# Harka Building

## Updated Building Summary

6/21/2024

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# Report Summary

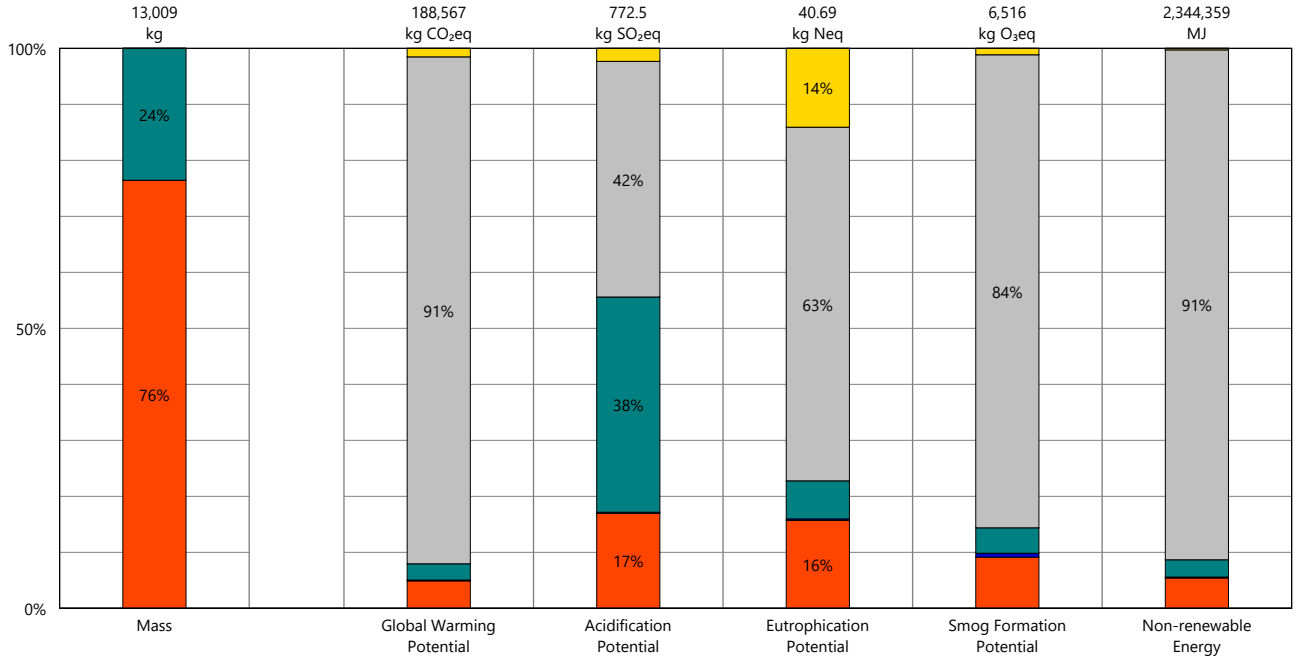
**Created with Tally**
Commercial Version 2023.09.13.01

**Goal and Scope of Assessment**
updated operational energy and sf discrepancy

| | |
|---|---|
| **Author** | |
| **Company** | Harka Architecture |
| **Date** | 6/21/2024 |
| **Project** | Harka Building |
| **Location** | |
| **Gross Area** | 680 $ft^2$ |
| **Building Life** | 60 years |
| **Boundaries** | Cradle to grave, exclusive of biogenic carbon; see appendix for a full list of materials and processes |
| **Operational Energy [B6]** | 6198 kWh annual electricity use<br>0 kWh annual heating energy use |

| **Environmental Impact Totals** | **Product Stage [A1-A3]** | **Construction Stage [A4]** | **Use Stage [B2-B6]** | **End of Life Stage [C2-C4]** | **Module D [D]** |
|---|---|---|---|---|---|
| Global Warming (kg $CO_2$eq) | 9,236 | 287.4 | 176,168 | 2,876 | -1,349 |
| Acidification (kg $SO_2$eq) | 131.1 | 1.428 | 621.9 | 18.00 | -4.56 |
| Eutrophication (kg Neq) | 6.387 | 0.1112 | 28.46 | 5.732 | -0.1929 |
| Smog Formation (kg $O_3$eq) | 595.2 | 45.66 | 5,800 | 75.09 | -58.1 |
| Ozone Depletion (kg CFC-11eq) | 3.102E-005 | 9.872E-012 | 6.375E-006 | 1.396E-010 | -5.046E-008 |
| Primary Energy (MJ) | 219,680 | 4,196 | 3,261,418 | 6,937 | -30,236 |
| Non-renewable Energy (MJ) | 126,969 | 4,096 | 2,206,800 | 6,493 | -20,344 |
| Renewable Energy (MJ) | 92,883 | 100.6 | 1,054,714 | 448.2 | -9,902 |
| **Environmental Impacts / Area** | | | | | |
| Global Warming (kg $CO_2$eq/$m^2$) | 146.2 | 4.549 | 2,789 | 45.53 | -21.4 |
| Acidification (kg $SO_2$eq/$m^2$) | 2.076 | 0.0226 | 9.844 | 0.2849 | -0.07222 |
| Eutrophication (kg Neq/$m^2$) | 0.1011 | 0.001761 | 0.4505 | 0.09073 | -0.003054 |
| Smog Formation (kg $O_3$eq/$m^2$) | 9.422 | 0.7227 | 91.81 | 1.189 | -0.9194 |
| Ozone Depletion (kg CFC-11eq/$m^2$) | 4.910E-007 | 1.563E-013 | 1.009E-007 | 2.209E-012 | -7.987E-010 |
| Primary Energy (MJ/$m^2$) | 3,477 | 66.42 | 51,626 | 109.8 | -479 |
| Non-renewable Energy (MJ/$m^2$) | 2,010 | 64.84 | 34,932 | 102.8 | -322 |
| Renewable Energy (MJ/$m^2$) | 1,470 | 1.592 | 16,695 | 7.094 | -157 |

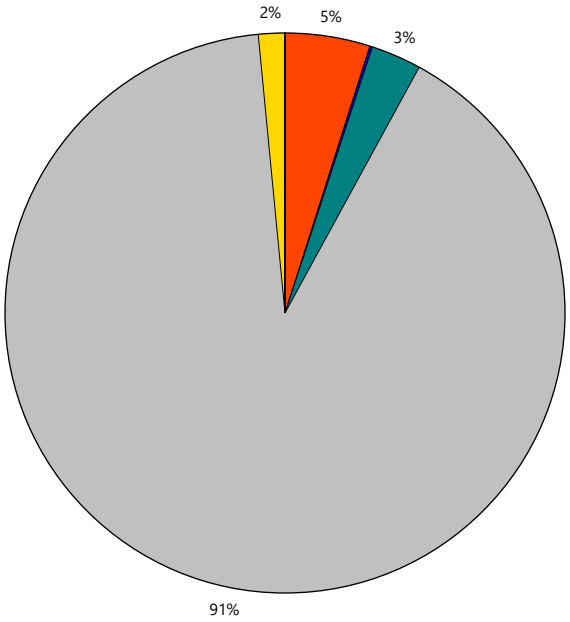
## Results per Life Cycle Stage




### Legend

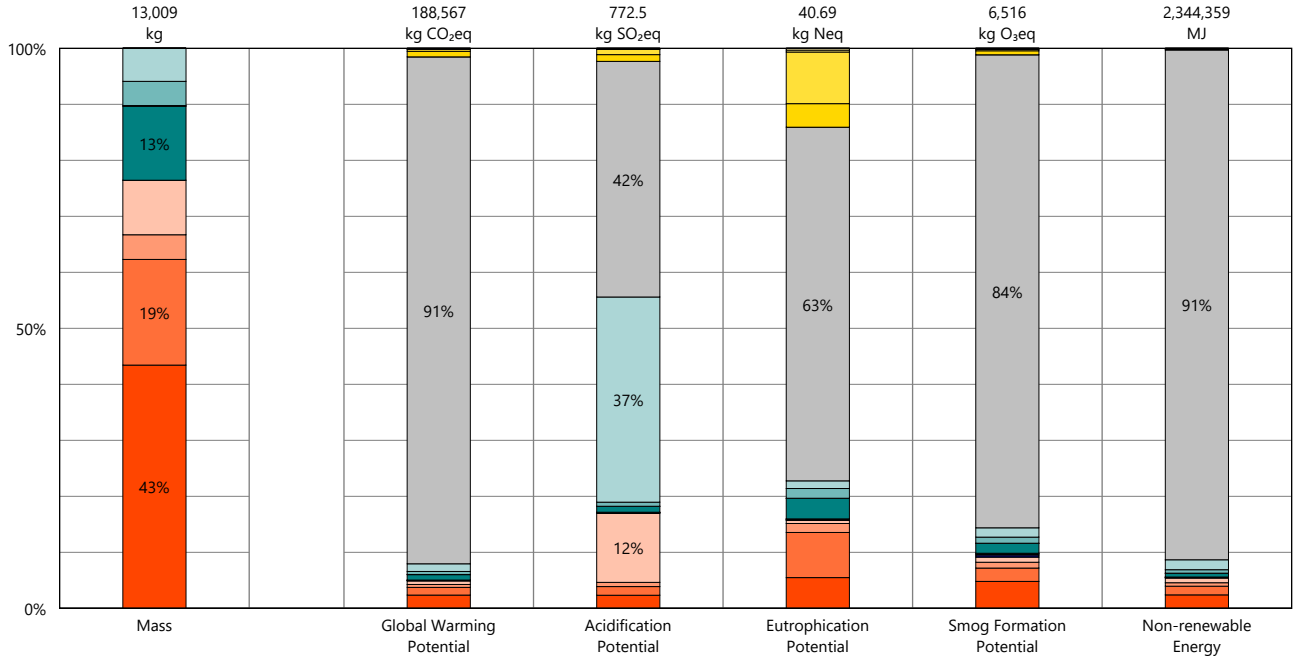
Life Cycle Stages

- Product [A1-A3]
- Transportation [A4]
- Maintenance and Replacement [B2-B5]
- Operational Energy [B6]
- End of Life [C2-C4]
- Module D [D]




Global Warming Potential

## Results per Life Cycle Stage, itemized by Division




## Legend

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

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

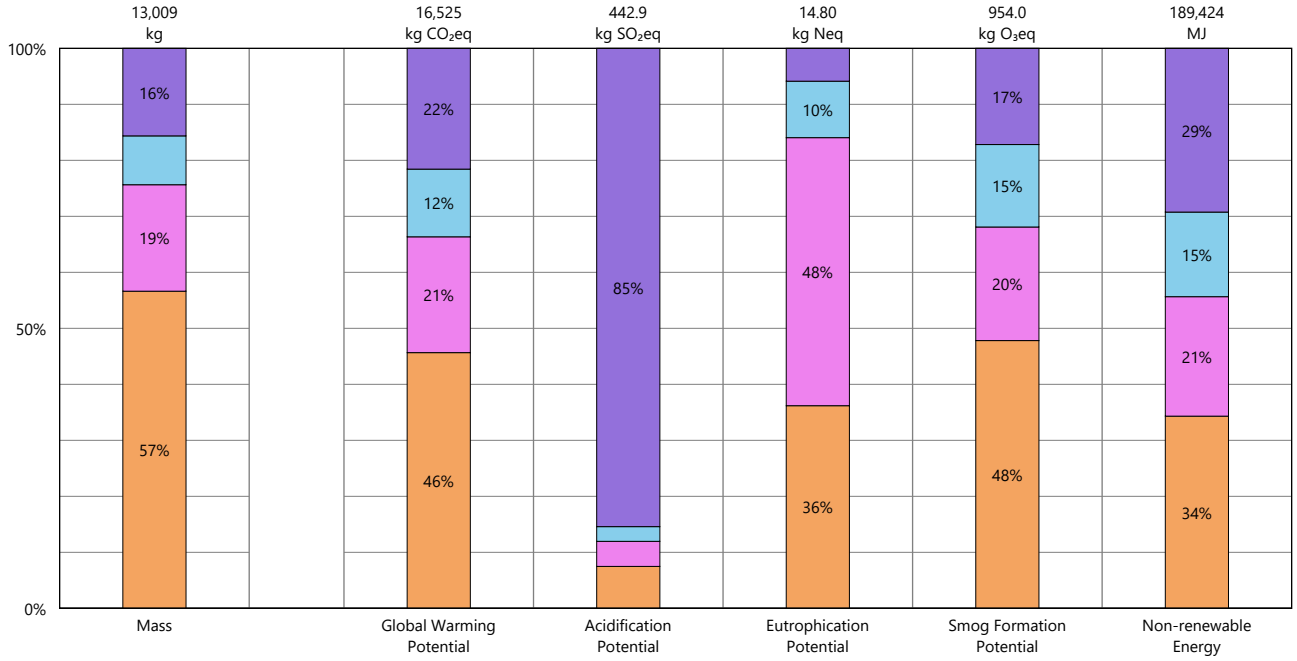
### Maintenance and Replacement [B2-B5]
- 06 - Wood/Plastics/Composites
- 07 - Thermal and Moisture Protection
- 08 - Openings and Glazing
- 09 - Finishes

### Operational Energy [B6]
- Electricity
- Heating

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

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

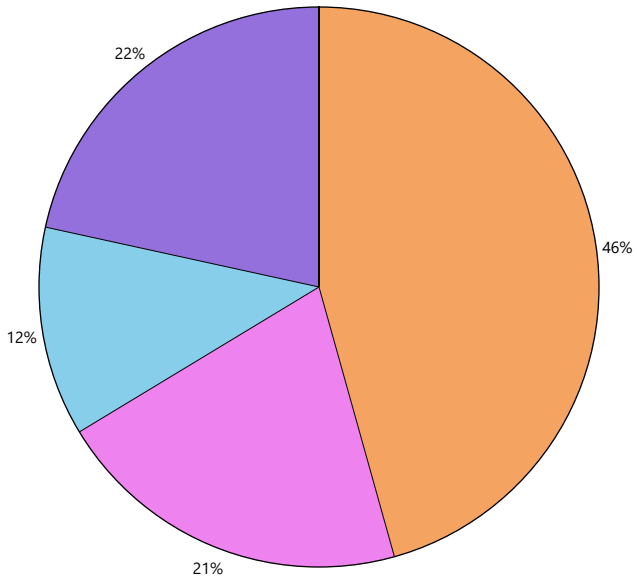
## Results per Division




### Legend

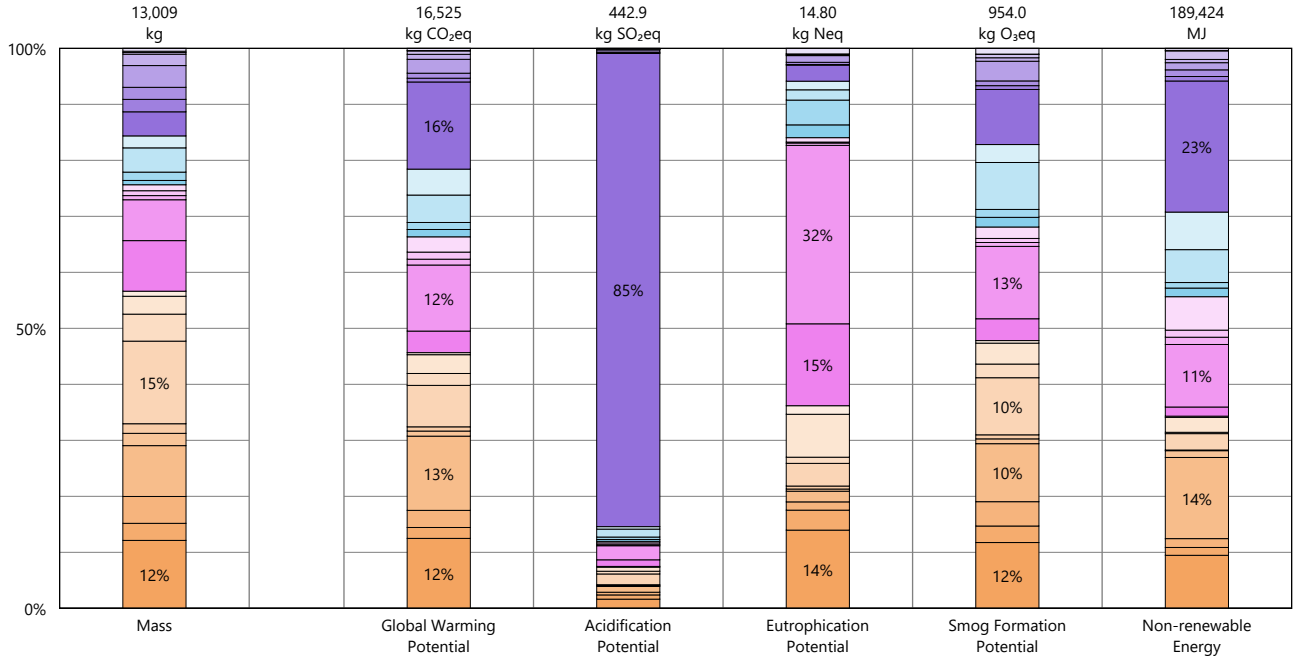
Divisions

- 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

### 06 - Wood/Plastics/Composites

- Cement bonded particle board
- Composite wood I-joist
- Domestic hardwood
- Fiber cement construction panel
- Fiberglass mat gypsum sheathing
- Heavy timber
- Plywood, exterior grade
- Wood framing
- Wood framing with insulation
- Wood veneer

### 07 - Thermal and Moisture Protection

- Cellulose insulation, blown
- Cellulose insulation, board
- Glass wool, batt or blown
- Mineral wool, board, generic
- TPO roofing membrane

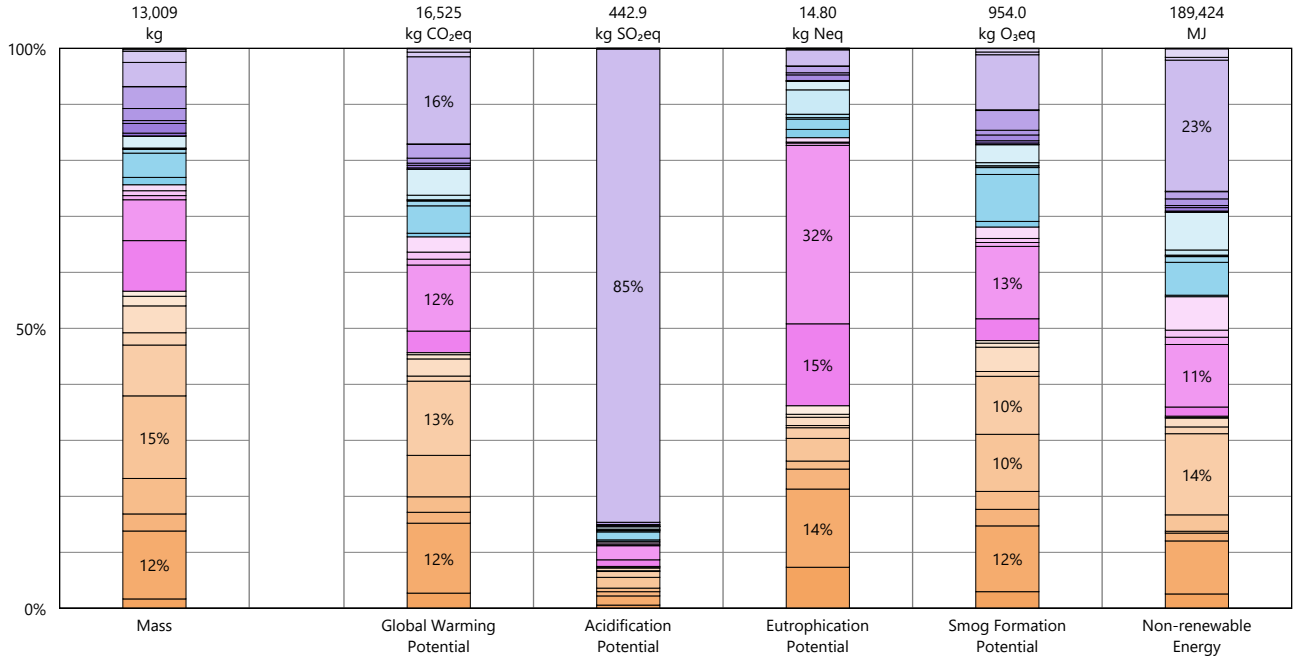
### 08 - Openings and Glazing

- Door, exterior, glass
- Door, interior, wood, hollow core, flush
- Glazing, double pane IGU
- Window frame, vinyl

### 09 - Finishes

- Carpet, nylon
- Ceramic tile
- Fiberglass mat gypsum sheathing
- Flooring, solid wood plank
- Portland cement stucco
- Synthetic Stucco
- Wall board, gypsum
- Wall covering, cork

## Results per Division, itemized by Material




### Legend

#### 06 - Wood/Plastics/Composites

- Cellulose insulation, boards
- Cement bonded particle board
- Composite wood I-joist, AWC - EPD
- Domestic softwood, US, AWC - EPD
- Exterior grade plywood, US
- Fiber cement structural panel, Eternit, Eterplan - EPD
- Fiberglass mat gypsum sheathing board
- Hard maple lumber, 1 inch
- Heavy timber, US
- Softwood veneer

#### 07 - Thermal and Moisture Protection

- Cellulose insulation, blown
- Cellulose insulation, boards
- Glass wool unfaced batt, Knauf, EcoBatt - EPD
- Mineral wool, high density, NAIMA - EPD
- TPO membrane, 60 mils, SPRI - EPD

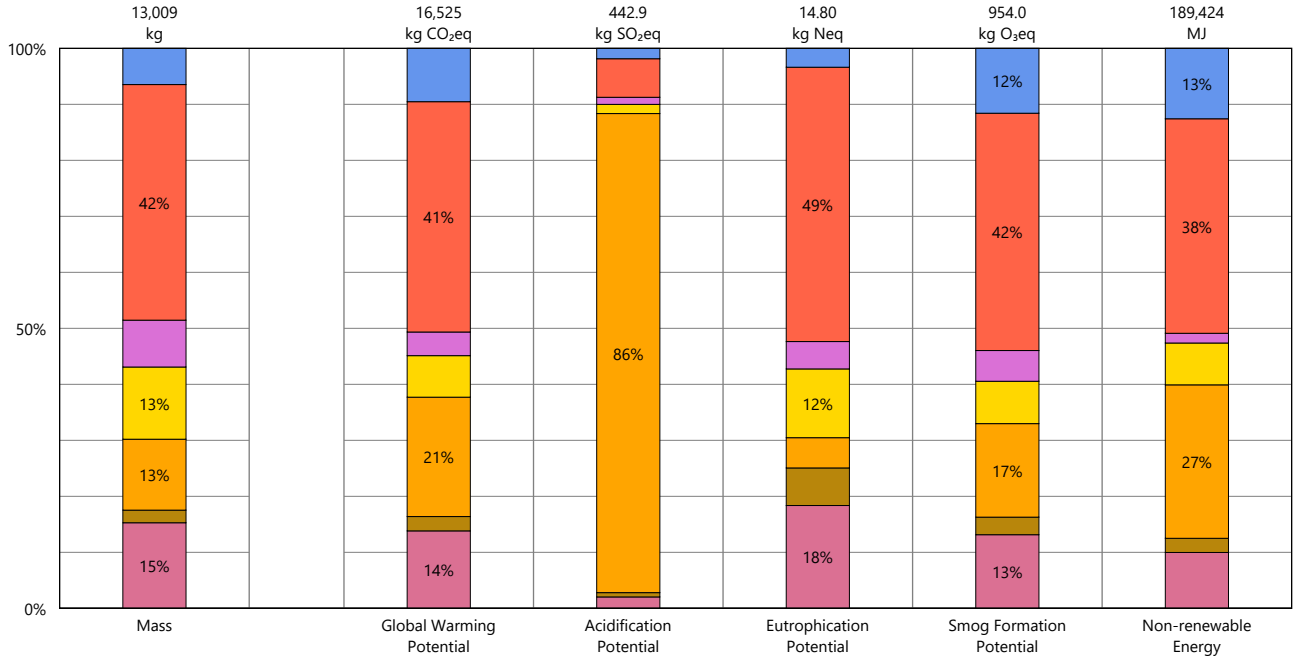
#### 08 - Openings and Glazing

- Door, interior, wood, hollow core
- Glazing, double, insulated (air)
- Glazing, monolithic sheet, tempered
- Hardware, stainless steel
- Low-e coating (for glazing)
- Steel door hinge
- Window frame, vinyl, operable
- Wood stain, water based

#### 09 - Finishes

- Cement mortar, TCNA - EPD
- Ceramic tile, glazed
- Cork tile
- Fiberglass mat gypsum sheathing board
- Hard maple lumber, 1 inch
- Metal lath, for plaster
- Nylon carpet tiles, Mohawk, EcoFlex ICT - EPD
- Stucco, portland cement
- Stucco, synthetic
- Wall board, gypsum, natural

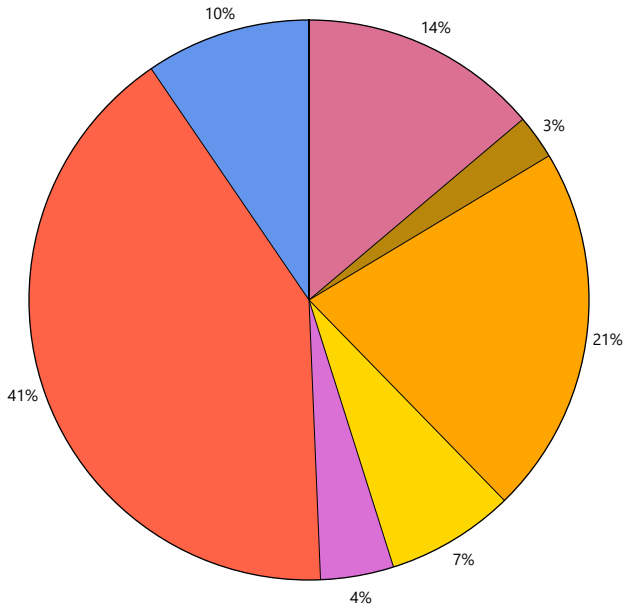
## Results per Revit Category




### Legend

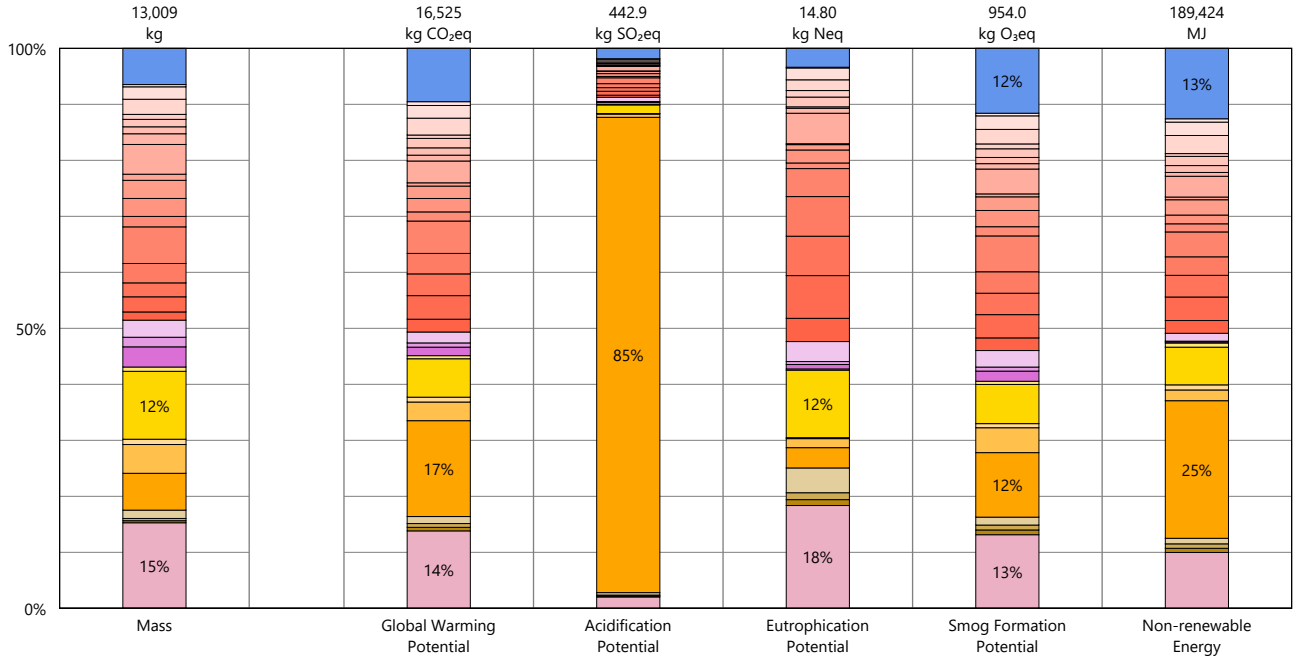
Revit Categories

- Ceilings
- Doors
- Floors
- Roofs
- Structure
- Walls
- Windows




Global Warming Potential

## Results per Revit Category, itemized by Family




## Legend

### Ceilings
- Awning
- GWB on Wood Joists

### Doors
- Exterior - Glazed
- Exterior - Single - Flush
- Interior - Single - Flush

### Floors
- Interior - 2x10 over crawl (N Carpet)
- Interior - 2x10 over crawl (N Madrone)
- Interior - 2x10 over crawl (Tile)

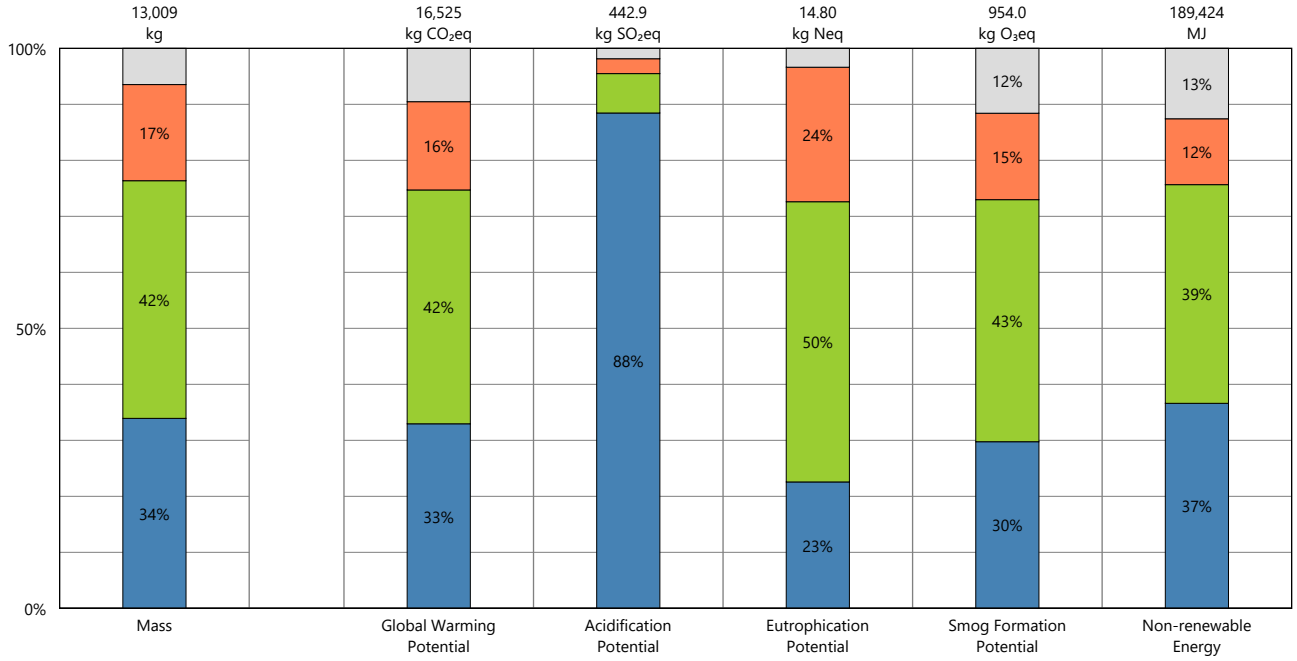
### Roofs
- 14" TJI - TPO - new
- 14" TJI - TPO - new eave

### Structure
- Dimension Lumber
- LVL-Laminated Veneer Lumber
- Plywood Web Joist

### Walls
- Exterior - 3 1/2" Wood Studs (n)
- Exterior (Addition) - 3 1/2" Wood Studs (n)
- Exterior (East Wall) - 3 1/2" Wood Studs (n)
- Exterior (Entry) - 3 1/2" Wood Studs (N)
- Exterior (N)- 3 1/2" Wood Studs -North
- Exterior (N)- 3 1/2" Wood Studs -North (bathroom)
- Exterior (N)- 3 1/2" Wood Studs -North conf
- Exterior(N) (parapet) - 3 1/2" Wood Studs (acrylic stucco) 2
- Exterior(N) (parapet) - 3 1/2" Wood Studs 7
- Exterior(N) (Upper Ext) - 3 1/2" Wood Studs (acrylic stucco)
- Exterior(N) (Upper Ext) - 3 1/2" Wood Studs 6
- Interior - Non-rated - 3 1/2" Wood Studs
- Interior - Non-rated - 3 1/2" Wood Studs (insulation)
- Interior - Non-rated - 3 1/2" Wood Studs (insulation) cork
- Interior - Wood Stud - 3 1/2" - bath
- Interior - Wood Stud - 3 1/2" - bath/conf
- Interior - Wood Stud - 3 1/2" - office new

### Windows
- Standard Window - Single

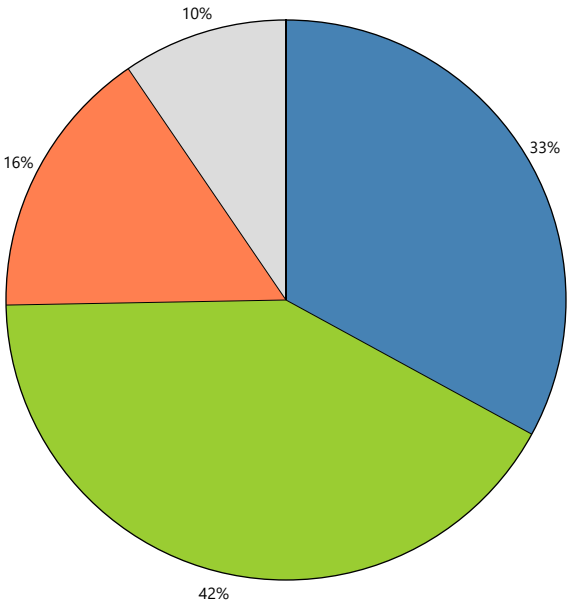
## Results per Building Element




### Legend

Building Elements

- Superstructure
- Enclosure
- Interiors
- Undefined




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

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 $CO_2$eq).

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 $SO_2$eq

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 $CO_2$eq

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 $O_3$eq

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)

## OPERATIONAL ENERGY [B6]

Each associated dataset includes relevant upstream impacts associated with extraction of energy resources (such as coal or crude oil), including refining, combustion, transmission, losses, and other associated factors.

**Operational Electrical Energy** **6198 kWh**

Description:
Subregional grid mix - Electricity grid mix for Oregon, Washington, Idaho, Nevada, Utah, Montana, western Wyoming

Scope:
The data set represents the average region specific electricity supply for final consumers, including native power production, own consumption, transmission/distribution losses, and electricity imports. The development of the regions is based on the subregions from US EPA's, eGRID2014 (Emission & Generation Resource Integrated Database). Since the data set represents a consumption mix, the imports from neighboring regions and countries (CA, MX) have been included.

LCI Source:
US: Electricity grid mix - NWPP ts (2014)

**Operational Heating Energy** **0 kWh**

Description:
Natural gas - Natural gas in the western US (roughly west of Colorado/Kansas border)

Scope:
The data set represents region-specific natural gas use for heating during building use and operations. Entry includes upstream production of natural gas, transport from refinery to filling station, and on-site combustion.

LCI Source:
US: Thermal energy from natural gas (West) ts (2014)

## 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

**Harka Building_CD_Tally_Carbon Takeoffs_NEW ONLY_2024**

Worksets
- N/A

Phases
- 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.

**Cellulose insulation, blown** **1,174.6 kg**

Used in the following Revit families:

| | |
|---|---|
| 14" TJI - TPO - new | 830.6 kg (60 yrs*) |
| GWB on Wood Joists | 344.0 kg (60 yrs) |

Used in the following Tally entries:
- Cellulose insulation, blown

Description:
- Blown-in cellulose insulation

Life Cycle Inventory:
- Waste paper fibers
- Boric acid
- Boraxpentahydrate

Product Scope:
- Cradle to gate

Transportation Distance:
- By truck: 1020 km

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

LCI Source:
- DE: Cellulose fibre blowing insulation material (EN15804 A1-A3) ts (2017)

**Cellulose insulation, boards** **1,168.0 kg**

Used in the following Revit families:

| | |
|---|---|
| Exterior - 3 1/2" Wood Studs (n) | 120.1 kg (60 yrs) |
| Exterior (Addition) - 3 1/2" Wood Studs (n) | 221.2 kg (60 yrs) |
| Exterior (East Wall) - 3 1/2" Wood Studs (n) | 203.8 kg (60 yrs) |
| Exterior (Entry) - 3 1/2" Wood Studs (N) | 155.5 kg (60 yrs) |
| Exterior (N)- 3 1/2" Wood Studs -North | 101.6 kg (60 yrs) |
| Exterior (N)- 3 1/2" Wood Studs -North (bathroom) | 18.6 kg (60 yrs) |
| Exterior (N)- 3 1/2" Wood Studs -North conf | 45.0 kg (60 yrs) |
| Exterior(N) (Upper Ext) - 3 1/2" Wood Studs (acrylic stucco) | 130.8 kg (60 yrs) |
| Exterior(N) (Upper Ext) - 3 1/2" Wood Studs 6 | 20.3 kg (60 yrs) |
| Interior - Non-rated - 3 1/2" Wood Studs (insulation) | 45.7 kg (60 yrs) |
| Interior - Non-rated - 3 1/2" Wood Studs (insulation) cork | 21.6 kg (60 yrs) |
| Interior - Wood Stud - 3 1/2" - bath | 46.4 kg (60 yrs) |
| Interior - Wood Stud - 3 1/2" - bath/conf | 37.3 kg (60 yrs) |

Used in the following Tally entries:
- Cellulose insulation, board
- Wood framing with insulation

Description:
- Cellulose insulation, boards

Life Cycle Inventory:
- Waste paper fibers
- Tall oil resin
- Ferrochrome-lignine sulfonate
- Borax

# LCI Data (continued)

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 1020 km

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

LCI Source:
DE: Cellulose fibre boards (EN 15804 A1-A3) ts (2017)

**Cement bonded particle board** **1,578.0 kg**

Used in the following Revit families:

| | |
|---|---|
| GWB on Wood Joists | 1,578.0 kg (30 yrs) |

Used in the following Tally entries:
Cement bonded particle board

Description:
Sheet material comprised of cement and reinforcing fibers (wood flakes) formed into sheets, 1/4 to 1/2 inch thick, apropriate for use in roofs, floors, and walls, including fire-rated assemblies.

Life Cycle Inventory:
72.5% cement
17.5% cellulose fibers
10% water (via fiber moisture content)
<1% binding agent

Product Scope:
Cradle to gate, uncoated

Transportation Distance:
By truck: 172 km

End-of-Life Scope:
100% Landfilled (17.5% biodegradable waste, 82.5% inert waste)

LCI Source:
US: Portland cement PCA/ts (2014)
DE: Cellulose fibre boards (EN 15804 A1-A3) ts (2017)
DE: Polyvinyl acetate (PVAC) ts 2017

**Cement mortar, TCNA - EPD** **64.3 kg**

Used in the following Revit families:

| | |
|---|---|
| Exterior (N)- 3 1/2" Wood Studs -North (bathroom) | 9.8 kg (60 yrs) |
| Interior - 2x10 over crawl (Tile) | 10.2 kg (60 yrs) |
| Interior - Wood Stud - 3 1/2" - bath | 24.5 kg (60 yrs) |
| Interior - Wood Stud - 3 1/2" - bath/conf | 19.7 kg (60 yrs) |

Used in the following Tally entries:
Ceramic tile

Description:
Average cement mortar for tile installation, appropriate for use as thinset mortar. Industry-wide EPD from the Tile Council of North America.

Life Cycle Inventory:
For information and quantities, see EPD

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 500 km

End-of-Life Scope:
100% Landfilled

LCI Source:
EPD (US), Tile Council of North America (2016)

EPD Source:
4787109018.102.1

EPD Designation Holder:
Tile Council of North America (TCNA)

EPD Program Operator:
UL Environment

EPD Expiration:
9/30/2021

**Ceramic tile, glazed** **224.5 kg**

Used in the following Revit families:

| | |
|---|---|
| Exterior (N)- 3 1/2" Wood Studs -North (bathroom) | 34.8 kg (60 yrs) |
| Interior - 2x10 over crawl (Tile) | 33.4 kg (60 yrs) |
| Interior - Wood Stud - 3 1/2" - bath | 86.7 kg (60 yrs) |
| Interior - Wood Stud - 3 1/2" - bath/conf | 69.7 kg (60 yrs) |

Used in the following Tally entries:
Ceramic tile

Description:
Ceramic tile, glazed

Life Cycle Inventory:
100% Ceramic tile, glazed

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 805 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)

**Composite wood I-joist, AWC - EPD** **396.5 kg**

Used in the following Revit families:

| | |
|---|---|
| Plywood Web Joist | 396.5 kg (60 yrs) |

Used in the following Tally entries:
Composite wood I-joist

Description:
Engineered wood I-joist. Industry-wide EPD from the American Wood Council. 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: 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: Engineered I-joists CORRIM (2011)

EPD Source:
13CA24184.106.1

EPD Designation Holder:
American Wood Council and Canadian Wood Council

EPD Program Operator:
UL Environment

EPD Expiration:
7/23/2019

**Cork tile** **67.1 kg**

Used in the following Revit families:

| | |
|---|---|
| Interior - Non-rated - 3 1/2" Wood Studs (insulation) cork | 24.6 kg (25 yrs) |
| Interior - Wood Stud - 3 1/2" - bath/conf | 42.5 kg (25 yrs) |

Used in the following Tally entries:
Wall covering, cork

Description:
Cork tile. Entry does not include backing (if any), coating (if any), or adhesive. Reference unit is 3/16" thick cork flooring tile.

# LCI Data (continued)

Life Cycle Inventory:
100% Cork tile

Product Scope:
Cradle to gate

Transportation Distance:
By container ship: 6437 km
By truck: 2414 km

End-of-Life Scope:
100% Landfilled (biodegradable material)

LCI Source:
DE: Corkboard, 1m², 8 mm (EN15804 A1-A3) ts (2017)

**Domestic softwood, US, AWC - EPD** **823.9 kg**

Used in the following Revit families:

| | |
|---|---|
| Awning | 6.8 kg (60 yrs) |
| Dimension Lumber | 468.3 kg (60 yrs) |
| Exterior (N)- 3 1/2" Wood Studs -North | 7.4 kg (60 yrs) |
| Exterior (N)- 3 1/2" Wood Studs -North (bathroom) | 1.4 kg (60 yrs) |
| Exterior (N)- 3 1/2" Wood Studs -North conf | 3.3 kg (60 yrs) |
| Exterior(N) (parapet) - 3 1/2" Wood Studs (acrylic stucco) 2 | 5.3 kg (60 yrs) |
| Exterior(N) (parapet) - 3 1/2" Wood Studs 7 | 0.8 kg (60 yrs) |
| Exterior(N) (Upper Ext) - 3 1/2" Wood Studs (acrylic stucco) | 109.7 kg (60 yrs) |
| Exterior(N) (Upper Ext) - 3 1/2" Wood Studs 6 | 21.1 kg (60 yrs) |
| GWB on Wood Joists | 59.2 kg (60 yrs) |
| Interior - Non-rated - 3 1/2" Wood Studs | 63.6 kg (60 yrs) |
| Interior - Non-rated - 3 1/2" Wood Studs (insulation) | 38.5 kg (60 yrs) |
| Interior - Non-rated - 3 1/2" Wood Studs (insulation) cork | 38.5 kg (60 yrs) |
| Interior - Wood Stud - 3 1/2" - office new | 0.0 kg (60 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. Industry-wide EPD from the American Wood Council.

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)

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

**Door, interior, wood, hollow core** **170.6 kg**

Used in the following Revit families:

| | |
|---|---|
| Interior - Single - Flush | 170.6 kg (30 yrs) |

Used in the following Tally entries:
Door, interior, wood, hollow core, flush

Description:
Interior wood door with hollow core

Life Cycle Inventory:
100% Wood

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

Transportation Distance:
By truck: 496 km

End-of-Life Scope:
14.5% Wood products recovered
22% Wood products incinerated with energy recovery
63.5% Wood products landfilled (wood product waste)

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

LCI Source:
RNA: Softwood plywood CORRIM (2011)

**Exterior grade plywood, US** **1,918.7 kg**

Used in the following Revit families:

| | |
|---|---|
| 14" TJI - TPO - new | 404.9 kg (60 yrs*) |
| 14" TJI - TPO - new eave | 54.1 kg (60 yrs*) |
| Exterior (Entry) - 3 1/2" Wood Studs (N) | 85.0 kg (30 yrs) |
| Exterior (N)- 3 1/2" Wood Studs -North | 190.3 kg (30 yrs) |
| Exterior (N)- 3 1/2" Wood Studs -North (bathroom) | 34.8 kg (30 yrs) |
| Exterior (N)- 3 1/2" Wood Studs -North conf | 168.4 kg (30 yrs) |
| Exterior(N) (parapet) - 3 1/2" Wood Studs (acrylic stucco) 2 | 270.8 kg (30 yrs) |
| Exterior(N) (parapet) - 3 1/2" Wood Studs 7 | 42.4 kg (30 yrs) |
| Exterior(N) (Upper Ext) - 3 1/2" Wood Studs (acrylic stucco) | 244.9 kg (30 yrs) |
| Exterior(N) (Upper Ext) - 3 1/2" Wood Studs 6 | 38.1 kg (30 yrs) |
| Interior - 2x10 over crawl (N Carpet) | 237.0 kg (60 yrs*) |
| Interior - 2x10 over crawl (N Madrone) | 130.5 kg (60 yrs*) |
| Interior - 2x10 over crawl (Tile) | 17.4 kg (60 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)

**Fiber cement structural panel, Eternit, Eterplan - EPD** **1,181.1 kg**

Used in the following Revit families:

| | |
|---|---|
| Exterior - 3 1/2" Wood Studs (n) | 70.8 kg (60 yrs) |
| Exterior (Addition) - 3 1/2" Wood Studs (n) | 130.4 kg (60 yrs) |
| Exterior (East Wall) - 3 1/2" Wood Studs (n) | 120.1 kg (60 yrs) |
| Exterior (Entry) - 3 1/2" Wood Studs (N) | 91.6 kg (60 yrs) |
| Exterior (N)- 3 1/2" Wood Studs -North | 98.3 kg (60 yrs) |
| Exterior (N)- 3 1/2" Wood Studs -North (bathroom) | 59.8 kg (60 yrs) |
| Interior - 2x10 over crawl (Tile) | 57.5 kg (60 yrs*) |
| Interior - Non-rated - 3 1/2" Wood Studs | 98.0 kg (60 yrs) |
| Interior - Non-rated - 3 1/2" Wood Studs (insulation) | 88.5 kg (60 yrs) |
| Interior - Wood Stud - 3 1/2" - bath | 193.8 kg (60 yrs) |
| Interior - Wood Stud - 3 1/2" - bath/conf | 119.8 kg (60 yrs) |
| Interior - Wood Stud - 3 1/2" - office new | 52.4 kg (60 yrs) |

Used in the following Tally entries:
Fiber cement construction panel

Description:
Fiber cement structural construction panel by Eternit. 10 mm thick. EPD representative of German (DE) conditions.

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

# LCI Data (continued)

Product Scope:
Cradle to gate, including packaging

Transportation Distance:
By truck: 172 km

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

LCI Source:
DE: Construction panel Eterplan - Eternit (A1-A3) ts-EPD (2012)

EPD Source:
EPD-ETE-2013211-E

EPD Designation Holder:
Eternit AG

EPD Program Operator:
Institut Bauen und Umwelt (IBU)

EPD Expiration:
1/13/2018

**Fiberglass mat gypsum sheathing board** **565.3 kg**

Used in the following Revit families:

| | |
|---|---|
| 14" TJI - TPO - new | 251.7 kg (60 yrs*) |
| 14" TJI - TPO - new eave | 33.6 kg (60 yrs*) |
| Exterior(N) (parapet) - 3 1/2" Wood Studs (acrylic stucco) 2 | 99.7 kg (60 yrs) |
| Exterior(N) (Upper Ext) - 3 1/2" Wood Studs (acrylic stucco) | 180.3 kg (60 yrs) |

Used in the following Tally entries:
Fiberglass mat gypsum sheathing

Description:
Fiberglass treated gypsum sheathing product appropriate for use in high-moisture environments.

Life Cycle Inventory:
92% Gypsum
8% Fiberglass mat

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 172 km

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

LCI Source:
DE: Gypsum plaster board (Moisture resistant) (EN15804 A1-A3) ts (2017)
US: Fiberglass Duct Board NAIMA (2007)

**Glass wool unfaced batt, Knauf, EcoBatt - EPD** **96.5 kg**

Used in the following Revit families:

| | |
|---|---|
| Interior - 2x10 over crawl (N Carpet) | 59.4 kg (60 yrs) |
| Interior - 2x10 over crawl (N Madrone) | 32.7 kg (60 yrs) |
| Interior - 2x10 over crawl (Tile) | 4.4 kg (60 yrs) |

Used in the following Tally entries:
Glass wool, batt or blown

Description:
Knauf Insulation's batts and rolls are glasswool thermal and acoustical products that have very high post-consumer glass content and a bio-based a thermosetting resin that gives the product shape. R-values of 11 to 49. Available with kraft, foil, or flame-rated FSK-25 foil facings. EPD is representative of products manufactured in the US and for sale in North America (NA).

Life Cycle Inventory:
For information and quantities, see EPD

Product Scope:
Cradle to gate, including packaging disposal

Transportation Distance:
By truck: 172 km

End-of-Life Scope:
100% Landfilled

LCI Source:
EPD (NA), Knauf Insulation (2013)

EPD Source:
4786058564.101.1

EPD Designation Holder:
Knauf Insulation

EPD Program Operator:
UL Environment

**Glazing, double, insulated (air)** **563.6 kg**

Used in the following Revit families:

| | |
|---|---|
| Standard Window - Single | 563.6 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

**Glazing, monolithic sheet, tempered** **87.3 kg**

Used in the following Revit families:

| | |
|---|---|
| Exterior - Glazed | 43.7 kg (40 yrs) |
| Exterior - Single - Flush | 43.7 kg (40 yrs) |

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

Description:
Tempered float glass. Note: this entry is appropriate for clear or tinted glass. Default thickness is 3 mm.

Life Cycle Inventory:
Tempered glazing

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 940 km

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

LCI Source:
DE: Window glass simple (EN15804 A1-A3) ts (2017)
US: Electricity grid mix ts (2014)
US: Thermal energy from natural gas ts (2014)

**Hard maple lumber, 1 inch** **1,129.5 kg**

Used in the following Revit families:

| | |
|---|---|
| Exterior (N)- 3 1/2" Wood Studs -North | 383.9 kg (50 yrs) |
| Exterior (N)- 3 1/2" Wood Studs -North (bathroom) | 70.3 kg (50 yrs) |
| Exterior (N)- 3 1/2" Wood Studs -North conf | 169.9 kg (50 yrs) |
| Interior - 2x10 over crawl (N Madrone) | 505.5 kg (50 yrs) |

Used in the following Tally entries:
Domestic hardwood
Flooring, solid wood plank

Description:
Kiln-dried Hard Maple (sugar, rock, or black maple) hardwood lumber of 1" nominal thickness as produced in the United States, focusing on the main production technologies. Maple is frequently used for moulding, flooring, furniture, 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% Hard Maple

# LCI Data (continued)

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: Hard Maple lumber, 1 inch (705 kg/m$^3$), kiln-dried ts/AHEC (2017)

EPD Source:
Information

EPD Designation Holder:
American Hardwood Export Council (AHEC)

**Hardware, stainless steel** **13.8 kg**

Used in the following Revit families:

| | |
|---|---|
| Exterior - Single - Flush | 4.3 kg (60 yrs) |
| Interior - Single - Flush | 9.5 kg (60 yrs) |

Used in the following Tally entries:
Door, exterior, glass
Door, interior, wood, hollow core, flush

Description:
Finished, cast stainless steel, applicable for door, window or other accessory hardware

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)
DE: Steel cast part machining ts (2017)
US: Electricity grid mix ts (2014)
RER: Stainless steel flat product (304) - value of scrap Eurofer (2010)

**Heavy timber, US** **223.4 kg**

Used in the following Revit families:

| | |
|---|---|
| LVL-Laminated Veneer Lumber | 223.4 kg (60 yrs) |

Used in the following Tally entries:
Heavy timber

Description:
Heavy timber framing using rectangular solid-wood framing members that are 5 inches nominal (114 mm actual) or larger in both width and depth

Life Cycle Inventory:
38% PNW-sourced heavy timber
62% SE-sourced heavy timber

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:
US: Dry rough lumber, at kiln, PNW USLCI/PE (2009)
US: Dry rough lumber, at kiln, SE USLCI/PE (2009)

**Low-e coating (for glazing)** **1.1 kg**

Used in the following Revit families:

| | |
|---|---|
| Exterior - Glazed | 0.6 kg (40 yrs) |
| Exterior - Single - Flush | 0.6 kg (40 yrs) |

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

Description:
Low-e coating for application to glazing lite

Life Cycle Inventory:
Ferro chrome mix
Nickel mix
Tin
Silver mix

Product Scope:
Cradle to gate

Transportation Distance:
N/A

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

LCI Source:
Low-e coating from DE: Double glazing unit (EN15804 A1-A3) ts (2017)

**Metal lath, for plaster** **6.2 kg**

Used in the following Revit families:

| | |
|---|---|
| Exterior(N) (parapet) - 3 1/2" Wood Studs 7 | 2.2 kg (60 yrs) |
| Exterior(N) (Upper Ext) - 3 1/2" Wood Studs 6 | 4.0 kg (60 yrs) |

Used in the following Tally entries:
Portland cement stucco

Description:
Hot dip galvanized steel lath used as reinforcement of interior or exterior plaster (stucco).

Life Cycle Inventory:
100% Steel, hot dip galvanized

Product Scope:
Cradle to gate of panel only, excludes suspended grid system and installation hardware

Transportation Distance:
By truck: 431 km

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

Module D Scope:
Product has 5% scrap input while remainder is processed and credited as avoided burden

LCI Source:
GLO: Steel Electrogalvanized worldsteel (2014)
GLO: Steel sheet stamping and bending (5% loss) ts (2017)
US: Electricity grid mix ts (2014)
US: Lubricants at refinery ts (2014)
GLO: Compressed air 7 bar (medium power consumption) ts (2014)
GLO: Value of scrap worldsteel (2014)
GLO: Punching steel sheet small part ts (2011)

**Mineral wool, high density, NAIMA - EPD** **113.3 kg**

Used in the following Revit families:

| | |
|---|---|
| Exterior (N)- 3 1/2" Wood Studs -North | 69.7 kg (60 yrs) |
| Exterior (N)- 3 1/2" Wood Studs -North (bathroom) | 12.8 kg (60 yrs) |
| Exterior (N)- 3 1/2" Wood Studs -North conf | 30.8 kg (60 yrs) |

Used in the following Tally entries:
Mineral wool, board, generic

Description:
Rock board, heavy density. Industry-wide EPD from the North America Insulation Manufacturers Association. EPD representative of conditions in North America.

# LCI Data (continued)

Life Cycle Inventory:
For information and quantities, see EPD

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 172 km

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

LCI Source:
US: Rock board insulation (heavy density) NAIMA (2007)

EPD Source:
4786060412.102.1

EPD Designation Holder:
North American Insulation Manufacturer's Association (NAIMA)

EPD Program Operator:
UL Environment

EPD Expiration:
11/8/2018

**Nylon carpet tiles, Mohawk, EcoFlex ICT - EPD** **559.2 kg**

Used in the following Revit families:
Interior - 2x10 over crawl (N Carpet) 559.2 kg (15 yrs)

Used in the following Tally entries:
Carpet, nylon

Description:
Modular Commercial Floor Covering by Mohawk, constructed using the EcoFlex ICT recycled content backing system in combination with a pile fiber wear layer containing nylon Type 6, 6.6, or Recycled Type 6. Average face weight of 22 oz. per square yard. EPD is representative of conditions in the US.

Life Cycle Inventory:
For information and quantities, see EPD

Product Scope:
Cradle to gate, including installation

Transportation Distance:
By truck: 805 km

End-of-Life Scope:
76.2% Landfilled (plastic material)
18.6% Incinerated
5.6% Recovered

Module D Scope:
Avoided burden credit for nylon granulate, includes recycling energy
Credit includes energy recovery from waste incineraiton

LCI Source:
US: Nylon carpet tiles with backing, EcoFlex ICT Modular Carpet Tiles, EPD - Mohawk (2013)

EPD Source:
12CA57885.101.1

EPD Designation Holder:
Mohawk Group

EPD Program Operator:
UL Environment

EPD Expiration:
5/30/2018

**Softwood veneer** **117.9 kg**

Used in the following Revit families:
Exterior (Entry) - 3 1/2" Wood Studs (N) 117.9 kg (25 yrs)

Used in the following Tally entries:
Wood veneer

Description:
Softwood veneer

Life Cycle Inventory:
43% PNW-sourced softwood
57% SE-sourced softwood

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:
US: Dry veneer, at plywood plant, PNW USLCI/PE (2009)
US: Dry veneer, at plywood plant, SE USLCI/PE (2009)

**Steel door hinge** **16.8 kg**

Used in the following Revit families:
Exterior - Glazed 3.5 kg (30 yrs)
Exterior - Single - Flush 3.5 kg (30 yrs)
Interior - Single - Flush 9.8 kg (30 yrs)

Used in the following Tally entries:
Door, exterior, glass
Door, interior, wood, hollow core, flush

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

**Stucco, portland cement** **257.2 kg**

Used in the following Revit families:
Exterior(N) (parapet) - 3 1/2" Wood Studs 7 92.1 kg (60 yrs)
Exterior(N) (Upper Ext) - 3 1/2" Wood Studs 6 165.2 kg (60 yrs)

Used in the following Tally entries:
Portland cement stucco

Description:
Portland cement plastering (stucco), 7/8" (22.25 mm) nominal thickness is typical

Life Cycle Inventory:
100% Light plaster (Silica sand, Portland cement, Calcinated lime)

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 172 km

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

# LCI Data (continued)

LCI Source:
US: Silica sand (Excavation and processing) ts (2017)
US: Portland cement PCA/ts (2015)
US: Lime (CaO) calcination ts (2017)

**Stucco, synthetic** **38.9 kg**

Used in the following Revit families:

| | |
|---|---|
| Exterior(N) (parapet) - 3 1/2" Wood Studs (acrylic stucco) 2 | 13.8 kg (30 yrs) |
| Exterior(N) (Upper Ext) - 3 1/2" Wood Studs (acrylic stucco) | 25.0 kg (30 yrs) |

Used in the following Tally entries:
Synthetic Stucco

Description:
Acrylic latex stucco layer, typically applied over a PVC lath. Base stucco layer with a default thickness of 3/8" (9.5 mm).

Life Cycle Inventory:
90% Acrylic resin
10% Quartz sand
2.2% NMVOC emissions during application

Product Scope:
Cradle to gate, including emissions during application

Transportation Distance:
By truck: 642 km

End-of-Life Scope:
97.8% Solids landfilled (plastic waste)

LCI Source:
DE: Acrylate resin (solvent systems) PE (2015)
US: Silica sand (excavation and processing) ts (2017)

**TPO membrane, 60 mils, SPRI - EPD** **139.1 kg**

Used in the following Revit families:

| | |
|---|---|
| 14" TJI - TPO - new | 90.5 kg (60 yrs*) |
| 14" TJI - TPO - new eave | 12.1 kg (60 yrs*) |
| Exterior(N) (parapet) - 3 1/2" Wood Studs (acrylic stucco) 2 | 31.5 kg (30 yrs) |
| Exterior(N) (parapet) - 3 1/2" Wood Studs 7 | 4.9 kg (30 yrs) |

Used in the following Tally entries:
TPO roofing membrane

Description:
Thermoplastic polyolefin (TPO) roofing membrane, default thickness 60 mils (1.5 mm). Industry-wide EPD from the Single Ply Roofing Industry.

Life Cycle Inventory:
For information and quantities, see EPD

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 172 km

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

LCI Source:
US: TPO single ply roofing membrane, 60 mils, A1-A3 - SPRI ts (2017)

EPD Source:
4786842353.102.1

EPD Designation Holder:
Single Ply Roofing Industry (SPRI)

EPD Program Operator:
UL Environment

EPD Expiration:
9/23/2021

**Wall board, gypsum, natural** **30.9 kg**

Used in the following Revit families:

| | |
|---|---|
| Interior - Non-rated - 3 1/2" Wood Studs (insulation) cork | 30.9 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)

**Window frame, vinyl, operable** **278.1 kg**

Used in the following Revit families:

| | |
|---|---|
| Standard Window - Single | 278.1 kg (30 yrs) |

Used in the following Tally entries:
Window frame, vinyl

Description:
Vinyl operable window frame inclusive of steel bracing

Life Cycle Inventory:
Vinyl frame: 2.8 kg/m (1.3 kg/m PVC part
metal reinforcement 1.5 kg/m (Steel cold rolled, zinc-coated))

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** **3.5 kg**

Used in the following Revit families:

| | |
|---|---|
| Interior - Single - Flush | 3.5 kg (10 yrs) |

Used in the following Tally entries:
Door, interior, wood, hollow core, flush

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)