Workshop

Full building summary

1/7/2025

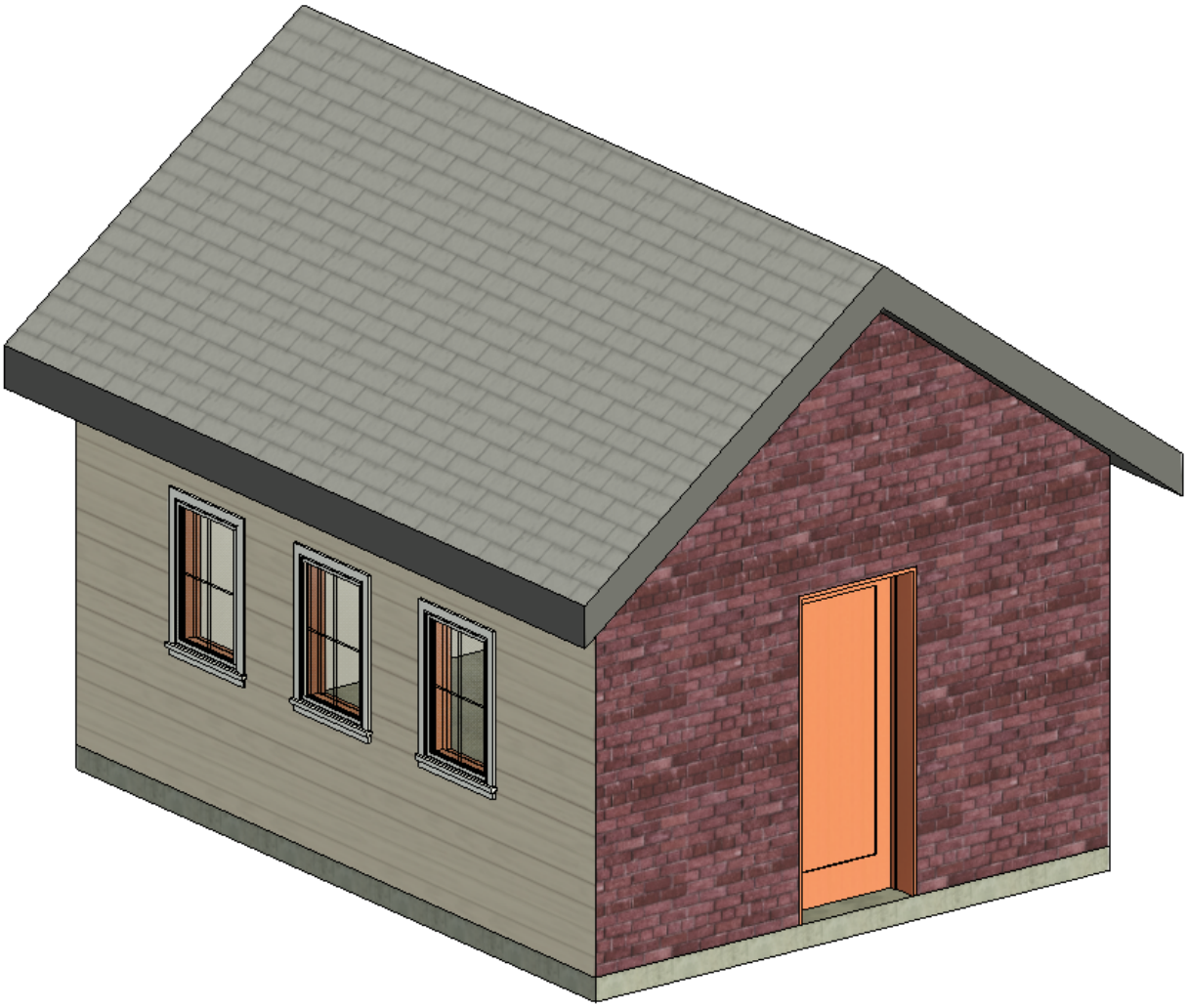

Table of Contents

Report Summary

Created with Tally
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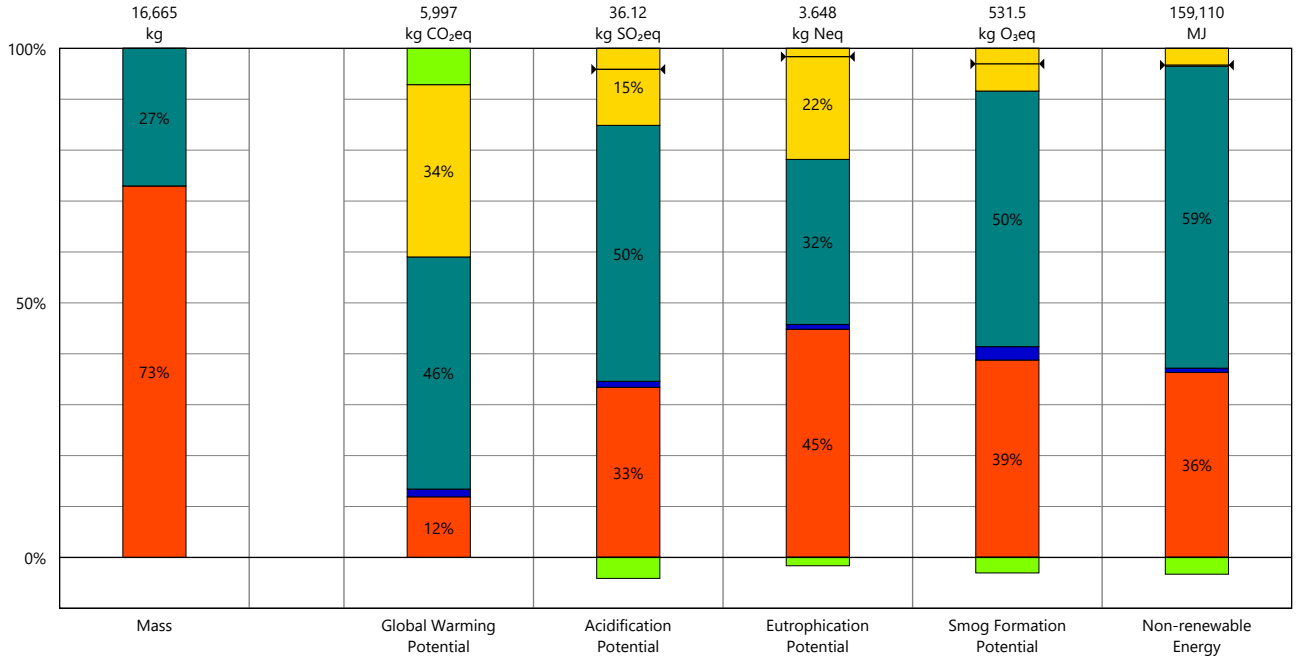
Author	Dillon McBride
Company	CTE Center - CEA
Date	1/7/2025
Project	Workshop
Location	Enter address here
Gross Area	192 ft^2
Building Life	80 years
Boundaries	Cradle to grave, inclusive of biogenic carbon; see appendix for a full list of materials and processes

Goal and Scope of Assessment
This is a report on the embodied carbon of the workshop included in the life cycle of the full building

Environmental Impact Totals	Product Stage [A1-A3]	Construction Stage [A4]	Use Stage [B2-B5]	End of Life Stage [C2-C4]	Module D [D]
Global Warming (kg CO_2eq)	713.7	91.40	2,735	2,030	428.0
Acidification (kg SO_2eq)	12.07	0.4235	18.16	5.464	-1.49
Eutrophication (kg Neq)	1.635	0.03449	1.183	0.796	-0.05973
Smog Formation (kg O_3eq)	206.1	14.00	266.9	44.61	-16.2
Ozone Depletion (kg CFC-11eq)	1.988E-005	3.130E-012	1.498E-005	6.740E-011	-1.418E-006
Primary Energy (MJ)	71,658	1,329	110,193	6,005	-10,385
Non-renewable Energy (MJ)	57,855	1,297	94,341	5,616	-5,246
Renewable Energy (MJ)	13,811	32.14	15,875	393.2	-5,123
Environmental Impacts / Area					
Global Warming (kg CO_2eq/m^2)	40.01	5.124	153.3	113.8	24.00
Acidification (kg SO_2eq/m^2)	0.6767	0.02374	1.018	0.3063	-0.08342
Eutrophication (kg Neq/m^2)	0.09165	0.001933	0.06632	0.04462	-0.003349
Smog Formation (kg O_3eq/m^2)	11.55	0.7846	14.96	2.501	-0.9092
Ozone Depletion (kg CFC-11eq/m^2)	1.115E-006	1.755E-013	8.399E-007	3.778E-012	-7.951E-008
Primary Energy (MJ/m^2)	4,017	74.52	6,178	336.7	-582
Non-renewable Energy (MJ/m^2)	3,243	72.73	5,289	314.9	-294
Renewable Energy (MJ/m^2)	774.3	1.802	890.0	22.05	-287

Results per Life Cycle Stage

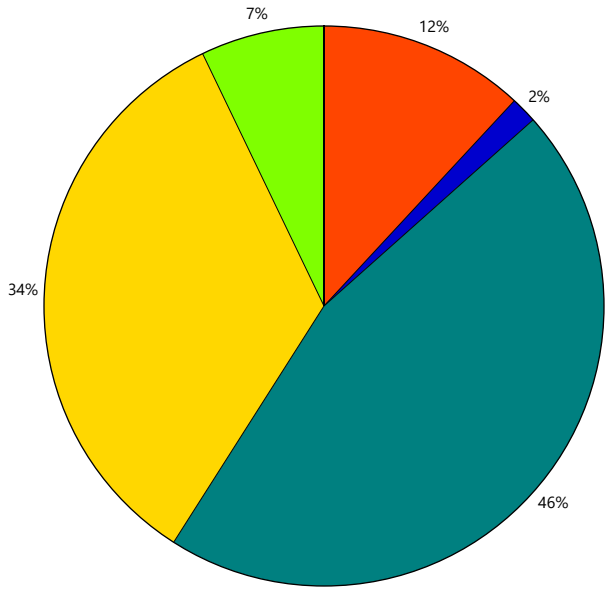


Legend

Net value (impacts + credits)

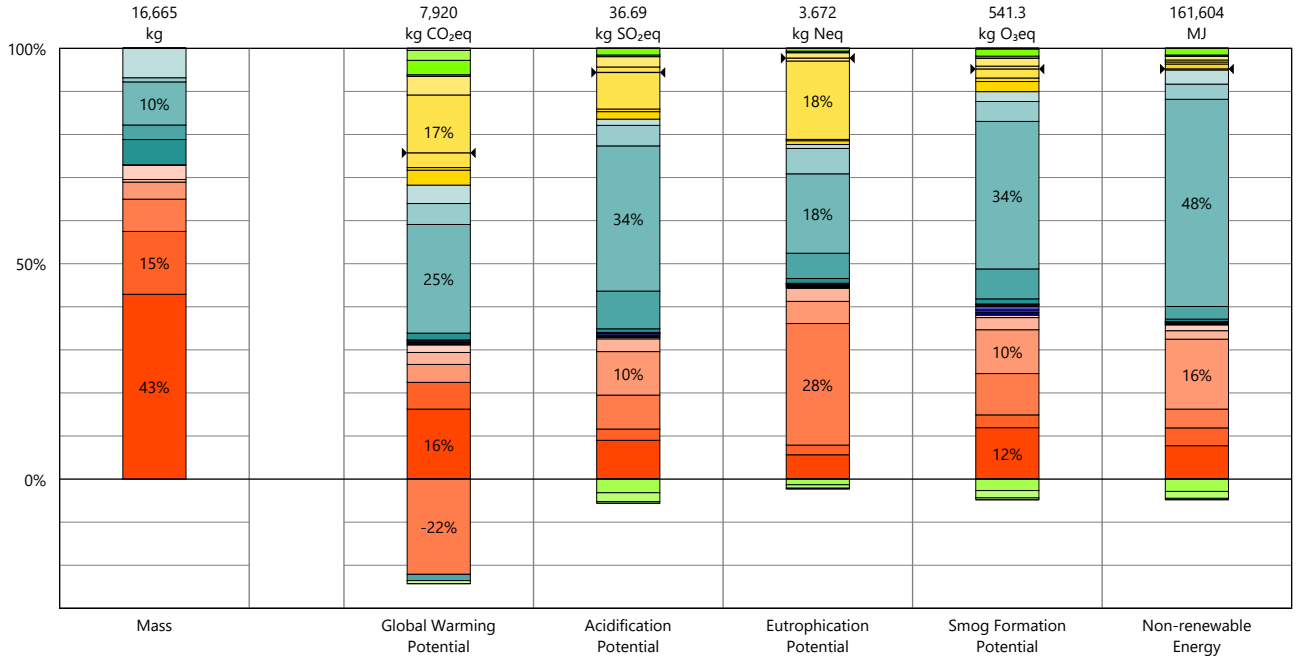
Life Cycle Stages

- Product [A1-A3]
- Transportation [A4]
- Maintenance and Replacement [B2-B5]
- End of Life [C2-C4]
- Module D [D]



Global Warming Potential

Results per Life Cycle Stage, itemized by Division



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Net value (impacts + credits)

Product [A1-A3]
- 03 - Concrete
- 04 - Masonry
- 06 - Wood/Plastics/Composites
- 07 - Thermal and Moisture Protection
- 08 - Openings and Glazing
- 09 - Finishes

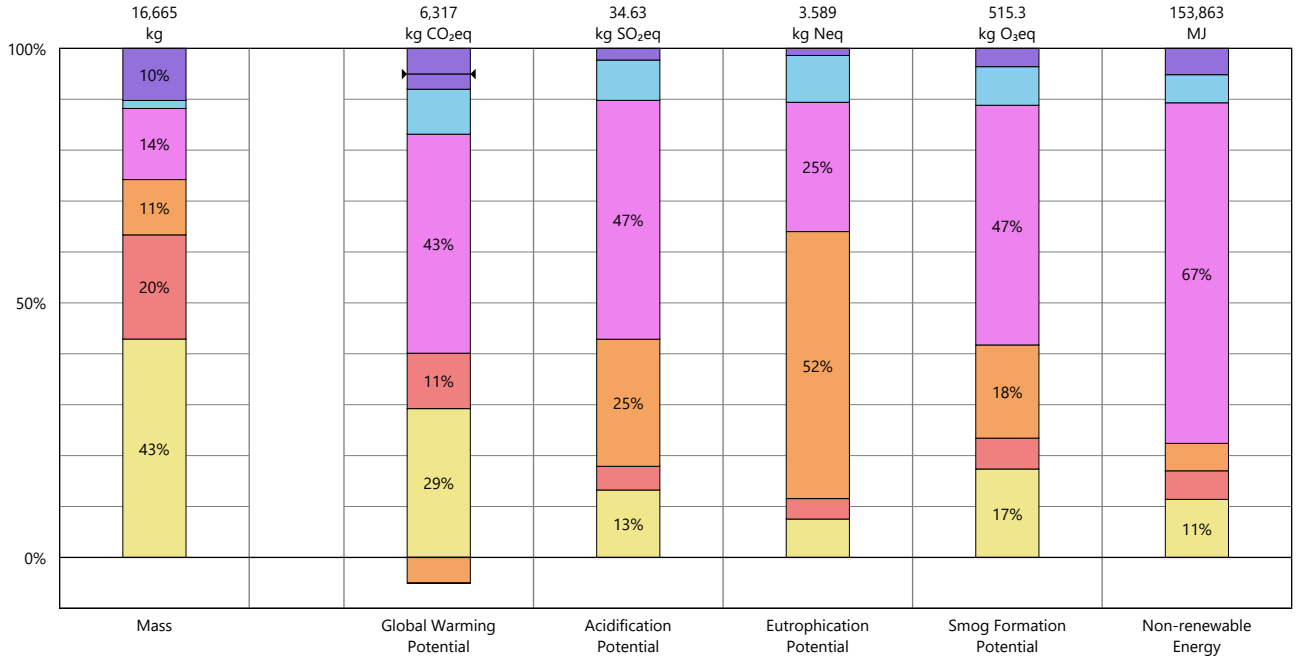
Transportation [A4]
- 03 - Concrete
- 04 - Masonry
- 06 - Wood/Plastics/Composites
- 07 - Thermal and Moisture Protection
- 08 - Openings and Glazing
- 09 - Finishes

Maintenance and Replacement [B2-B5]
- 03 - Concrete
- 04 - Masonry
- 06 - Wood/Plastics/Composites
- 07 - Thermal and Moisture Protection
- 08 - Openings and Glazing
- 09 - Finishes

End of Life [C2-C4]
- 03 - Concrete
- 04 - Masonry
- 06 - Wood/Plastics/Composites
- 07 - Thermal and Moisture Protection
- 08 - Openings and Glazing
- 09 - Finishes

Module D [D]
- 03 - Concrete
- 04 - Masonry
- 06 - Wood/Plastics/Composites
- 07 - Thermal and Moisture Protection
- 08 - Openings and Glazing
- 09 - Finishes

Results per Division

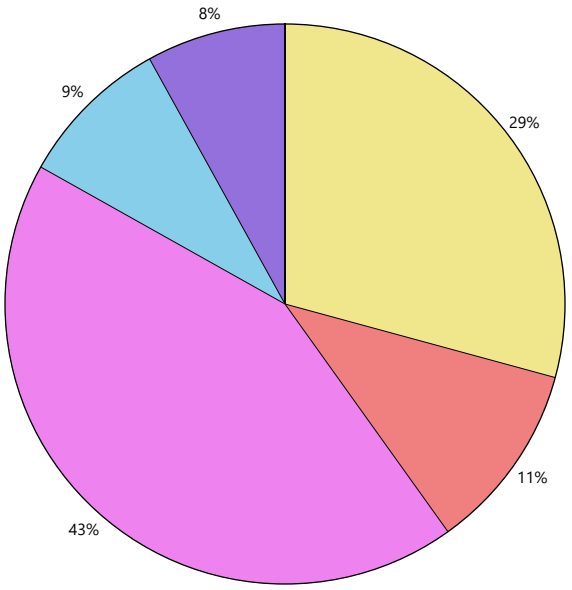


Legend

Net value (impacts + credits)

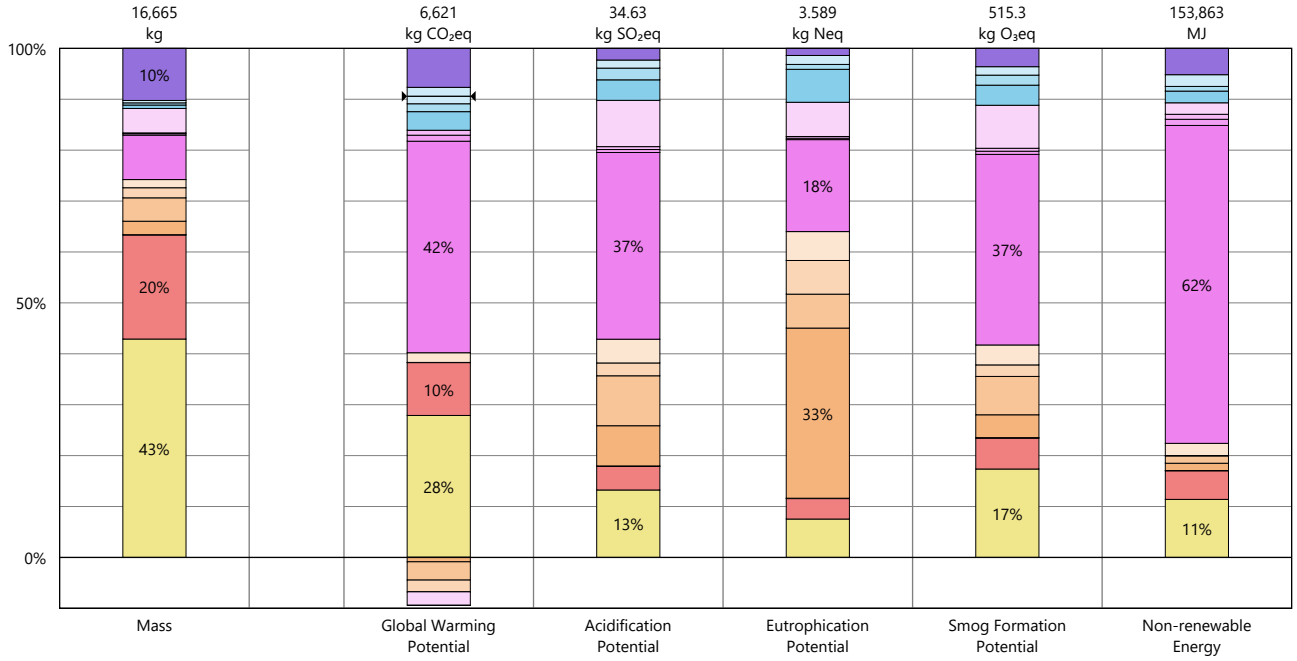
Divisions

- 03 - Concrete
- 04 - Masonry
- 06 - Wood/Plastics/Composites
- 07 - Thermal and Moisture Protection
- 08 - Openings and Glazing
- 09 - Finishes



Global Warming Potential

Results per Division, itemized by Tally Entry



Legend

Net value (impacts + credits)

03 - Concrete
- Cast-in-place concrete, structural concrete, 3000 psi

04 - Masonry
- Brick

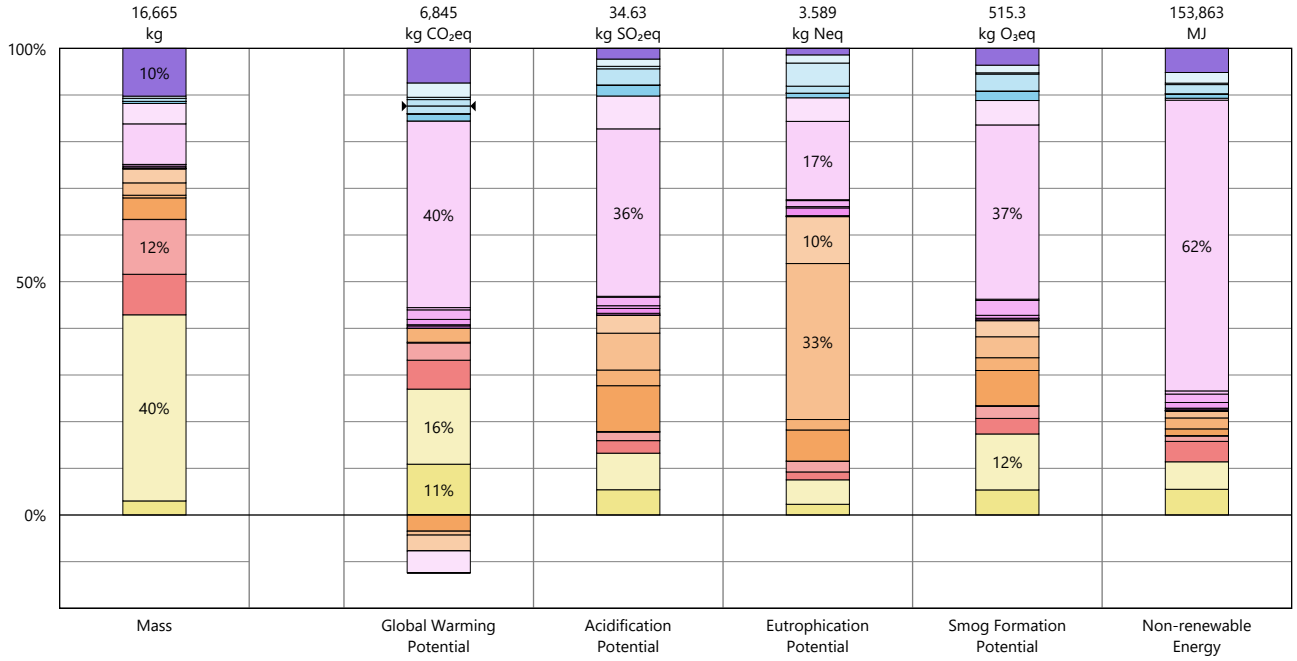
06 - Wood/Plastics/Composites
- Domestic hardwood
- Oriented strandboard (OSB)
- Plywood, exterior grade
- Wood framing
- Wood framing with insulation

07 - Thermal and Moisture Protection
- Asphalt roofing shingles
- Fluid applied synthetic polymer air barrier
- Polyethelene sheet vapor barrier (HDPE)
- Wood siding

08 - Openings and Glazing
- Door, exterior, steel
- Glazing, double pane IGU
- Window frame, vinyl

09 - Finishes
- Wall board, gypsum

Results per Division, itemized by Material



Legend

Net value (impacts + credits)

03 - Concrete

- Steel, concrete reinforcing steel, CMC - EPD
- Structural concrete, 3000 psi, South Central regional average

04 - Masonry

- Glazed brick, generic
- Mortar type N
- Steel, reinforcing rod | GLO

06 - Wood/Plastics/Composites

- Exterior grade plywood, US (deprecated)
- Fiberglass blanket insulation, paper faced
- Oriented Strand Board (OSB) | US, CA | iEPD
- Softwood Lumber | US, CA | iEPD
- White oak lumber, 1 inch
- Wood stain, water based

07 - Thermal and Moisture Protection

- Fasteners, galvanized steel
- Fasteners, stainless steel
- Fluid applied synthetic polymer air barrier
- Paint, exterior acrylic latex
- Polyethelene sheet vapor barrier (HDPE)
- SBS modified asphalt, strip, ARMA - EPD
- Softwood Lumber | US, CA | iEPD (expired)

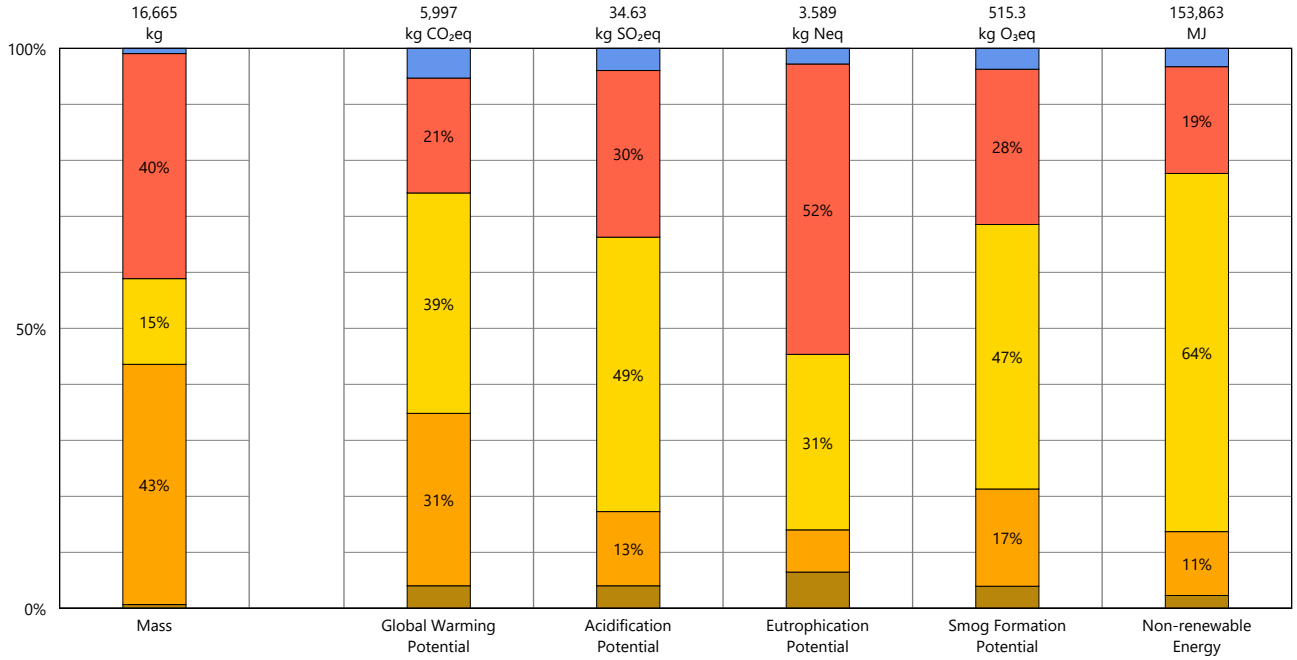
08 - Openings and Glazing

- Glazing, double, insulated (air)
- Hardware, aluminum
- Hardware, zinc
- Hollow door, exterior, steel, galvanized
- Steel door hinge
- Window frame, vinyl, fixed

09 - Finishes

- Wall board, gypsum, natural

Results per Revit Category



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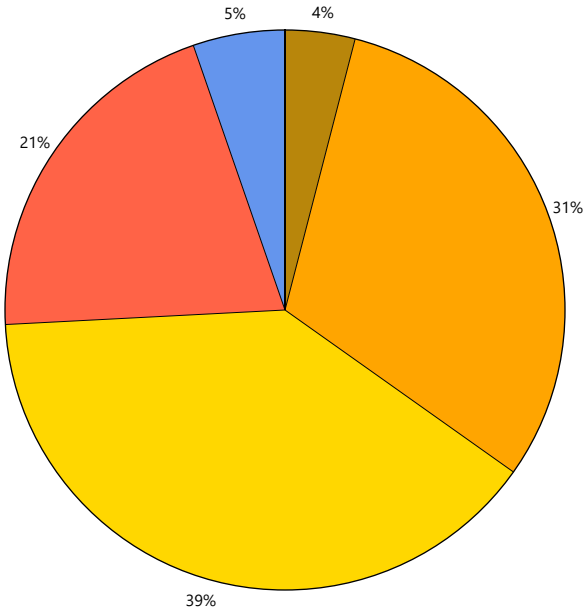
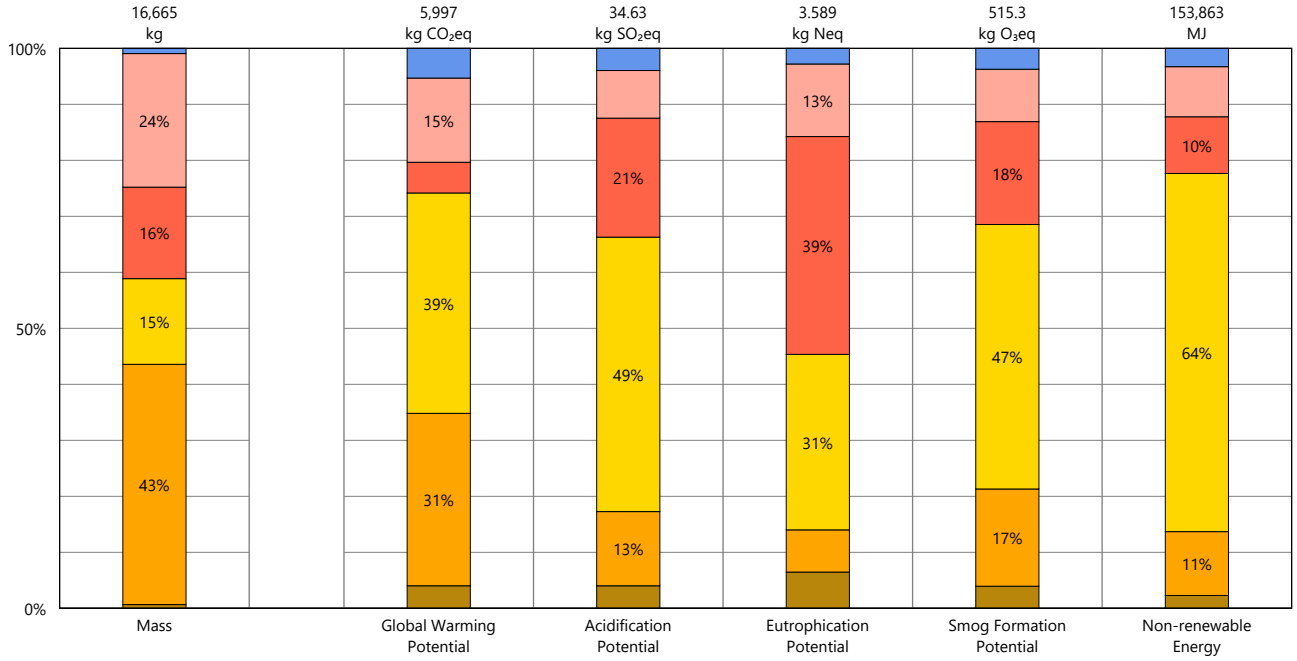
Revit Categories

- Doors
- Floors
- Roofs
- Walls
- Windows



Global Warming Potential

Results per Revit Category, itemized by Family



Legend

Doors
- Door-Interior-Single-1_Panel-Wood

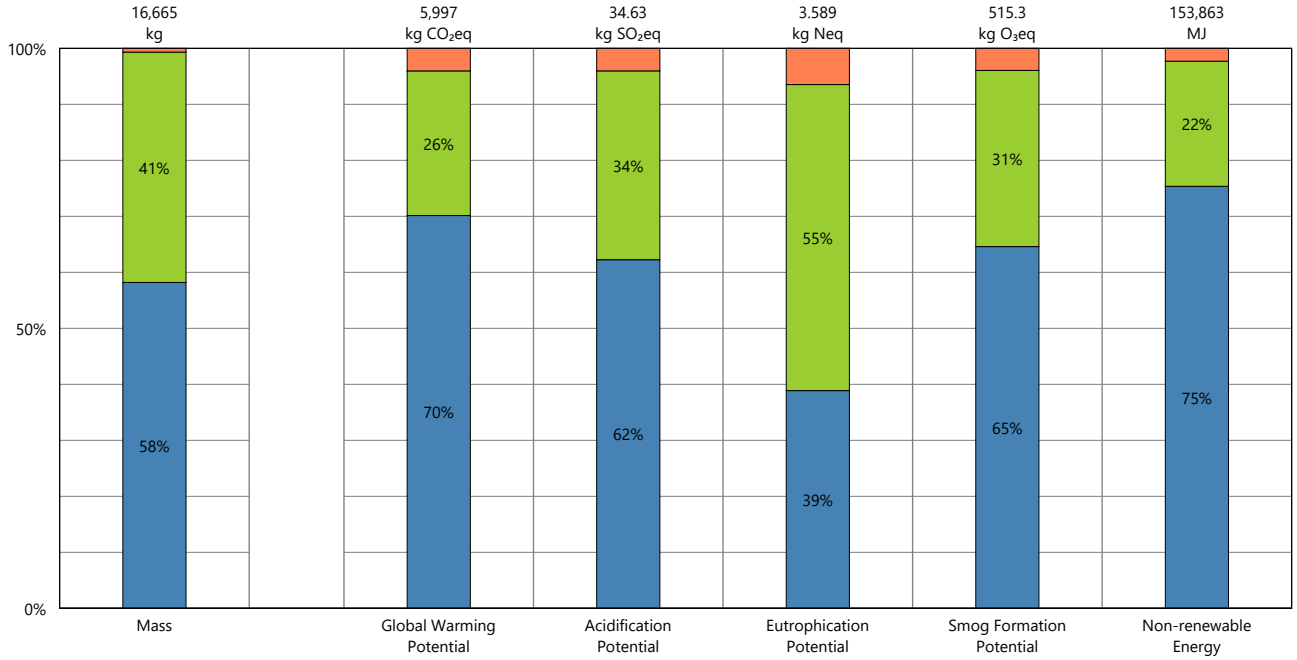
Floors
- Generic - 12"

Roofs
- Wood Rafter 8" - Asphalt Shingle - Insulated

Walls
- McBride Siding Wall
- Shed Brick Wall

Windows
- Window-Fixed

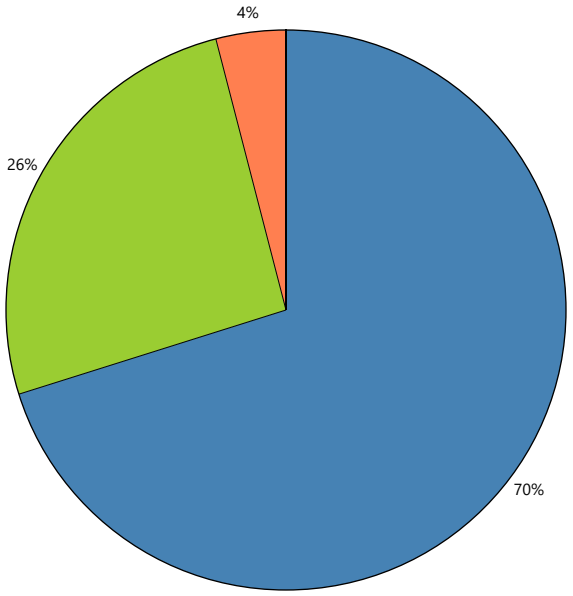
Results per Building Element



Legend

Building Elements

- Superstructure
- Enclosure
- Interiors



Global Warming Potential

Calculation Methodology

LIFE CYCLE ASSESSMENT METHODS

The following provides a description of terms and methods associated with the use of Tally to conduct life cycle assessment for construction works and construction products. Tally methodology is consistent with LCA standards ISO 14040-14044, ISO 21930:2017, ISO 21931:2010, EN 15804:2012, and EN 15978:2011. For more information about LCA, please refer to these standards or visit www.choosetally.com.

Studied objects

The life cycle assessment (LCA) results reported represent an analysis of a single building, multiple buildings, or a comparative analysis of two or more building design options. The assessment may represent the complete architectural, structural, and finish systems of the building(s) or a subset of those systems. This may be used to compare the relative environmental impacts associated with building components or for comparative study with one or more reference buildings. Design options may represent a full or partial building across various stages of the design process, or they may represent multiple schemes of a full or partial building that are being compared to one another across a range of evaluation criteria.

Functional unit and reference unit

A functional unit is the quantified performance of a product, building, or system that defines the object of the study. The functional unit of a single building should include the building type (e.g. office, factory), relevant technical and functional requirements (e.g. regulatory requirements, energy performance), pattern of use (e.g. occupancy, usable floor area), and the required service life. For a design option comparison of a partial building, the functional unit is the complete set of building systems or products that perform a given function. It is the responsibility of the modeler to assure that reference buildings or design options are functionally equivalent in terms of scope and relevant performance. The expected life of the building has a default value of 60 years and can be modified by the modeler.

The reference unit is the full collection of processes and materials required to produce a building or portion thereof and is quantified according to the given goal and scope of the assessment over the full life of the building. If construction impacts are included in the assessment, the reference unit also includes the energy, water, and fuel consumed on the building site during construction. If operational energy is included in the assessment, the reference unit includes the electrical and thermal energy consumed on site over the life of the building.

Data source

Tally utilizes a custom designed LCA database that combines material attributes, assembly details, and architectural specifications with environmental impact data resulting from the collaboration between KieranTimberlake and thinkstep. LCA modeling was conducted in GaBi 8.5 using GaBi 2018 databases and in accordance with GaBi databases and modeling principles.

The data used are intended to represent the US and the year 2017. Where representative data were unavailable, proxy data were used. The datasets used, their geographic region, and year of reference are listed for each entry. An effort was made to choose proxy datasets that are technologically consistent with the relevant entry.

Data quality and uncertainty

Uncertainty in results can stem from both the data used and their application. Data quality is judged by: its measured, calculated, or estimated precision; its completeness, such as unreported emissions; its consistency, or degree of uniformity of the methodology applied on a study serving as a data source; and geographical, temporal, and technological representativeness. The GaBi LCI databases have been used in LCA models worldwide in both industrial and scientific applications. These LCI databases have additionally been used both as internal and critically reviewed and published studies. Uncertainty introduced by the use of proxy data is reduced by using technologically, geographically, and/or temporally similar data. It is the responsibility of the modeler to appropriately apply the predefined material entries to the building under study.

System boundaries and delimitations

The analysis accounts for the full cradle to grave life cycle of the design options studied across all life cycle stages, including material manufacturing, maintenance and replacement, and eventual end of life. Optionally, the construction impacts and operational energy of the building can be included within the scope. Product stage impacts are excluded for materials and components indicated as existing or salvaged by the modeler. The modeler defines whether the boundary includes or excludes the flow of biogenic carbon, which is the carbon absorbed and generated by biological sources (e.g. trees, algae) rather than from fossil resources.

Architectural materials and assemblies include all materials required for the product's manufacturing and use including hardware, sealants, adhesives, coatings, and finishing. The materials are included up to a 1% cut-off factor by mass except for known materials that have high environmental impacts at low levels. In these cases, a 1% cut-off was implemented by impact.

Calculation Methodology

LIFE CYCLE STAGES

The following describes the scope and system boudaries used to define each stage of the life cycle of a building or building product, from raw material acquisition to final disposal. For products listed in Tally as Environmental Product Declarations (EPD), the full life cycle impacts are included, even if the published EPD only includes the Product stage [A1-A3].

Product [EN 15978 A1 - A3]

This encompasses the full manufacturing stage, including raw material extraction and processing, intermediate transportation, and final manufacturing and assembly. The product stage scope is listed for each entry, detailing any specific inclusions or exclusions that fall outside of the cradle to gate scope. Infrastructure (buildings and machinery) required for the manufacturing and assembly of building materials are not included and are considered outside the scope of assessment.

Transportation [EN 15978 A4]

This counts transportation from the manufacturer to the building site during the construction stage and can be modified by the modeler.

Construction Installation [EN 15978 A5] (Optional)

This includes the anticipated or measured energy and water consumed on-site during the construction installation process, as specified by the modeler.

Maintenance and Replacement [EN 15978 B2-B5]

This encompasses the replacement of materials in accordance with their expected service life. This includes the end of life treatment of the existing products as well as the cradle to gate manufacturing and transportation to site of the replacement products. The service life is specified separately for each product. Refurbishment of materials marked as existing or salvaged by the modeler is also included.

Operational Energy [EN 15978 B6] (Optional)

This is based on the anticipated or measured energy and natural gas consumed at the building site over the lifetime of the building, as indicated by the modeler.

End of Life [EN 15978 C2-C4]

This includes the relevant material collection rates for recycling, processing requirements for recycled materials, incineration rates, and landfilling rates. The impacts associated with landfilling are based on average material properties, such as plastic waste, biodegradable waste, or inert material. Stage C2 encompasses the transport from the construction site to end-of-life treatment based on national averages. Stages C3-C4 account for waste processing and disposal, i.e., impacts associated with landfilling or incineration.

Module D [EN 15978 D]

This accounts for reuse potentials that fall beyond the system boundary, such as energy recovery and recycling of materials. Along with processing requirements, the recycling of materials is modeled using an avoided burden approach, where the burden of primary material production is allocated to the subsequent life cycle based on the quantity of recovered secondary material. Incineration of materials includes credit for average US energy recovery rates.

PRODUCT	CONSTRUCTION	USE	END-OF-LIFE	MODULE D
A1. Extraction **A2. Transport (to factory)** **A3. Manufacturing**	**A4. Transport (to site)** ***A5. Construction Installation***	B1. Use **B2. Maintenance** **B3. Repair** **B4. Replacement** **B5. Refurbishment** ***B6. Operational energy*** B7. Operational water	C1. Demolition **C2. Transport (to disposal)** **C3. Waste processing** **C4. Disposal**	**D. Benefits and loads beyond the system boundary from:** **1. Reuse** **2. Recycling** **3. Energy recovery**

Life-Cycle Stages as defined by EN 15978. Processes included in Tally modeling scope are shown in bold. Italics indicate optional processes.

Calculation Methodology

ENVIRONMENTAL IMPACT CATEGORIES

A characterization scheme translates all emissions and fuel use associated with the reference flow into quantities of categorized environmental impact. As the degree that the emissions will result in environmental harm depends on regional ecosystem conditions and the location in which they occur, the results are reported as impact potential. Potential impacts are reported in kilograms of equivalent relative contribution (eq) of an emission commonly associated with that form of environmental impact (e.g. kg CO_2eq).

The following list provides a description of environmental impact categories reported according to the TRACI 2.1 characterization scheme, the environmental impact model developed by the US EPA to quantify environmental impact risk associated with emissions to the environment in the United States. TRACI is the standard environmental impact reporting format for LCA in North America. Impacts associated with land use change and fresh water depletion are not included in TRACI 2.1. For more information on TRACI 2.1, reference Bare 2010, EPA 2012, and Guinée 2001. For further description of measurement of environmental impacts in LCA, see Simonen 2014.

Acidification Potential (AP) kg SO_2eq

A measure of emissions that cause acidifying effects to the environment. The acidification potential is a measure of a molecule's capacity to increase the hydrogen ion (H^+) concentration in the presence of water, thus decreasing the pH value. Potential effects include fish mortality, forest decline, and the deterioration of building materials.

Eutrophication Potential (EP) kg Neq

A measure of the impacts of excessively high levels of macronutrients, the most important of which are nitrogen (N) and phosphorus (P). Nutrient enrichment may cause an undesirable shift in species composition and elevated biomass production in both aquatic and terrestrial ecosystems. In aquatic ecosystems, increased biomass production may lead to depressed oxygen levels caused by the additional consumption of oxygen in biomass decomposition.

Global Warming Potential (GWP) kg CO_2eq

A measure of greenhouse gas emissions, such as carbon dioxide and methane. These emissions are causing an increase in the absorption of radiation emitted by the earth, increasing the natural greenhouse effect. This may, in turn, have adverse impacts on ecosystem health, human health, and material welfare.

Ozone Depletion Potential (ODP) kg CFC-11eq

A measure of air emissions that contribute to the depletion of the stratospheric ozone layer. Depletion of the ozone leads to higher levels of UVB ultraviolet rays reaching the earth's surface with detrimental effects on humans and plants. As these impacts tend to be very small, ODP impacts can be difficult to calculate and are prone to a larger margin of error than the other impact categories.

Smog Formation Potential (SFP) kg O_3eq

A measure of ground level ozone, caused by various chemical reactions between nitrogen oxides (NO_x) and volatile organic compounds (VOCs) in sunlight. Human health effects can result in a variety of respiratory issues, including increasing symptoms of bronchitis, asthma, and emphysema. Permanent lung damage may result from prolonged exposure to ozone. Ecological impacts include damage to various ecosystems and crop damage.

Primary Energy Demand (PED) MJ (lower heating value)

A measure of the total amount of primary energy extracted from the earth. PED tracks energy resource use, not the environmental impacts associated with the resource use. PED is expressed in energy demand from non-renewable resources and from renewable resources. Efficiencies in energy conversion (e.g. power, heat, steam, etc.) are taken into account when calculating this result.

Non-Renewable Energy Demand MJ (lower heating value)

A measure of the energy extracted from non-renewable resources (e.g. petroleum, natural gas, etc.) contributing to the PED. Non-renewable resources are those that cannot be regenerated within a human time scale. Efficiencies in energy conversion (e.g. power, heat, steam, etc.) are taken into account when calculating this result.

Renewable Energy Demand MJ (lower heating value)

A measure of the energy extracted from renewable resources (e.g. hydropower, wind energy, solar power, etc.) contributing to the PED. Efficiencies in energy conversion (e.g. power, heat, steam, etc.) are taken into account when calculating this result.

LCI Data

END-OF-LIFE [C2-C4]

A Life Cycle Inventory(LCI) is a compilation and quantification of inputs and outputs for the reference unit.The following LCI provides a summary of all energy, construction, transportation, and material inputs present in the study. Materials are listed in alphabetical order along with a list of all Revit families and Tally entries in which they occur, along with any notes and system boundaries accompanying their database entries. Each entry lists the detailed scope for the LCI data sources used from the GaBi LCI database and identifies the LCI data source.

For LCI data sourced from an Environmental Product Declaration (EPD), the product manufacturer, EPD identification number, and Program Operator are listed. Where the LCI source does not provide data for all life cycle stages, default North American average values are used. This is of particular importance for European EPD sources, as EPD data are generally only provided for the product stage, and North American average values are used for the remaining life cycle stages.

Where specific quantities are associated with a data entry, such as user inputs, energy values, or material mass, the quantity is listed on the same line as the title of the entry.

TRANSPORTATION [A4]

Default transportation values are based on the three-digit material commodity code in the 2012 Commodity Flow Survey by the US Department of Transportation Bureau of Transportation Statistics and the US Department of Commerce where more specific industry-level transportation is not available.

Transportation by Barge

Scope:
The data set represents the transportation of 1 kg of material from the manufacturer location to the building site by barge.

LCI Source:
GLO: Average ship, 1500t payload capacity/ canal ts (2017)
US: Diesel mix at filling station ts (2014)

Transportation by Container Ship

Scope:
The data set represents the transportation of 1 kg of material from the manufacturer location to the building site by container ship.

LCI Source:
GLO: Container ship, 27500 dwt payload capacity, ocean going ts (2017)
US: Heavy fuel oil at refinery (0.3wt.% S) ts (2014)

Transportation by Rail

Scope:
The data set represents the transportation of 1 kg of material from the manufacturer location to the building site by cargo rail.

LCI Source:
GLO: Rail transport cargo - Diesel, average train, gross tonne weight 1000t / 726t payload capacity ts (2017)
US: Diesel mix at filling station ts (2014)

Transportation by Truck

Scope:
The data set represents the transportation of 1 kg of material from the manufacturer location to the building site by diesel truck.

LCI Source:
US: Truck - Trailer, basic enclosed / 45,000 lb payload - 8b ts (2017)
US: Diesel mix at filling station ts (2014)

LCI Data (continued)

END-OF-LIFE [C2-C4]

Specific end-of-life scenarios are detailed for each entry based on the US construction and demolition waste treatment methods and rates in the 2016 WARM Model by the US Environmental Protection Agency except where otherwise specified. Heterogeneous assemblies are modeled using the appropriate methodologies for the component materials.

End-of-Life Landfill

Scope:

Materials for which no recycling or incineration rates are known, no recycling occurs within the US at a commercial scale, or which are unable to be recycled are landfilled. This includes glass, drywall, insulation, and plastics. The solids contents of coatings, sealants, and paints are assumed to go to landfill, while the solvents or water evaporate during installation. Where the landfill contains biodegradable material, the energy recovered from landfill gas utilization is reflected as a credit in Module D.

LCI Source:

US: Glass/inert on landfill ts (2017)
US: Biodegradable waste on landfill, post-consumer ts (2017)
US: Plastic waste on landfill, post-consumer ts (2017)

Concrete End-of-Life

Scope:

Concrete (or other masonry products) are recycled into aggregate or general fill material or they are landfilled. It is assumed that 55% of the concrete is recycled. Module D accounts for both the credit associated with off-setting the production aggregate and the burden of the grinding energy required for processing.

LCI Source:

US: Diesel mix at refinery ts (2014)
GLO: Fork lifter (diesel consumption) ts (2016)
EU - 28 Gravel 2/32 ts (2017)
US: Glass/inert on landfill ts (2017)

Metals End-of-Life

Scope:

Metal products are modeled using the avoided burden approach. The recycling rate at end of life is used to determine how much secondary metal can be recovered after having subtracted any scrap input into manufacturing (net scrap). Net scrap results in an environmental credit in Module D for the corresponding share of the primary burden that can be allocated to the subsequent product system using secondary material as an input. If the value in Module D reflects an environmental burden, then the original product (A1-A3) contains more secondary material than is recovered.

LCI Source:

Aluminum - RNA: Primary Aluminum Ingot AA/ts (2010)
Aluminum - RNA: Secondary Aluminum Ingot AA/ts (2010)
Brass - GLO: Zinc mix ts (2012)
Brass - GLO: Copper (99.99% cathode) ICA (2013)
Brass - EU-28: Brass (CuZn20) ts (2017)
Copper - DE: Recycling potential copper sheet ts (2016)
Steel - GLO: Value of scrap worldsteel (2014)
Zinc - GLO: Special high grade zinc IZA (2012)

Wood End-of-Life

Scope:

End of Life waste treatment methods and rates for wood are based on the 2014 Municipal Solid Waste and Construction Demolition Wood Waste Generation and Recovery in the United States report by Dovetail Partners, Inc. It is assumed that 63.5% of wood is sent to landfill, 22% to incineration, and 14.5% to recovery.

LCI Source:

US: Untreated wood in waste incineration plant ts (2017)
US: Wood product (OSB, particle board) waste in waste incineration plant ts (2017)
US: Wood products (OSB, particle board) on landfill, post-consumer ts (2017)
US: Untreated wood on landfill, post-consumer ts (2017)
RNA: Softwood lumber CORRIM (2011)

LCI Data

MODEL ELEMENTS

Revit Categories
- Ceilings
- Curtainwall Mullions
- Curtainwall Panels
- Doors
- Floors
- Roofs
- Stairs and Railings
- Structure
- Walls
- Windows

DM - Shed

Worksets
- N/A

Phases
- Existing
- New Construction

PRODUCT [A1-A3]

Materials and components are listed in alphabetical order along with a list of all Revit families and Tally entries in which they occur. The masses given here refer to the quantity of each material used over the building's life-cycle, which includes both Product [A1-A3] and Use [B2-B5] stages.

Additional provided data describing scope boundaries for each life cycle stage may be useful for interpretation of the impacts associated with the specific material or component. Each material or component is listed with its service life, or period of time after installation it is expected to meet the service requirements prior to replacement or repair. This value is indicated in parentheses next to the mass of the material associated with the listed Revit family. Values for transportation distance or service life shown with an asterisk (*) indicate user-defined changes to default values. Values for service life shown with a dagger (†) indicate materials identified by the modeler as existing or salvaged.

Exterior grade plywood, US (deprecated) **765.7 kg**

Used in the following Revit families:
- Wood Rafter 8" - Asphalt Shingle - Insulated — 765.7 kg (30 yrs)

Used in the following Tally entries:
- Plywood, exterior grade

Description:
- Plywood, unfinished

Life Cycle Inventory:
- Proxied by interior grade plywood

Product Scope:
- Cradle to gate, uncoated

Transportation Distance:
- By truck: 468 km

End-of-Life Scope:
- 14.5% Recovered
- 22% Incinerated with energy recovery
- 63.5% Landfilled (wood product waste)

Module D Scope:
- Recovered wood products credited as avoided burden.

LCI Source:
- RNA: Softwood plywood CORRIM (2011)

Fasteners, galvanized steel **13.7 kg**

Used in the following Revit families:
- McBride Siding Wall — 10.8 kg (40 yrs)
- Shed Brick Wall — 2.9 kg (40 yrs)

Used in the following Tally entries:
- Polyethelene sheet vapor barrier (HDPE)

Description:
- Galvanized steel part, appropriate for use as fasteners and specialized hardware (bolts, rails, clips, etc.).

Life Cycle Inventory:
- 100% Galvanized steel

Product Scope:
- Cradle to gate

Transportation Distance:
- By truck: 1001 km

End-of-Life Scope:
- 70% Recovered
- 30% Landfilled (inert material)

Module D Scope:
- Product has 16% scrap input while remainder is processed and credited as avoided burden

LCI Data (continued)

LCI Source:
GLO: Steel wire rod worldsteel (2014)
GLO: Steel turning ts (2017)
GLO: Electrolytic galvanisation (1 m^2 steel sheet part, electrolytic) ts (2017)
GLO: Value of scrap worldsteel (2014)

Fasteners, stainless steel **7.8 kg**

Used in the following Revit families:

McBride Siding Wall	1.8 kg (50 yrs)
Wood Rafter 8" - Asphalt Shingle - Insulated	6.0 kg (30 yrs)

Used in the following Tally entries:
Asphalt roofing shingles
Wood siding

Description:
Stainless steel part, appropriate for use as fasteners and specialized hardware (bolts, rails, clips, etc.). Data based on industry-wide EPDs for primary and secondary metal from the World Steel Association.

Life Cycle Inventory:
100% Stainless steel

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 1001 km

End-of-Life Scope:
98% Recovered
2% Landfilled (inert material)

Module D Scope:
Product has 58% scrap input while remainder is processed and credited as avoided burden

LCI Source:
RER: Stainless steel Quarto plate (304) Eurofer (2010)
GLO: Steel turning ts (2017)
US: Electricity grid mix ts (2014)
RER: Stainless steel flat product (304) - value of scrap Eurofer (2010)

Fiberglass blanket insulation, paper faced **95.6 kg**

Used in the following Revit families:

McBride Siding Wall	75.3 kg (75 yrs)
Shed Brick Wall	20.3 kg (75 yrs)

Used in the following Tally entries:
Wood framing with insulation

Description:
Kraft-faced fiberglass batt
density varies from 10-14 kg/m^3

Life Cycle Inventory:
99% Fiberglass
1% Kraft paper

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 172 km

End-of-Life Scope:
100% Landfilled (10% biodegradable waste, 90% inert waste)

LCI Source:
US: Fiberglass Kraft Faced NAIMA (2007)

Fluid applied synthetic polymer air barrier **48.3 kg**

Used in the following Revit families:

Shed Brick Wall	48.3 kg (40 yrs)

Used in the following Tally entries:
Fluid applied synthetic polymer air barrier

Description:
Liquid-applied rubberized membrane

Life Cycle Inventory:
34% Calcium carbonate
30% Polymer blend (SBS)
1% Silica
5% Titanium dioxide
30% Water

Product Scope:
Cradle to gate for materials only, neglects manufacturing requirements

Transportation Distance:
By truck: 555 km

End-of-Life Scope:
70% Landfilled (plastic waste) (excludes water evaporation)

LCI Source:
US: Styrene-butadiene rubber (SBR) ts (2017)
US: Silica sand (flour) ts (2017)
US: Tap water from groundwater ts (2017)
US: Titanium dioxide pigment ts (2017)
US: Limestone flour (5mm) ts (2017)
US: Electricity grid mix ts (2014)

Glazed brick, generic **1,447.5 kg**

Used in the following Revit families:

Shed Brick Wall	1,447.5 kg (80 yrs)

Used in the following Tally entries:
Brick

Description:
Common brick, with factory-applied glaze. Excludes mortar.

Life Cycle Inventory:
100% fired, glazed brick

Product Scope:
Cradle to gate
excludes mortar
anchors, ties, and metal accessories outside of scope (<1% mass)

Transportation Distance:
By truck: 172 km

End-of-Life Scope:
55% Recycled into coarse aggregate
45% Landfilled (inert material)

Module D Scope:
Avoided burden credit for coarse aggregate, includes grinding energy

LCI Source:
DE: Stoneware tiles, glazed (EN15804 A1-A3) ts (2017)

Glazing, double, insulated (air) **71.6 kg**

Used in the following Revit families:

Window-Fixed	71.6 kg (40 yrs)

Used in the following Tally entries:
Glazing, double pane IGU

Description:
Glazing, double, insulated (air filled), 1/8" (4 mm) float glass clear, inclusive of sealant, and spacers

Life Cycle Inventory:
Double-pane glass IGU (Air filled, with spacer and sealant)

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 940 km

End-of-Life Scope:
100% Landfilled (inert waste)

LCI Source:
DE: Double glazing unit ts (2017), modified to exclude coating and argon

LCI Data (continued)

Hardware, aluminum **1.1 kg**

Used in the following Revit families:
Window-Fixed 1.1 kg (80 yrs)

Used in the following Tally entries:
Window frame, vinyl

Description:
Milled aluminum applicable for door, window or other accessory hardware. Data based on industry-wide EPDs for primary (EPD ID 4786092064.104.1) and secondary ingot (EPD ID 4786092064.105.1) from the Aluminum Association.

Life Cycle Inventory:
50% Primary aluminum
50% Secondary aluminum

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 1001 km

End-of-Life Scope:
95% Recovered
5% Landfilled (inert material)

Module D Scope:
Product has 100% scrap input, burden reflects difference between recovered material and scrap input

LCI Source:
RNA: Secondary Aluminum Ingot AA/ts (2010) [EPD]
DE: Aluminium cast machining ts (2017)
DE: Aluminium die-cast part ts (2017)
RNA: Primary Aluminium Ingot AA/ts (2010) [EPD]
US: Electricity grid mix ts (2014)
US: Thermal energy from natural gas ts (2014)

Hardware, zinc **2.4 kg**

Used in the following Revit families:
Door-Interior-Single-1_Panel-Wood 2.4 kg (80 yrs)

Used in the following Tally entries:
Door, exterior, steel

Description:
Cast zinc hardware

Life Cycle Inventory:
100% Zinc

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 663 km

End-of-Life Scope:
90% Recovered
10% Landfilled (inert material)

Module D Scope:
Product has 2% scrap input while remainder is processed and credited as avoided burden

LCI Source:
GLO: Special high grade zinc IZA (2012)
DE: Aluminium cast machining ts (2017)
DE: Aluminium die-cast part ts (2017)
US: Electricity grid mix ts (2014)
US: Thermal energy from natural gas ts (2014)

Hollow door, exterior, steel, galvanized **105.3 kg**

Used in the following Revit families:
Door-Interior-Single-1_Panel-Wood 105.3 kg (30 yrs)

Used in the following Tally entries:
Door, exterior, steel

Description:
Hollow door, exterior, steel, 18 ga. inclusive of EPS insulation, no frame

Life Cycle Inventory:
5% Extruded polystyrene
95% Galvanized steel

Product Scope:
Cradle to gate, excludes assembly, frame, hardware, and adhesives

Transportation Distance:
By truck: 568 km

End-of-Life Scope:
70% Steel recovered
30% Steel landfilled (inert material)
100% Core landfilled (biodegradable material)

Module D Scope:
Product has 44% scrap input while remainder is processed and credited as avoided burden.

LCI Source:
DE: Expanded Polystyrene (PS 25) (EN15804 A1-A3) ts (2017)
GLO: Steel sheet stamping and bending (5% loss) ts (2017)
GLO: Value of scrap worldsteel (2014)
US: Electricity grid mix ts (2014)
US: Lubricants at refinery ts (2014)
GLO: Compressed air 7 bar (medium power consumption) ts (2014)
RNA: Steel hot dip galvanized worldsteel (2007)

Mortar type N **1,954.1 kg**

Used in the following Revit families:
Shed Brick Wall 1,954.1 kg (60 yrs)

Used in the following Tally entries:
Brick

Description:
Mortar Type N (moderate strength mortar) for use in masonry walls and flooring.

Life Cycle Inventory:
Dried mixture: 83% Sand
11% cement
6% limestone (11% water evaporates on drying)

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 172 km

End-of-Life Scope:
55% Recycled into coarse aggregate
45% Landfilled (inert material)

Module D Scope:
Avoided burden credit for coarse aggregate, includes grinding energy

LCI Source:
DE: Masonry mortar (MG II a) ts (2017)

Oriented Strand Board (OSB) | US, CA | iEPD **440.9 kg**

Used in the following Revit families:
McBride Siding Wall 347.4 kg (80 yrs)
Shed Brick Wall 93.5 kg (80 yrs)

Used in the following Tally entries:
Oriented strandboard (OSB)

Description:
Generic Oriented Strand Board (OSB or Flakeboard), engineered wood sheet product using wood strands bonded together with resin, pressed into sheets.

Life Cycle Inventory:
See EPD for additional information.

Product Scope:
Cradle-to-gate (A1-A3) data is sourced directly from a third-party verified EPD referenced below.

Transportation Distance:
By truck: 362 km

End-of-Life Scope:
14.5% Recovered
22% Incinerated with energy recovery
63.5% Landfilled (wood product waste)

Module D Scope:
Recovered wood products credited as avoided burden.

LCI Data (continued)

LCI Source:
Industry-wide EPD

EPD Source:
cqd.io/i/ec3tcaf9

EPD Designation Holder:
American Wood Council

EPD Program Operator:
UL

EPD Expiration:
7/1/2025

Paint, exterior acrylic latex **68.9 kg**

Used in the following Revit families:
McBride Siding Wall 68.9 kg (10 yrs)

Used in the following Tally entries:
Wood siding

Description:
Acrylic-based latex paint for exterior applications. Associated reference table includes primer.

Life Cycle Inventory:
20.5% Binding agent
35% Pigments and fillers
40% Water
4.5% Organic solvents

Product Scope:
Cradle to gate, including emissions during application

Transportation Distance:
By truck: 642 km

End-of-Life Scope:
100% to landfill (plastic waste)

LCI Source:
DE: Application paint emulsion (building, exterior, white) ts (2017)

Polyethelene sheet vapor barrier (HDPE) **12.6 kg**

Used in the following Revit families:
McBride Siding Wall 10.0 kg (80 yrs)
Shed Brick Wall 2.7 kg (80 yrs)

Used in the following Tally entries:
Polyethelene sheet vapor barrier (HDPE)

Description:
Polyethelene sheet vapor barrier (HDPE) membrane
entry exclusive of adhesive or other co-products

Life Cycle Inventory:
100% Polyethylene film

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 1299 km

End-of-Life Scope:
10.5% Recycled into HDPE
89.5% Landiflled (plastic waste)

Module D Scope:
Avoided burden credit includes processing

LCI Source:
US: Polyethylene High Density Granulate (PE-HD) ts (2017)
GLO: Plastic Film (PE, PP, PVC) ts (2017)
US: Electricity grid mix ts (2014)
US: Thermal energy from natural gas ts (2014)
US: Lubricants at refinery ts (2014)

SBS modified asphalt, strip, ARMA - EPD **1,447.3 kg**

Used in the following Revit families:
Wood Rafter 8" - Asphalt Shingle - Insulated 1,447.3 kg (20 yrs)

Used in the following Tally entries:
Asphalt roofing shingles

Description:
SBS-modified asphalt shingle assembly, including starter strip and hip and ridge shingles. User to add any felt underlayment, fiberglass leak barrier, flashing, vents, nails, laminating adhesives, and sealant. Industry-wide EPD from the Asphalt Roofing Manufacturers Association.

Life Cycle Inventory:
For information and quantities, see EPD.

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 172 km

End-of-Life Scope:
5% recycled into bitumen (includes grinding energy and avoided burden credit)
95% landfilled (inert waste)

LCI Source:
RNA: Asphalt shingles, asphalt shingle roofing system component - ARMA (A1-A3) ts (2012)

EPD Source:
4787168709.101.1

EPD Designation Holder:
Asphalt Roofing Manufacturers Association (ARMA)

EPD Program Operator:
UL Environment

EPD Expiration:
10/28/2021

Softwood Lumber | US, CA | iEPD **502.2 kg**

Used in the following Revit families:
McBride Siding Wall 135.3 kg (80 yrs)
Shed Brick Wall 36.4 kg (80 yrs)
Wood Rafter 8" - Asphalt Shingle - Insulated 330.4 kg (80 yrs)

Used in the following Tally entries:
Wood framing
Wood framing with insulation

Description:
Kiln-dried and planed softwood dimensional lumber for standard framing or planking.

Life Cycle Inventory:
See EPD for additional information.

Product Scope:
Cradle-to-gate (A1-A3) data is sourced directly from a third-party verified EPD referenced below.

Transportation Distance:
By truck: 439 km

End-of-Life Scope:
14.5% Recovered
22% Incinerated with energy recovery
63.5% Landfilled (wood product waste)

Module D Scope:
Recovered wood products credited as avoided burden.

LCI Source:
Industry-wide EPD

EPD Source:
cqd.io/i/ec332eeg

EPD Designation Holder:
American Wood Council

EPD Program Operator:
UL

EPD Expiration:
7/1/2025

LCI Data (continued)

Softwood Lumber | US, CA | iEPD (expired) **728.8 kg**

Used in the following Revit families:
McBride Siding Wall 728.8 kg (30 yrs)

Used in the following Tally entries:
Wood siding

Description:
Kiln-dried and planed softwood dimensional lumber for standard framing or planking.

Life Cycle Inventory:
For information and quantities, see EPD

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 383 km

End-of-Life Scope:
14.5% Recovered
22% Incinerated with energy recovery
63.5% Landfilled (wood product waste)

Module D Scope:
Recovered wood products credited as avoided burden.

LCI Source:
RNA: Softwood lumber CORRIM (2011)
(Newer data point available. Redefining this material is recommended.)

EPD Source:
13CA24184.102.1

EPD Designation Holder:
American Wood Council and Canadian Wood Council

EPD Program Operator:
UL Environment

EPD Expiration:
4/16/2019

Steel door hinge **4.6 kg**

Used in the following Revit families:
Door-Interior-Single-1_Panel-Wood 4.6 kg (30 yrs)

Used in the following Tally entries:
Door, exterior, steel

Description:
Steel and stainless steel door hinge. Data based on product-specific EPD from FV S+B.

Life Cycle Inventory:
See EPD

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 1001 km

End-of-Life Scope:
70% Recovered
30% Landfilled (inert material)

Module D Scope:
Product has 0% scrap input, burden reflects difference between recovered material and scrap input

LCI Source:
DE: Door hinge - Object hinge - FV S+B PE-EPD (2009)
GLO: Value of scrap worldsteel (2014)

EPD Source:
EPD-ARG-20160193-IBG2-EN

EPD Designation Holder:
European Federation of Associations of Lock and Builders Hardware Manufacturers (ARGE)

EPD Program Operator:
Institut Bauen and Umwelt (IBU)

EPD Expiration:
9/13/2021

Steel, concrete reinforcing steel, CMC - EPD **502.6 kg**

Used in the following Revit families:
Generic - 12" 502.6 kg (80 yrs)

Used in the following Tally entries:
Cast-in-place concrete, structural concrete, 3000 psi

Description:
Concrete reinforcing steel (rebar) by Commercial Metals Company. Appropriate for use as reinforcement in concrete. EPD representative of conditions in the US.

Life Cycle Inventory:
For information and quantities, see EPD

Product Scope:
Cradle-to-gate

Transportation Distance:
By truck: 431 km

End-of-Life Scope:
98% Recovered
2% Landfilled (inert material)

Module D Scope:
Product has 100% scrap input, burden reflects difference between recovered material and scrap input. Credit given for the avoided burden associated with recovered material.

LCI Source:
EPD (US), Commercial Metals Company (2015)

EPD Source:
EPD-012

EPD Designation Holder:
Commercial Metals Company (CMC)

EPD Program Operator:
ASTM International

EPD Expiration:
9/1/2020

Steel, reinforcing rod | GLO **7.7 kg**

Used in the following Revit families:
Shed Brick Wall 7.7 kg (80 yrs)

Used in the following Tally entries:
Brick

Description:
Common unfinished tempered steel rod suitable for structural reinforcement (rebar)

Life Cycle Inventory:
100% Steel rebar

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 431 km

End-of-Life Scope:
70% Recovered
30% Landfilled (inert material)

Module D Scope:
Product has a 16.4% scrap input while remainder is processed and credited as avoided burden.

LCI Source:
GLO: Steel rebar worldsteel (2014)

Structural concrete, 3000 psi, South Central regional average **6,646.5 kg**

Used in the following Revit families:
Generic - 12" 6,646.5 kg (80 yrs)

Used in the following Tally entries:
Cast-in-place concrete, structural concrete, 3000 psi

Description:
Structural concrete, 3000 psi, South Central regional average. Mix design matches National Ready-Mix Concrete Association (NRMCA) Industry-wide EPD.

Life Cycle Inventory:

LCI Data (continued)

Coarse aggregate: 44%, Sand: 37%, Portland cement PCA - EPD: 10%, Water: 7%, Fly ash: 2%, Admixture: <1%, Expanded slag: <1%

Product Scope:
Cradle to gate
Anchors, ties, and metal accessories outside of scope (<1% mass)

Transportation Distance:
By truck: 24 km

End-of-Life Scope:
55% Recycled into coarse aggregate
45% Landfilled (inert material)

Module D Scope:
Avoided burden credit for coarse aggregate, includes grinding energy

LCI Source:
US: Portland cement PCA/ts (2014)
DE: Pumice gravel (grain size 4/16) (EN15804 A1-A3) ts (2017)
DE: Gravel (Grain size 2/32) (EN15804 A1-A3) s (2017)
DE: Fly ash (EN15804 A1-A3) ts (2017)
DE: Slag-tap granulate (EN15804 A1-A3) ts (2017)
DE: Expanded clay (EN15804 A1-A3) ts (2017)
DE: alcium nitrate ts (2017)
DE: Sodium ligninsulfonate ts (2017)
DE: Sodium naphtalene sulfonate [estimated] ts (2017)
US: Sodium hydroxide (caustic soda) ix (100%) ts (2017)
US: Colophony (rosin, refined) from CN pine gum rosin ts (2017)
US: Tap water from groundwater ts (2017)
US: Electricity grid mix s (2014)
US: Natural gas mix ts (2014)
US: Diesel mix at filling station (100% fossil) ts (2014)
US: Liquefied Petroleum Gas (LPG) (70% propane
30% utane) ts (2014)
US: Light fuel oil at refinery ts (2014)

Wall board, gypsum, natural **1,706.7 kg**

Used in the following Revit families:

McBride Siding Wall	1,344.8 kg (30 yrs)
Shed Brick Wall	361.9 kg (30 yrs)

Used in the following Tally entries:
Wall board, gypsum

Description:
Natural gypsum board

Life Cycle Inventory:
100% Gypsum wallboard (Gypsum, Boric acid, Cement, Glass fibres, Ferrochrome-lignine sulfonate, Silane, Polyglucose, Perlite, Paper, Casein glue)

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 172 km

End-of-Life Scope:
100% Landfilled (inert waste)

LCI Source:
DE: Gypsum wallboard (EN15804 A1-A3) ts (2017)

White oak lumber, 1 inch **5.1 kg**

Used in the following Revit families:

Window-Fixed	5.1 kg (50 yrs)

Used in the following Tally entries:
Domestic hardwood

Description:
Kiln-dried American White Oak hardwood lumber of 1" nominal thickness as produced in the eastern United States, focusing on the main production technologies and region-specific characteristics. White oak is frequently used for mouldings, flooring, furniture, doors, and millwork. Link for interactive LCA data tool is provided at the link listed as "EPD Information"
full LCA report is available at
http://naturespackaging.org/wp-content/uploads/2016/02/LifeCycleAssessment-Lumber.pdf.

Life Cycle Inventory:
100% White Oak

Product Scope:
Cradle to gate, uncoated

Transportation Distance:
By truck: 383 km

End-of-Life Scope:
14.5% Recovered
22% Incinerated with energy recovery
63.5% Landfilled (wood product waste)

Module D Scope:
Recovered wood products credited as avoided burden.

LCI Source:
US: White Oak lumber, 1 inch (769 kg/m^3), kiln-dried ts/AHEC (2017)

EPD Source:
Information

EPD Designation Holder:
American Hardwood Export Council (AHEC)

Window frame, vinyl, fixed **76.8 kg**

Used in the following Revit families:

Window-Fixed	76.8 kg (30 yrs)

Used in the following Tally entries:
Window frame, vinyl

Description:
Vinyl fixed window frame inclusive of steel bracing

Life Cycle Inventory:
46% PVC part
54% metal reinforcement (Zinc-coated steel)

Product Scope:
Cradle to gate, excludes hardware, casing, sealant

Transportation Distance:
By truck: 496 km

End-of-Life Scope:
100% Landfilled (plastic waste)

LCI Source:
DE: Window frame PVC-U (EN15804 A1-A3) ts (2017)

Wood stain, water based **1.5 kg**

Used in the following Revit families:

Window-Fixed	1.5 kg (10 yrs)

Used in the following Tally entries:
Domestic hardwood

Description:
Semi-transparent stain for interior and exterior wood surfaces

Life Cycle Inventory:
60% Water
28% Acrylate resin
7% Acrylate emulsion
5% Dipropylene glycol
1.3% NMVOC emissions

Product Scope:
Cradle to gate, including emissions during application

Transportation Distance:
By truck: 642 km

End-of-Life Scope:
38.7% solids to landfill (plastic waste)

LCI Source:
US: Tap water from groundwater ts (2017)
US: Acrylate resin (solvent-systems) ts (2017)
DE: Acrylate (emulsion) ts (2017)
US: Dipropylene glycol by product propylene glycol via PO hydrogenation ts (2017)