>
<tr>
<th>Building Area</th>
<th>GWP per sq m</th>
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<tr>
<td>9,817 g/m²</td>
<td>246</td>
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</table>

**Global Warming Potential kg CO₂eq per m²**

<table>
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<tr>
<th>Initial GWP</th>
<th>Total GWP</th>
</tr>
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<tbody>
<tr>
<td>246</td>
<td>300</td>
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**Embodied Carbon**

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**Global Warming Potential kg CO₂eq per m²**

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<td>204</td>
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</tbody>
</table>

**Benefits and Potential**

- GWP per stage module
  - end-of-life
    - material extraction and production
  - transport
  - energy & water

**System Boundaries**

- **Input**
  - Fuel, electricity, water, raw materials, etc.
- **Output**
  - Air emissions, water emissions, solid waste emissions

**Impacts**

- Acidification
- Eutrophication
- Ozone depletion
- Smog formation
- Global warming potential
- Energy demand

**Report**

- Whole Building WBLCA (whole building life cycle assessment) EED (environmental declaration document)

**Research Team**

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