Environmental Product Declaration

EPD for Cross Laminated Timber produced by Vaagen Timbers in Colville, WA.
## ASTM Certified Environmental Product Declaration

### Program Operator

**ASTM International**  
100 Barr Harbor Drive  
PO Box C700  
West Conshohocken, PA,  
19428-2959 USA  
www.astm.org

### General Program Instructions and Version Number

ASTM Program Operator for Product Category Rules (PCR) and Environmental Product Declarations (EPDs) - General Program Instructions, version: 8.0

### Declaration Owner

**Vaagen Timbers, LLC**  
1245 N. Highway  
Colville, WA 99114 USA  
Vaagentimbers.com

### Declaration Number

EPD 168

### Declared Product

Cross Laminated Timber (CLT)

### Declared Unit

1 m³ of CLT produced at Vaagen Timbers facility in Colville, WA

### Reference PCR and Version Number

- **ISO 21930:2017** Sustainability in Building Construction — Environmental Declaration of Building Products. [9]
- **UL Environment**: Product Category Rules for Building-Related Products and Services  
  **Part A**: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report, v3.2 [13]  
  **Part B**: Structural and Architectural Wood Products EPD Requirements, v1.0 [14]

### Description of Product’s intended application and use

Crosslam CLT is an engineered wood product with high structural strength and stability. It can be used as building material for any floor, wall, roof, or core construction.

### Markets of Applicability

Construction Sector, Mass timber design

### Date of Issue

April 15, 2021

### Period of Validity

April 15, 2026

### EPD Type

Product-specific EPD

### EPD Scope

Cradle to Gate

### Year of reported manufacturer primary data

2019

### LCA Software

SimaPro v8.5

### LCI Databases

USLCI [11], Ecoinvent 3.5 [15], Datasmart [10]

### LCIA Methodology

TRACI 2.1 [5]

### The sub-category PCR review was conducted by:

- **Dr. Thomas Gloria** (chair)  
  Industrial Ecology Consultants
- **Dr. Indro Ganguly**  
  University of Washington
- **Dr. Sahoo**  
  University of Georgia
**LCA and EPD Developer**  
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:  

* Athena Sustainable Materials Institute  
  280 Albert Street, Suite 404  
  Ottawa, Ontario  
  Canada K1P 5G8  
  www.athenasmi.org

James Salazar

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<table>
<thead>
<tr>
<th><strong>Independent Verifier</strong></th>
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<tbody>
<tr>
<td>This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
| Dr. Thomas Gloria  
  Industrial Ecology Consultants |  

<table>
<thead>
<tr>
<th><strong>Limitations</strong></th>
</tr>
</thead>
</table>
| ● Environmental declarations from different programs (ISO 14025) may not be comparable.  
● Comparison of the environmental performance using EPD information shall consider all relevant information modules over the full life cycle of the products within the building.  
● This PCR allows EPD comparability only when the same functional requirements between products are ensured and the requirements of ISO 21930:2017 §5.5 are met. It should be noted that different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared. |
COMPANY AND PRODUCT DESCRIPTION

Vaagen Timbers, LLC
Vaagen Timbers, LLC is a manufacturer of engineered wood products. Two of the company’s main products are cross laminated timber (CLT) and glued laminated timber (glulam).

CLT
CLT is an engineered wood product consisting of several alternating layers of kiln-dry dimensional lumber glued together. Panels typically consist of three, five, seven or nine layers. CLT has a high strength to weight ratio and shows advantages for structural, fire, thermal and acoustic performance. [3]
The main product components of CLT are dimensional softwood lumber (98%) and various resins (2%). The softwood lumber used for CLT production is derived from sustainable managed forests in Washington (See below ‘Treatment of biogenic carbon and sustainable forest management certification’).

METHODOLOGICAL FRAMEWORK

Type of EPD and Life Cycle Stages
The underlying LCA [5] investigates the CLT product system from cradle to gate. This comprises the production stage including the information modules ‘A1 Extraction and upstream production’, ‘A2 Transport to factory’ and ‘A3 Manufacturing’ (Figure 1).

<table>
<thead>
<tr>
<th>Production stage</th>
<th>Construction Stage</th>
<th>Use stage</th>
<th>End-of-life stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extraction and upstream production</td>
<td>Transport to factory</td>
<td>Installation</td>
<td>Use</td>
</tr>
<tr>
<td>Transport to site</td>
<td>Use</td>
<td>Maintenance</td>
<td>Repair</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>Replacement</td>
<td>Refurbishment</td>
<td>Operational Energy Use</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Operation Water Use</td>
<td>De-Construction/Demolition</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transport to waste processing or disposal</td>
<td>Waste processing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Waste processing</td>
<td>Disposal</td>
</tr>
</tbody>
</table>

A1 A2 A3 A4 A5 B1 B2 B3 B4 B5 B6 B7 C1 C2 C3 C4
X X X MND MND MND MND MND MND MND MND MND MND MND

Figure 1 Life Cycle Stages and Information Modules per ISO 21930:2017. (MND: module not declared)
System Boundaries and Product Flow Diagram

The product system described in Figure 2 includes the following information modules and unit processes:

**A1 Extraction and upstream production**
A1 includes the cradle-to-gate production of softwood lumber and resins that are used in CLT manufacture. The upstream resource extraction includes removal of raw materials and processing, processing of secondary material input (e.g., recycling processes) after crossing the system boundary of the previous product system. A1 also includes reforestation processes that include nursery operations (which include fertilizer, irrigation, energy for greenhouses if applicable etc.), site preparation, as well as planting, fertilization, thinning and other management operations.

**A2 Transport to facility**
Average or specific transportation of raw materials (including secondary materials and fuels) from extraction site or source to manufacturing site (including any recovered materials from source to be recycled in the process).

**A3 Manufacturing**
Manufacturing of the CLT product, including packaging (lumber wrap).

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**Figure 2: Cradle-to-Gate CLT Product System**
Declared Unit
Table 1 shows the declared unit and additional product information.

<table>
<thead>
<tr>
<th>Table 1: Declared Unit and Product Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Declared Unit</strong></td>
</tr>
<tr>
<td>The declared unit is “the production of one cubic meter (1 m³) of CLT produced at Vaagen Timbers facility in Colville, WA”</td>
</tr>
<tr>
<td><strong>Property</strong></td>
</tr>
<tr>
<td>Mass</td>
</tr>
<tr>
<td>Moisture Content</td>
</tr>
<tr>
<td><strong>Product Composition</strong></td>
</tr>
<tr>
<td>Softwood Lumber</td>
</tr>
<tr>
<td>Resins</td>
</tr>
</tbody>
</table>

Allocation Methods
Allocation is the method used to partition the environmental load of a process when several products or functions share the same process. The Vaagen Timbers facility in Colville produces CLT and glulam products. In accordance with UL PCR 2019, the environmental load among these products is allocated according to its mass. Furthermore, the manufacturing process does produce wood waste that is transferred for free to downstream users. No environmental burden has been allocated to these wastes. A detailed explanation of the allocation methodology of upstream lumber production is provided in the lumber LCA project report.

Cut-off Criteria
The cut-off criteria for all activity stage flows considered within the system boundary conform with ISO 21930: 2017 Section 7.1.8. Specifically, the cut-off criteria were applied as follows:

- All inputs and outputs for which data are available are included in the calculated effects and no collected core process data are excluded.
- A one percent cut-off is considered for renewable and non-renewable primary energy consumption and the total mass of inputs within a unit process. The sum of the total neglected flows does not exceed 5% of all energy consumption and mass of inputs.
- All flows known to contribute a significant impact or to uncertainty are included.
- The cut-off rules are not applied to hazardous and toxic material flows – all of which are included in the life cycle inventory.

No material or energy input or output was knowingly excluded from the system boundary.

Data Sources
Primary and secondary data sources, as well as the respective data quality assessment are documented in the underlying LCA project report in accordance with UL PCR 2019.

This EPD estimates the impacts of forest management by the weighted industry average LCA of Pacific Northwest softwood lumber.
Third party verified ISO 14040/44 secondary LCI data sets contribute more than 67% of total impact to any of the required impact categories identified by the applicable PCR.

Treatment of Biogenic Carbon and Sustainable Forest Management Certification

Biogenic carbon emissions and removals are reported in accordance with ISO 21930 7.2.7. and 7.2.12. Detailed information is provided in the underlying LCA in Section 2.5.

ISO 21930 requires a demonstration of forest sustainability to characterize carbon removals with a factor of -1 kg CO2e/kg CO2. ISO 21930 Section 7.2.11 Note 2 states the following regarding demonstrating forest sustainability: “Other evidences such as national reporting under the United Nations Framework Convention on Climate Change (UNFCCC) can be used to identify forests with stable or increasing forest carbon stocks.” The United States UNFCCC annual report Table 6-1 provides annual NET GHG Flux Estimates for different land use categories. This reporting indicates non-decreasing forest carbon stocks and thus the source forests meet the conditions for characterization of removals with a factor of -1 kg CO2e/kg CO2.

Table 3 provides additional inventory parameters related to biogenic carbon removal and emissions.

ENVIRONMENTAL PARAMETERS DERIVED FROM LCA

Table 2 presents the LCIA and LCI parameter results for the declared unit of 1 m³ of CLT. The impact categories and characterization factors (CF) for the LCIA were derived from the U.S. EPA Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts -TRACI 2.1 [5].

The total primary energy consumption is tabulated from the LCI results based on the Cumulative Energy Demand Method published by ecoinvent [15]. Lower heating value of primary energy carriers is used to calculate the primary energy values reported in the study.

Other inventory parameters concerning material use, waste, water use and biogenic carbon were drawn from the LCI results. We followed the ACLCA’s Guidance to Calculating non-LCIA Inventory Metrics in accordance with ISO 21930:2017 [1].

SimaPro v8.5 [12] was used to organize and accumulate the LCI data, and to calculate the LCIA results.
Table 2: LCIA Results Summary for Cradle-to-Gate production of 1 m³ of CLT

<table>
<thead>
<tr>
<th>Core Mandatory Impact Indicator</th>
<th>Total</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global warming potential – TRACI 2.1</td>
<td>GWPTRACI kg CO2e</td>
<td>136.11</td>
<td>88.75</td>
<td>2.16</td>
</tr>
<tr>
<td>Global warming potential – w/ biogenic CO2</td>
<td>GWPBIO kg CO2e</td>
<td>136.11</td>
<td>-850.23</td>
<td>2.16</td>
</tr>
<tr>
<td>Depletion potential of the stratospheric ozone layer</td>
<td>ODP kg CFC11e</td>
<td>8.97E-06</td>
<td>5.69E-06</td>
<td>9.12E-11</td>
</tr>
<tr>
<td>Acidification potential of soil and water sources</td>
<td>AP kg SO2e</td>
<td>0.90</td>
<td>0.70</td>
<td>0.03</td>
</tr>
<tr>
<td>Eutrophication potential</td>
<td>EP kg Ne</td>
<td>0.54</td>
<td>0.24</td>
<td>0.00</td>
</tr>
<tr>
<td>Formation potential of tropospheric ozone</td>
<td>SFP kg O3e</td>
<td>19.31</td>
<td>16.64</td>
<td>0.64</td>
</tr>
<tr>
<td>Abiotic depletion potential (ADPfossil) for fossil resources;</td>
<td>ADPf MJ, NCV</td>
<td>1,968.13</td>
<td>1,353.78</td>
<td>30.99</td>
</tr>
<tr>
<td>Fossil fuel depletion</td>
<td>FFD MJ Surplus</td>
<td>244.87</td>
<td>178.25</td>
<td>4.58</td>
</tr>
</tbody>
</table>

Use of Primary Resources

<table>
<thead>
<tr>
<th>Use of Primary Resources</th>
<th>RPRE MJ, NCV</th>
<th>2,619.65</th>
<th>2,619.65</th>
<th>0.00</th>
<th>0.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renewable primary energy carrier used as material</td>
<td>RPRM MJ, NCV</td>
<td>13,784.07</td>
<td>13,012.37</td>
<td>32.85</td>
<td>738.85</td>
</tr>
<tr>
<td>Non-renewable primary energy carrier used as energy</td>
<td>NRPRE MJ, NCV</td>
<td>910.13</td>
<td>910.13</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Non-renewable primary energy carrier used as material</td>
<td>NRPRM MJ, NCV</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Secondary Material, Secondary Fuel and Recovered Energy

<table>
<thead>
<tr>
<th>Secondary Material, Secondary Fuel and Recovered Energy</th>
<th>SM kg</th>
<th>0.00</th>
<th>0.00</th>
<th>0.00</th>
<th>0.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renewable secondary fuel</td>
<td>RSF MJ, NCV</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Non-renewable secondary fuel</td>
<td>NRSF MJ, NCV</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Recovered energy</td>
<td>RE MJ, NCV</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Mandatory Inventory Parameters

<table>
<thead>
<tr>
<th>Mandatory Inventory Parameters</th>
<th>FW m3</th>
<th>0.19</th>
<th>0.03</th>
<th>0.00</th>
<th>0.17</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption of freshwater resources</td>
<td>HWD kg</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Hazardous waste disposed</td>
<td>NHWD kg</td>
<td>23.51</td>
<td>0.00</td>
<td>0.00</td>
<td>23.51</td>
</tr>
<tr>
<td>Non-hazardous waste disposed</td>
<td>HLRW m3</td>
<td>6.56E-08</td>
<td>1.43E-08</td>
<td>0.00E+00</td>
<td>5.13E-08</td>
</tr>
<tr>
<td>High-level radioactive waste, conditioned, to final repository</td>
<td>ILLRW m3</td>
<td>5.48E-07</td>
<td>5.88E-07</td>
<td>0.00E+00</td>
<td>4.79E-07</td>
</tr>
<tr>
<td>Intermediate- and low-level radioactive waste, conditioned, to final repository</td>
<td>CRU kg</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Components for re-use</td>
<td>MR kg</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Materials for recycling</td>
<td>MER kg</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Materials for energy recovery</td>
<td>EE MJ, NCV</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>
To ensure transparency Table 3 shows additional inventory parameters related to biogenic carbon removal and emissions. The carbon dioxide flows are presented unallocated to consider co-products leaving the product system in information module A3. Even though, the system boundary of this study included only the information modules A1-A3, in accordance with ISO 21930, BCEK was reported in A5 and BCEP of the main product in C3/C4.

The net carbon emission across the entire life cycle is zero. It is assumed that all carbon removed from the atmosphere is eventually emitted to the atmosphere as CO2. Total $GWP_{\text{BIO}}$ includes biogenic carbon emissions and removals from the information modules A1-A3, A5 and C3/C4, leading to a net zero contribution of biogenic carbon to $GWP_{\text{BIO}}$. Therefore, in Table 2, results for total $GWP_{\text{TRACI}}$ and total $GWP_{\text{BIO}}$ are equal.

Table 3: Biogenic carbon inventory parameters for CLT

<table>
<thead>
<tr>
<th>Additional Inventory Parameters</th>
<th>Total</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A5</th>
<th>C3/C4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biogenic Carbon Removal from Product</td>
<td>BCRP</td>
<td>kg CO2</td>
<td>-938.98</td>
<td>-938.98</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Biogenic Carbon Emission from Product</td>
<td>BCEP</td>
<td>kg CO2</td>
<td>938.98</td>
<td>-</td>
<td>-</td>
<td>128.46</td>
</tr>
<tr>
<td>Biogenic Carbon Removal from Packaging</td>
<td>BCRK</td>
<td>kg CO2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Biogenic Carbon Emission from Packaging</td>
<td>BCEK</td>
<td>kg CO2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Biogenic Carbon Emission from Combustion of Waste from Ren. Sources Used in Production</td>
<td>BCEW</td>
<td>kg CO2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Net biogenic carbon emission</td>
<td>kg CO2</td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

INTERPRETATION AND LIMITATIONS

Comparability

Environmental declarations from different programs (ISO 14025) may not be comparable. Comparison of the environmental performance using EPD information shall consider all relevant information modules over the full life cycle of the products within the building.

This PCR allows EPD comparability only when the same functional requirements between products are ensured and the requirements of ISO 21930:2017 §5.5 are met. In addition, to be compared EPDs must comply with the same core and sub-category PCRs (Part A and B) and include all relevant information modules. It should be noted that different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

Forest Management

While this EPD does not address landscape level forest management impacts, potential impacts may be addressed through requirements put forth in regional regulatory frameworks, ASTM 7612-15 guidance, and ISO 21930 Section 7.2.11 including notes therein. These documents, combined with this EPD, may provide a more complete picture of environmental and social performance of wood products.

While this EPD does not address all forest management activities that influence forest carbon, wildlife habitat, endangered species, and soil and water quality, these potential impacts may be addressed through other mechanisms such as regulatory frameworks and/or forest certification systems which, combined with this EPD, will give a more complete picture of environmental and social performance of wood products.
Scope of the EPD
EPDs can complement but cannot replace tools and certifications that are designed to address environmental impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, etc.

Data
National or regional life cycle averaged data for raw material extraction does not distinguish between extraction practices at specific sites and can greatly affect the resulting impacts.

Accuracy of Results
EPDs regularly rely on estimations of impacts; the level of accuracy in estimation of effect differs for any particular product line and reported impact when averaging data.

ADDITIONAL ENVIRONMENTAL INFORMATION
Information should be provided in this section on the relationship between the product, the environment and health, including any possible harmful substances or emissions e.g. reference to a product safety data sheet (SDS).

EXTRAORDINARY EFFECTS
- **FIRE**
  Information should be included on the product’s fire test response characteristics and possible impacts on the environment e.g. reaction-to-fire, other relevant fire tests as applicable, and emissions to air.
- **WATER**
  Information should be included on the product’s performance and possible impacts on the environment following unforeseeable influence of water, e.g. flooding.
- **MECHANICAL DESTRUCTION**
  Information should be included on the product’s performance and possible impacts on the environment following unforeseeable mechanical destruction, such as an earthquake.

ENVIRONMENTAL ACTIVITIES AND CERTIFICATIONS
- Categorization of sources of wood fiber according to their forest management or certification systems may be provided in accordance with ASTM D7612-10.
- Other environmental activities, such as participation in recycling or recovery programs along with the details of these programs and contact information, may be provided.
- For certifications applied to the product and listed in the EPD, a statement shall be included on where an interested party can find details of the certification program.

FURTHER INFORMATION
- A reference source for additional information, e.g. safety data sheet.
REFERENCES


12. PRé Consultants BV (2018) SimaPro v8.5 LCA Software

