Harka Office Building

Full building summary_New Baseline

6/25/2024

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Report Summary

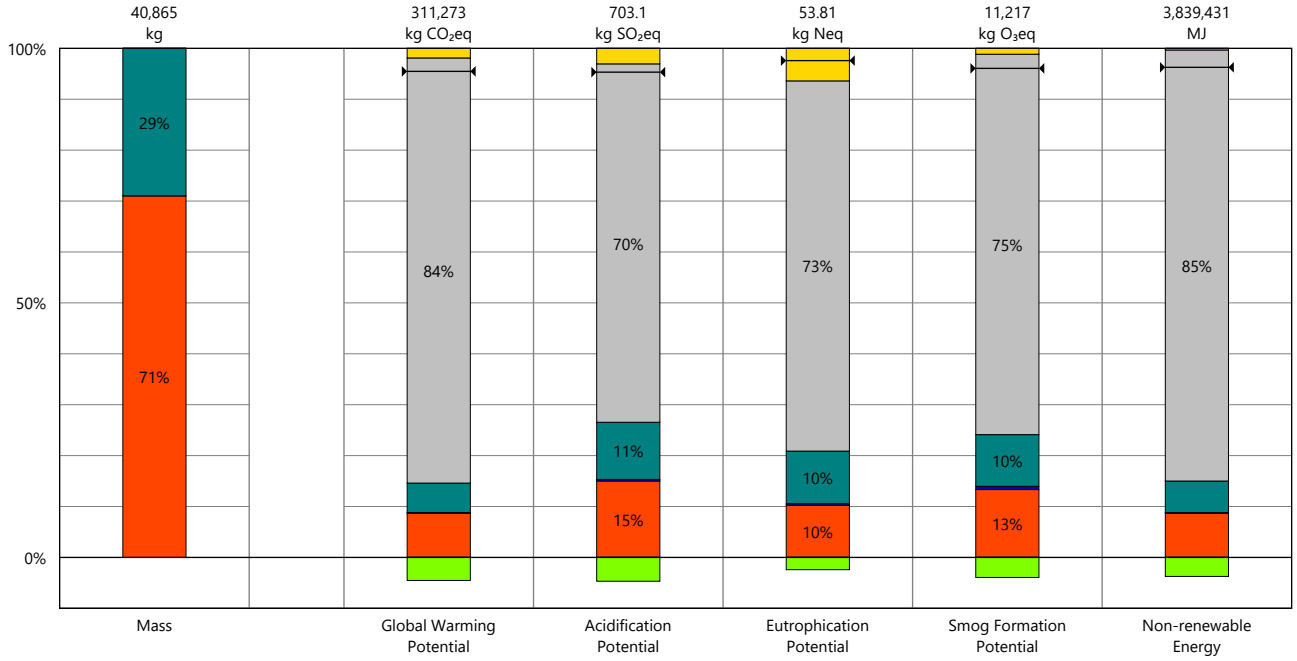
Created with Tally
Commercial Version 2023.09.13.01

Author	
Company	Harka Architecture
Date	6/25/2024
Project	Harka Office Building
Location	680 ft²
Gross Area	60 years
Building Life	
Boundaries	Cradle to grave, exclusive of biogenic carbon; see appendix for a full list of materials and processes
Operational Energy [B6]	9438.99 kWh annual electricity use 0 kBtu annual heating energy use

Goal and Scope of Assessment
Baseline model: new construction 680 sf office building. Built to meet code standards using standard building materials.

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_2eq)	27,013	461.5	277,921	5,878	-14,091
Acidification (kg SO_2eq)	105.5	2.150	573.9	21.45	-32.9
Eutrophication (kg Neq)	5.508	0.1751	44.69	3.441	-1.30
Smog Formation (kg O_3eq)	1,495	71.05	9,521	129.6	-442
Ozone Depletion (kg CFC-11eq)	2.482E-004	1.589E-011	2.036E-004	1.566E-010	8.421E-005
Primary Energy (MJ)	431,171	6,748	5,110,860	13,302	-156,808
Non-renewable Energy (MJ)	331,788	6,587	3,488,609	12,448	-143,270
Renewable Energy (MJ)	99,471	163.2	1,622,228	860.8	-13,507
Environmental Impacts / Area					
Global Warming (kg CO_2eq/m²)	427.6	7.305	4,399	93.04	-223
Acidification (kg SO_2eq/m²)	1.671	0.03404	9.085	0.3395	-0.5208
Eutrophication (kg Neq/m²)	0.08719	0.002771	0.7074	0.05447	-0.02056
Smog Formation (kg O_3eq/m²)	23.67	1.125	150.7	2.052	-6.99
Ozone Depletion (kg CFC-11eq/m²)	3.929E-006	2.516E-013	3.223E-006	2.479E-012	1.333E-006
Primary Energy (MJ/m²)	6,825	106.8	80,901	210.6	-2,482
Non-renewable Energy (MJ/m²)	5,252	104.3	55,222	197.0	-2,268
Renewable Energy (MJ/m²)	1,575	2.583	25,679	13.63	-214

Results per Life Cycle Stage

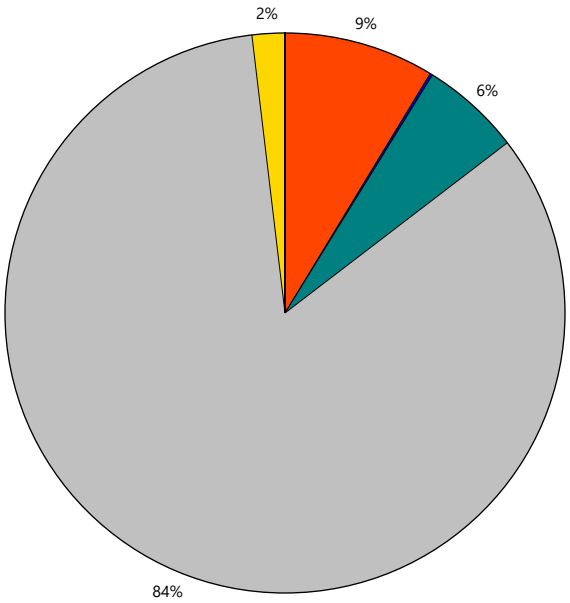


Legend

Net value (impacts + credits)

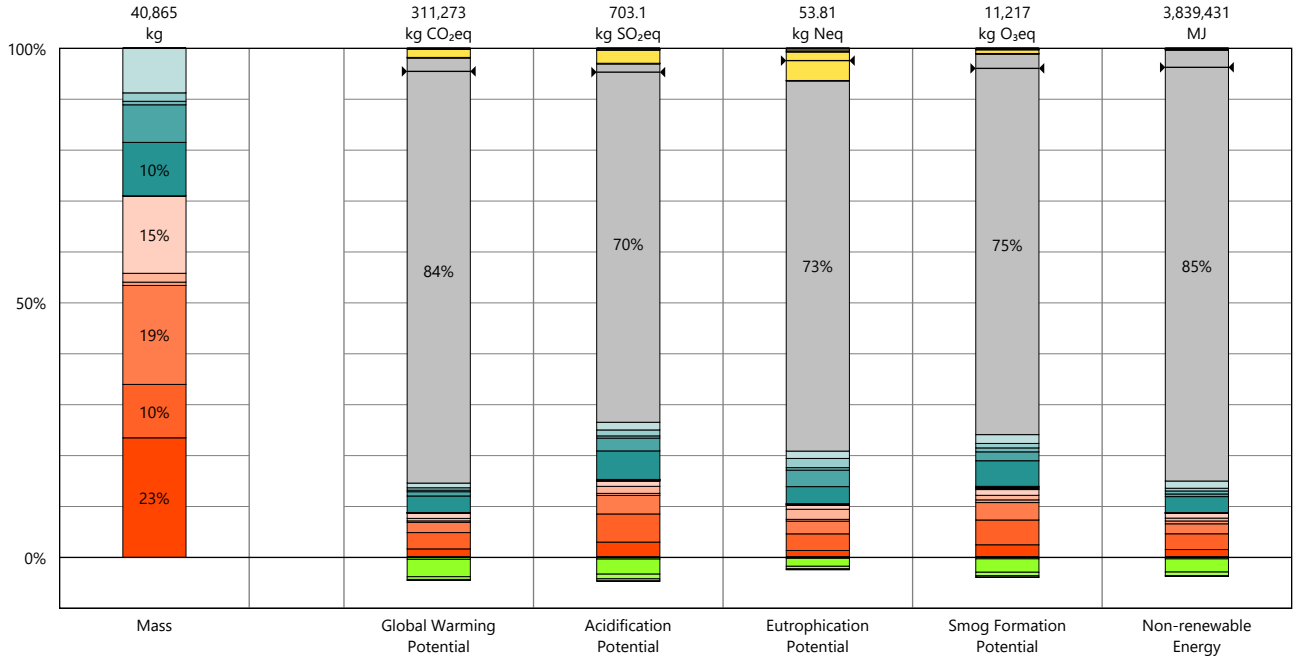
Life Cycle Stages

- 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

Net value (impacts + credits)

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

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

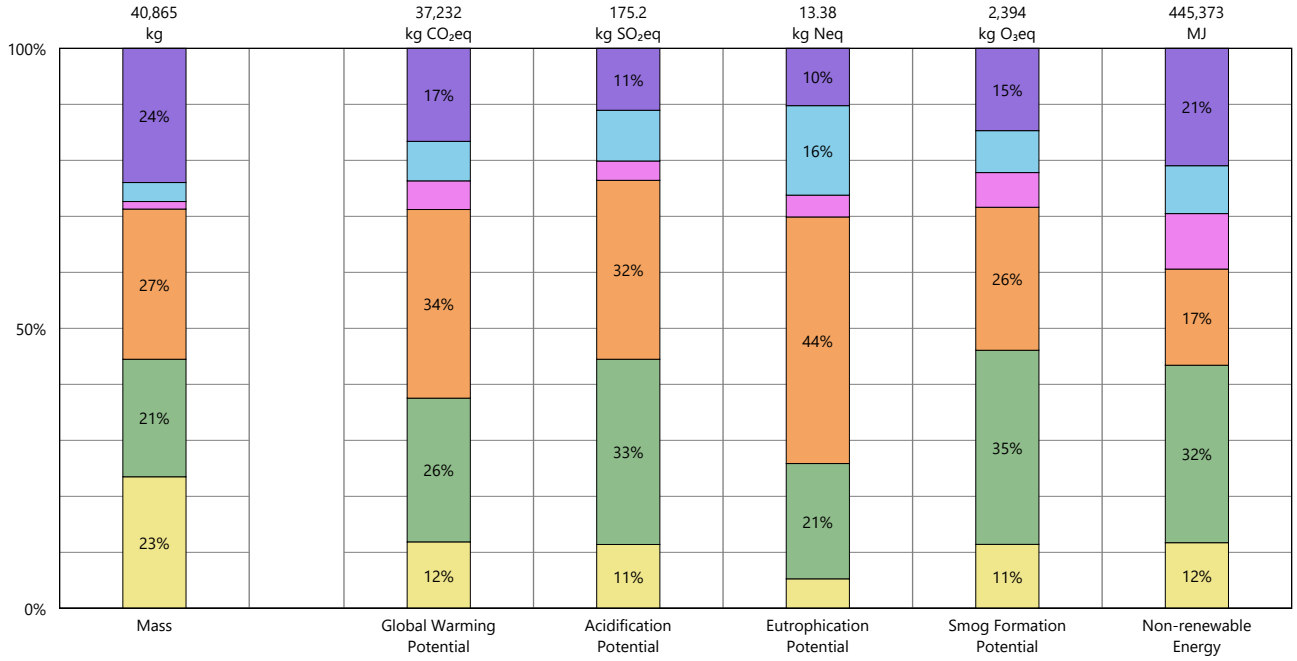
Maintenance and Replacement [B2-B5]
- 03 - Concrete
- 05 - Metals
- 06 - Wood/Plastics/Composites
- 07 - Thermal and Moisture Protection
- 08 - Openings and Glazing
- 09 - Finishes

Operational Energy [B6]
- Electricity
- Heating

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

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

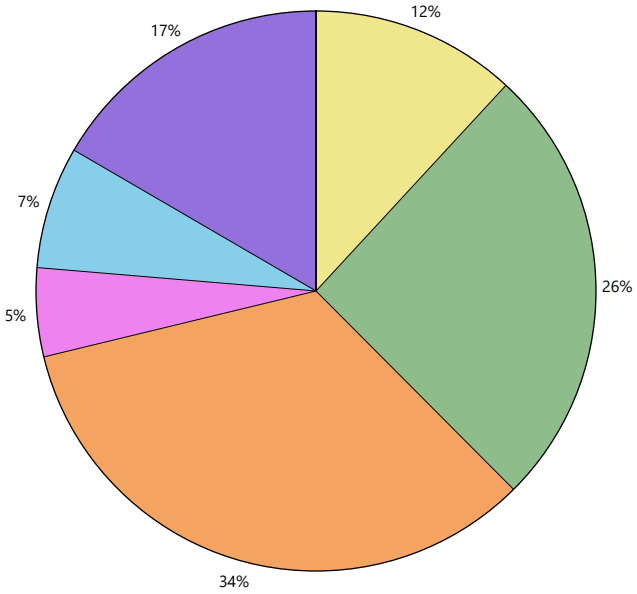
Results per Division



Legend

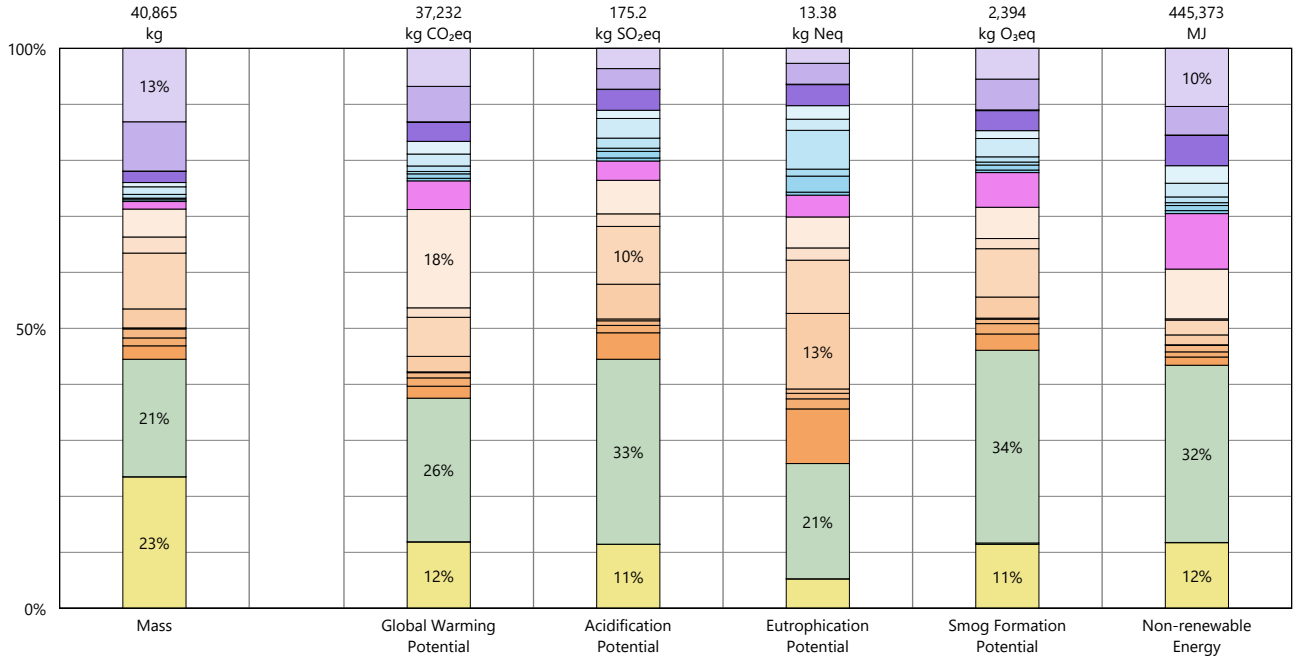
Divisions

- 03 - Concrete
- 05 - Metals
- 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

03 - Concrete

- Cast-in-place concrete, structural concrete, 2500 psi

05 - Metals

- Steel, round tubing
- Steel, sheet, carbon steel

06 - Wood/Plastics/Composites

- Composite wood I-joist
- Domestic hardwood
- Fiberglass mat gypsum sheathing
- Glue laminated timber (Glulam)
- Oriented strandboard (OSB)
- Plywood, exterior grade
- Wood framing
- Wood framing with insulation

07 - Thermal and Moisture Protection

- EPDM, roofing membrane

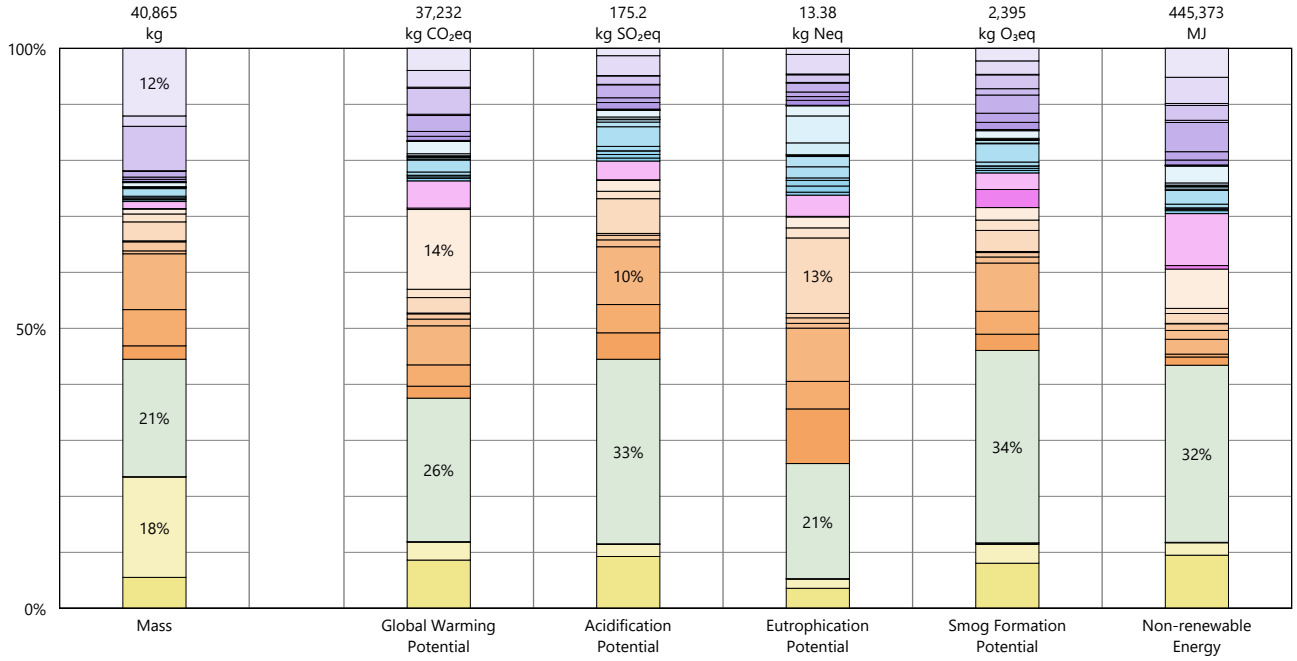
08 - Openings and Glazing

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

09 - Finishes

- Flooring, resilient
- Flooring, solid wood plank
- Portland cement stucco
- Wall board, gypsum

Results per Division, itemized by Material



Legend

03 - Concrete
- Steel, reinforcing rod
- Structural concrete, 2500 psi, Pacific Northwest regional average

05 - Metals
- Cold formed structural steel
- Paint, enamel, solvent based
- Paint, exterior metal coating, silicone-based
- Steel, sheet

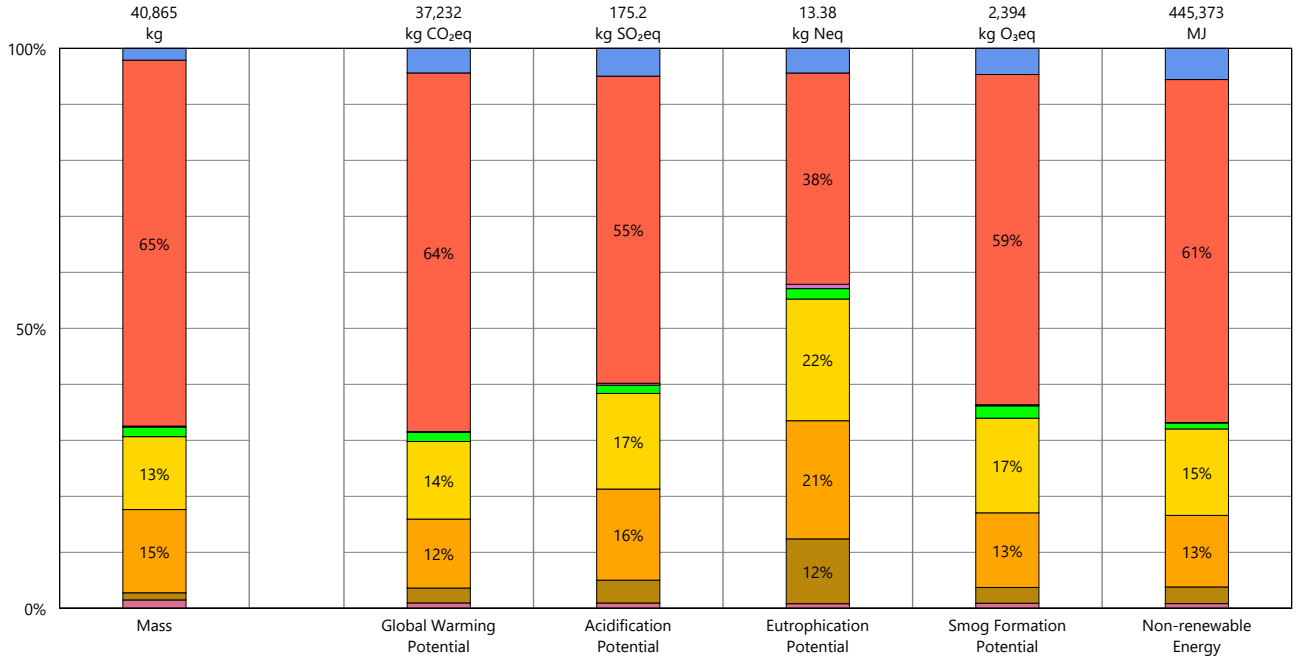
06 - Wood/Plastics/Composites
- Composite wood I-joist, AWC - EPD
- Domestic softwood, US, AWC - EPD
- Exterior grade plywood, US
- Fiberglass blanket insulation, unfaced
- Fiberglass mat gypsum sheathing board
- Glue laminated timber (Glulam), AWC - EPD
- Oriented strandboard (OSB), AWC - EPD
- Red oak lumber, 1 inch
- Spray polyurethane foam, closed cell (HFC blowing agent), SPFA - EPD

07 - Thermal and Moisture Protection
- Adhesive, polychloroprene (neoprene)
- EPDM, reinforced membrane, 60 mils, SPRI - EPD

08 - Openings and Glazing
- Door frame, aluminum, powder-coated, no door
- Door, interior, wood, MDF core
- Door, interior, wood, MDF core, large vision panel
- Fasteners, galvanized steel
- Glazing, double, 3 mm, laminated safety glass
- Glazing, double, insulated (air)
- Hardware, stainless steel
- Hollow door, exterior, steel, galvanized
- Low-e coating (for glazing)
- Paint, interior acrylic latex
- Stainless steel door hinge
- Steel door hinge
- Window frame, vinyl, operable
- Wood stain, water based

09 - Finishes
- Domestic softwood, US, AWC - EPD
- Floor and wall adhesive, latex
- Floor and wall adhesive, urethane
- Kraft paper
- Metal lath, for plaster
- Paint, exterior acrylic latex
- Paint, interior acrylic latex
- Polyurethane floor finish, water-based
- Stucco, portland cement
- Underlayment, foam
- Vinyl composition tile, ERFMI - EPD
- Wall board, gypsum, natural

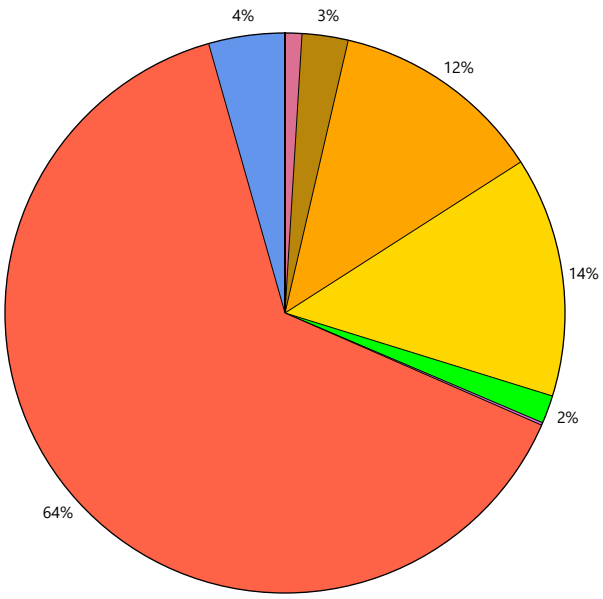
Results per Revit Category



Legend

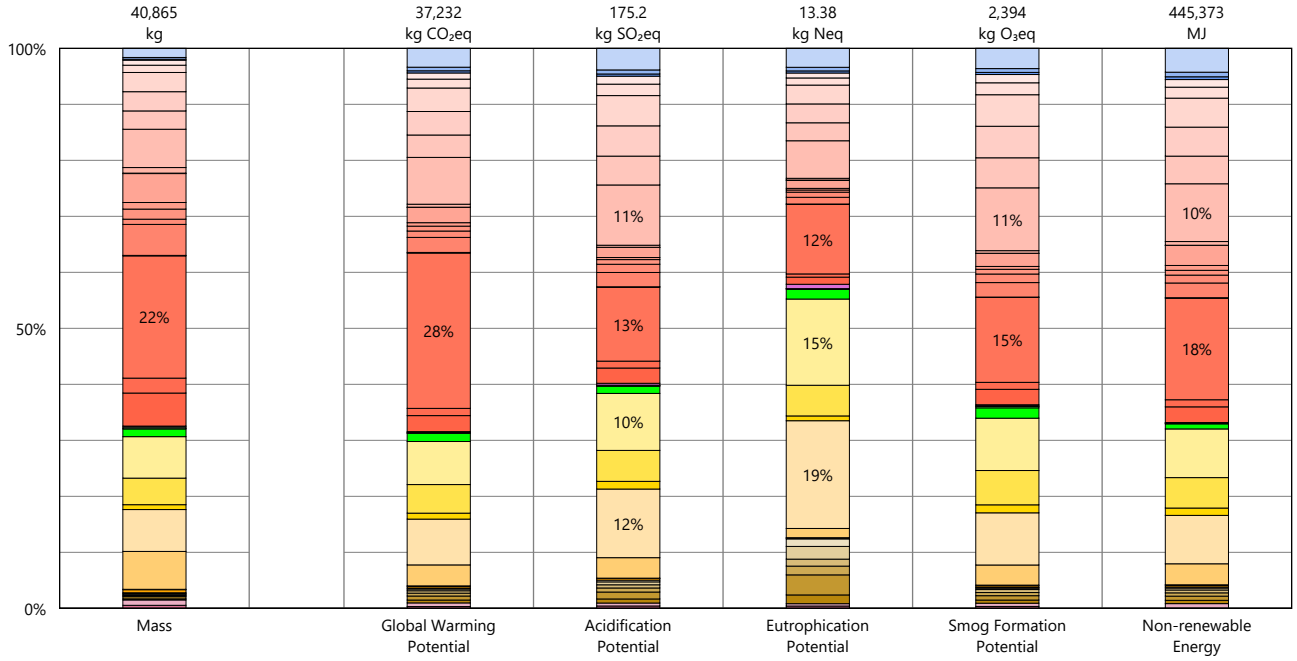
Revit Categories

- Ceilings
- Doors
- Floors
- Roofs
- Stairs and Railings
- Structure
- Walls
- Windows



Global Warming Potential

Results per Revit Category, itemized by Family



Legend

Ceilings
- Awning
- GWB on 2X4 Wood Joists

Doors
- Door-Exterior-Single-Entry-Half Flat Glass-Wood_Clad
- Door-Passage-Single-Full_Lite
- Exterior - Glazed
- Exterior - Single - Flush
- Interior - Double - Flush
- Interior - Single - Flush

Floors
- Exterior - Uninsulated Slab
- Generic - 1"
- Generic - 12"
- Interior - 2x10 over crawl 2

Roofs
- Generic - 1"
- New
- Wood Rafter 14" TJI MEMBRABE ROOF

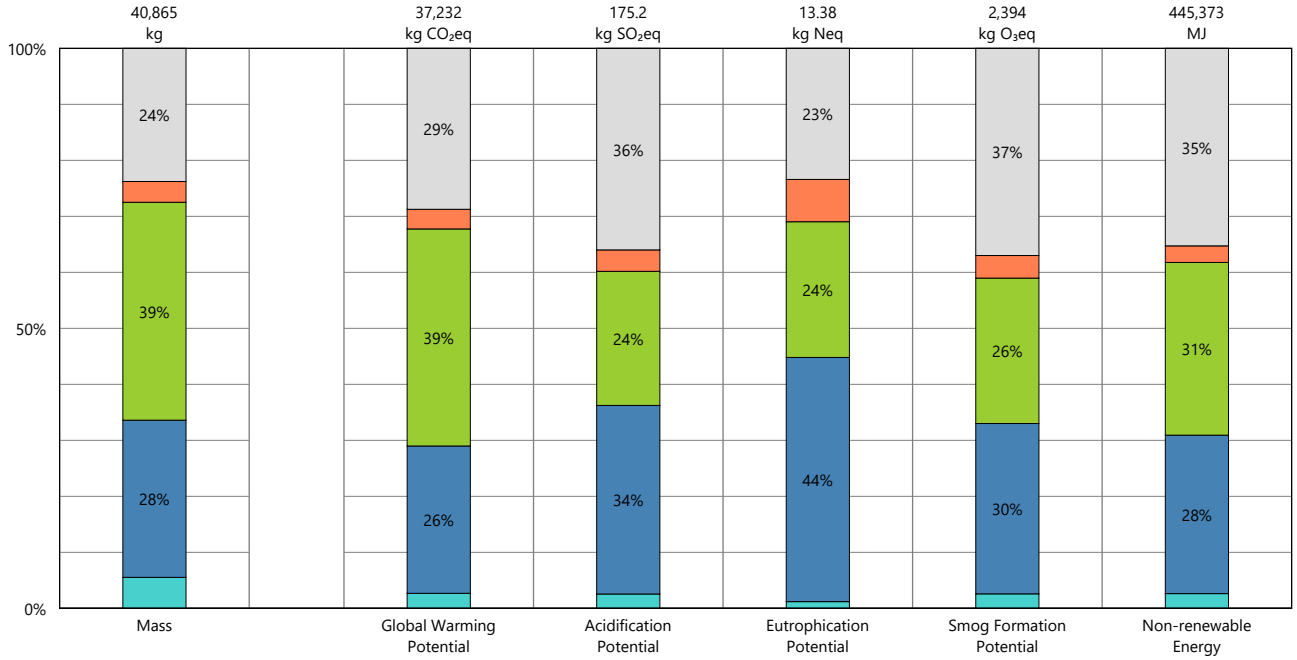
Stairs and Railings
- Fence - Horizontal tall
- Handrail Only
- Monolithic Stair (Residential)

Structure
- Dimension Lumber

Walls
- 6" Conc
- Basement
- Exterior - 3 1/2" Wood Studs 2
- Exterior - 3 1/2" Wood Studs 3
- Foundation - 6" Concrete
- Generic - 1"
- Generic - 6"
- Interior - 1.5" Furring Wall
- Interior - Non-rated - 3 1/2" Wood Studs
- Interior - Non-rated - 5.5 actual
- Interior - Non-rated - 5.5"
- ROOF CAP
- SQ SWEEP2
- SQ SWEEP3
- SQ SWEEP4
- TRIM AT PARAPET
- Walls 9

Windows
- Awning
- Standard Window - Double Stacked
- Standard Window - Single

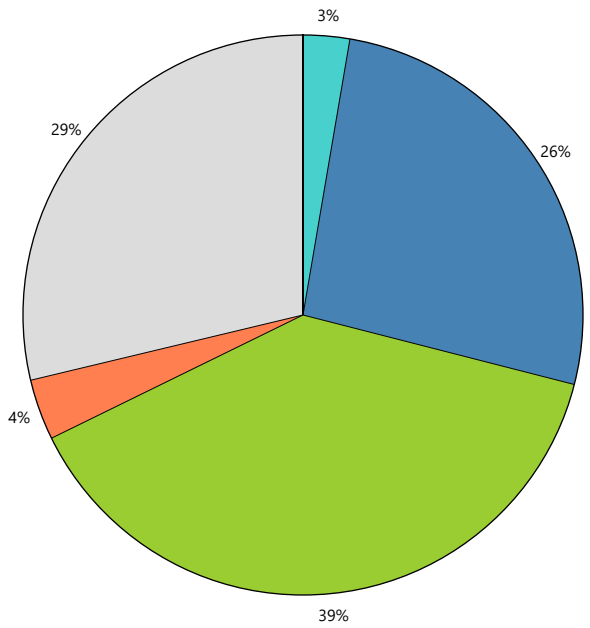
Results per Building Element



Legend

Building Elements

- Substructure
- 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_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)

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 **9438.99 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 kBtu**

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_CDs_Baseline_2024

Worksets
- N/A

Phases
- Demolition
- EXISTING
- NEW

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.

Adhesive, polychloroprene (neoprene) **36.5 kg**

Used in the following Revit families:
- New 16.9 kg (20 yrs)
- Wood Rafter 14" TJI MEMBRABE ROOF 19.6 kg (20 yrs)

Used in the following Tally entries:
- EPDM, roofing membrane

Description:
Generic polychlorprene contact adhesive.

Life Cycle Inventory:
- Polychloroprene
- Alkylphenolic resin
- Magnesium oxide, tin oxide
- Solvents (petroleum ether/cycloaliphatic/ketone/ester blends)

Product Scope:
Cradle to gate, plus emissions during application, excludes energy for application

Transportation Distance:
By truck: 840 km

End-of-Life Scope:
27% solids to landfill (plastic waste)

LCI Source:
EU-28: Solvent-based polychloroprene adhesive of good heat resistance (estimation) (2017)

Cold formed structural steel **0.0 kg**

Used in the following Revit families:
- Handrail Only 0.0 kg (60 yrs)

Used in the following Tally entries:
- Steel, round tubing

Description:
Cold-rolled or formed structural steel, such as used in steel studs.

Life Cycle Inventory:
100% Cold rolled steel

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 16% scrap input while remainder is processed and credited as avoided burden

LCI Source:
RNA: Steel finished cold rolled coil worldsteel (2007)

LCI Data (continued)

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)

Composite wood I-joist, AWC - EPD **980.2 kg**

Used in the following Revit families:

Wood Rafter 14" TJI MEMBRABE ROOF	980.2 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

Domestic softwood, US, AWC - EPD **2,663.8 kg**

Used in the following Revit families:

Awning	220.3 kg (60 yrs)
Exterior - 3 1/2" Wood Studs 2	703.8 kg (60 yrs)
Exterior - 3 1/2" Wood Studs 3	1.7 kg (60 yrs)
Generic - 1"	21.4 kg (30 yrs)
GWB on 2X4 Wood Joists	79.6 kg (60 yrs)
Interior - 1.5" Furring Wall	36.4 kg (60 yrs)
Interior - 2x10 over crawl 2	683.2 kg (60 yrs)
Interior - Non-rated - 3 1/2" Wood Studs	300.8 kg (60 yrs)
Interior - Non-rated - 5.5 actual	10.1 kg (60 yrs)
Interior - Non-rated - 5.5"	74.0 kg (60 yrs)
New	532.4 kg (60 yrs)

Used in the following Tally entries:
Flooring, solid wood plank
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 frame, aluminum, powder-coated, no door **40.6 kg**

Used in the following Revit families:

Door-Exterior-Single-Entry-Half Flat Glass-Wood_Clad	10.2 kg (50 yrs)
Door-Passage-Single-Full_Lite	20.3 kg (50 yrs)
Exterior - Glazed	10.2 kg (50 yrs)

Used in the following Tally entries:
Door frame, aluminum

Description:
Aluminum door frame

Life Cycle Inventory:
94% Aluminum
6% Powder coat (by weight)

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

Transportation Distance:
By truck: 568 km

End-of-Life Scope:
95% aluminum recovered
5% aluminum landfilled (inert material)

Module D Scope:
Product has 36.4% scrap input while remainder is processed and credited as avoided burden

LCI Source:
DE: Aluminium frame profile, powder coated (EN15804 A1-A3) ts (2017)
modified with: RNA: Aluminum extrusion, mill finish - AEC ts (2015)
DE: Top coat powder (aluminium) (EN15804 A1-A3) ts (2017)
RNA: Secondary Aluminum Ingot AA/ts (2010)
RNA: Primary Aluminum Ingot AA/ts (2010)

Door, interior, wood, MDF core **108.9 kg**

Used in the following Revit families:

Interior - Double - Flush	68.4 kg (30 yrs)
Interior - Single - Flush	40.5 kg (30 yrs)

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

Description:
Interior flush wood door with MDF core

Life Cycle Inventory:
40% Wood
60% MDF

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 Data (continued)

LCI Source:
RNA: Softwood plywood CORRIM (2011)
RNA: Medium density fiberboard (MDF) CORRIM (2011)

Door, interior, wood, MDF core, large vision panel **121.5 kg**

Used in the following Revit families:
Door-Passage-Single-Full_Lite 121.5 kg (30 yrs)

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

Description:
Interior flush wood door with large vision panel (>50% door area) and MDF core

Life Cycle Inventory:
40% Wood
36% MDF
24% Glass

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)
100% Glass landfilled (inert waste)

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

LCI Source:
RNA: Softwood plywood CORRIM (2011)
RNA: Medium density fiberboard (MDF) CORRIM (2011)
DE: Window glass simple (EN15804 A1-A3) ts (2017)

EPDM, reinforced membrane, 60 mils, SPRI - EPD **513.1 kg**

Used in the following Revit families:
New 237.4 kg (40 yrs)
Wood Rafter 14" TJI MEMBRABE ROOF 275.7 kg (40 yrs)

Used in the following Tally entries:
EPDM, roofing membrane

Description:
Reinforced ethylene propylene diene terpolymer (EPDM) synthetic rubber roofing membrane, default thickness of 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: Reinforced EPDM single ply roofing membrane, 60 mils, A1-A3 - SPRI ts (2017)

EPD Source:
4786842353.101.1

EPD Designation Holder:
Single Ply Roofing Industry (SPRI)

EPD Program Operator:
UL Environment

EPD Expiration:
9/23/2021

Exterior grade plywood, US **4,075.2 kg**

Used in the following Revit families:
Exterior - 3 1/2" Wood Studs 2 1,821.6 kg (30 yrs)
Exterior - 3 1/2" Wood Studs 3 7.6 kg (30 yrs)
New 1,150.9 kg (30 yrs)
Wood Rafter 14" TJI MEMBRABE ROOF 1,095.1 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 **0.9 kg**

Used in the following Revit families:
Door-Exterior-Single-Entry-Half Flat Glass-Wood_Clad 0.2 kg (40 yrs)
Door-Passage-Single-Full_Lite 0.4 kg (40 yrs)
Exterior - Glazed 0.2 kg (40 yrs)

Used in the following Tally entries:
Door frame, aluminum

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 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)

Fiberglass blanket insulation, unfaced **211.1 kg**

Used in the following Revit families:
GWB on 2X4 Wood Joists 32.0 kg (60 yrs)
Interior - 2x10 over crawl 2 179.1 kg (60 yrs)

Used in the following Tally entries:
Wood framing with insulation

Description:
Fiberglass batt
density varies from 10-14 kg/m^3.

Life Cycle Inventory:
100% Fiberglass

Product Scope:
Cradle to gate

LCI Data (continued)

Transportation Distance:
By truck: 172 km

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

LCI Source:
US: Fiberglass Batt NAIMA (2007)

Fiberglass mat gypsum sheathing board **655.8 kg**

Used in the following Revit families:
Wood Rafter 14" TJI MEMBRABE ROOF 655.8 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)

Floor and wall adhesive, latex **5.2 kg**

Used in the following Revit families:
Interior - 2x10 over crawl 2 5.2 kg (20 yrs)

Used in the following Tally entries:
Flooring, resilient

Description:
Latex adhesive, for use with cork, rubber, or wood flooring and wall coverings.

Life Cycle Inventory:
60% Calcium carbonate
10% Petroleum carbonate oil
7% Magnesite
1.5% Ethylene glycol
21.5% Water
1.6% NMVOC emissions

Product Scope:
Cradle to gate, plus emissions during application

Transportation Distance:
By truck: 840 km

End-of-Life Scope:
76.9% solids to landfill (inert waste)

LCI Source:
US: Limestone flour (5mm) ts (2017)
US: Lubricants at refinery ts (2014)
EU-27: Magnesium carbonate (MgCO3, fine, washed for fillers) ts (2017)
US: Ethylene glycol (from ethene and oxygen via EO) ts (2017)
US: Tap water from groundwater ts (2017)
US: Electricity grid mix ts (2014)

Floor and wall adhesive, urethane **5.0 kg**

Used in the following Revit families:
Generic - 1" 5.0 kg (20 yrs)

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

Description:
Urethane adhesive for use with flooring and wall coverings.

Life Cycle Inventory:
50% Limestone
13% Lime
30% Polyurethane
1.5% Stearic acid
5% Methylene bis(phenylisocyanate) (MDI)
1.3% NMVOC emissions

Product Scope:
Cradle to gate, plus emissions during application

Transportation Distance:
By truck: 840 km

End-of-Life Scope:
98.7% solids to landfill (plastic waste)

LCI Source:
US: Limestone flour (5mm) ts (2017)
DE: Polyurethane (copolymer-component) (estimation from TPU adhesive) ts (2017)
US: Lime (CaO) calcination ts (2017)
US: Methylene diisocyanate (MDI) ts (2017)
DE: Stearic acid ts (2017)
US: Electricity grid mix ts (2014)

Glazing, double, 3 mm, laminated safety glass **118.9 kg**

Used in the following Revit families:
Door-Exterior-Single-Entry-Half Flat Glass-Wood_Clad 59.5 kg (35 yrs)
Exterior - Glazed 59.5 kg (35 yrs)

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

Description:
Laminated glass, 2 lites 3 mm thick, inclusive of polyvinyl butyral. Note: this entry is appropriate for clear or tinted glass.

Life Cycle Inventory:
3% PVB film (30% adipic acid
70% PVB)
97% Glass

Product Scope:
Cradle to gate, excluding sealant

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)
DE: Adipic acid from cyclohexane ts (2017)
DE: Polyvinyl Butyral Granulate (PVB) 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)

Glazing, double, insulated (air) **552.1 kg**

Used in the following Revit families:
Awning 39.7 kg (40 yrs)
Standard Window - Double Stacked 79.5 kg (40 yrs)
Standard Window - Single 432.9 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)

Glue laminated timber (Glulam), AWC - EPD **76.4 kg**

Used in the following Revit families:

Dimension Lumber	76.4 kg (60 yrs)

Used in the following Tally entries:
Glue laminated timber (Glulam)

Description:
Architectural grade structural glue-laminated timber (Glulam), an engineered wood product manufactured from end-joined, laminated, and planed lumber pressure-treated with resins. Typically used for beams, headers, columns, and arches. Entry inclusive of factory applied sealer. 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: 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: Glue laminated timbers CORRIM (2011)

EPD Source:
13CA24184.104.1

EPD Designation Holder:
American Wood Council and Canadian Wood Council

EPD Program Operator:
UL Environment

EPD Expiration:
4/16/2019

Hardware, stainless steel **39.8 kg**

Used in the following Revit families:

Awning	0.9 kg (60 yrs)
Door-Exterior-Single-Entry-Half Flat Glass-Wood_Clad	4.3 kg (60 yrs)
Door-Passage-Single-Full_Lite	6.7 kg (60 yrs)
Exterior - Glazed	4.3 kg (60 yrs)
Exterior - Single - Flush	3.6 kg (60 yrs)
Interior - Double - Flush	5.0 kg (60 yrs)
Interior - Single - Flush	3.0 kg (60 yrs)
Standard Window - Double Stacked	1.9 kg (60 yrs)
Standard Window - Single	10.1 kg (60 yrs)

Used in the following Tally entries:
Door, exterior, glass
Door, exterior, steel
Door, interior, wood, MDF core, flush
Window frame, vinyl

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)

Hollow door, exterior, steel, galvanized **65.8 kg**

Used in the following Revit families:

Exterior - Single - Flush	65.8 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)

Kraft paper **47.3 kg**

Used in the following Revit families:

Exterior - 3 1/2" Wood Studs 2	47.1 kg (20 yrs)
Exterior - 3 1/2" Wood Studs 3	0.2 kg (20 yrs)

Used in the following Tally entries:
Portland cement stucco

Description:
Water vapor permeable paper backing

Life Cycle Inventory:
100% Kraft paper

Product Scope:
Cradle to gate, excludes adhesives, backings, or any additional coatings

Transportation Distance:
By truck: 641 km

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

Module D Scope:
Accounts for recovered energy from landfill gas utilization

LCI Source:
EU-28: Kraft paper agg (2017)

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

Used in the following Revit families:

Door-Exterior-Single-Entry-Half Flat Glass-Wood_Clad	0.6 kg (40 yrs)
Exterior - Glazed	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

LCI Data (continued)

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 **156.5 kg**

Used in the following Revit families:

Exterior - 3 1/2" Wood Studs 2	155.8 kg (60 yrs)
Exterior - 3 1/2" Wood Studs 3	0.7 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)

Oriented strandboard (OSB), AWC - EPD **1,384.4 kg**

Used in the following Revit families:

Interior - 2x10 over crawl 2	1,384.4 kg (50 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. Industry-wide EPD from the American Wood Council.

Life Cycle Inventory:
For information and quantities, see EPD

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: Oriented strand board (OSB) CORRIM (2011)

EPD Source:
13CA24184.101.1

EPD Designation Holder:
American Wood Council and Canadian Wood Council

EPD Program Operator:
UL Environment

EPD Expiration:
4/16/2019

Paint, enamel, solvent based **3.1 kg**

Used in the following Revit families:

Handrail Only	3.1 kg (15 yrs)

Used in the following Tally entries:
Steel, round tubing

Description:
Solvent-based enamel paint, appropriate for use on metals

Life Cycle Inventory:
17% Binding agent
16% Pigments and fillers
67% Solvent

Product Scope:
Cradle to gate, including emissions during application

Transportation Distance:
By truck: 642 km

End-of-Life Scope:
33% Solids landfilled (plastic waste)

LCI Source:
DE: Solvent paint white (EN15804 A1-A3) ts (2017)

Paint, exterior acrylic latex **163.7 kg**

Used in the following Revit families:

Exterior - 3 1/2" Wood Studs 2	163.0 kg (10 yrs)
Exterior - 3 1/2" Wood Studs 3	0.7 kg (10 yrs)

Used in the following Tally entries:
Portland cement stucco

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)

Paint, exterior metal coating, silicone-based **5.6 kg**

Used in the following Revit families:

Generic - 1"	0.5 kg (30 yrs)
ROOF CAP	0.9 kg (30 yrs)
SQ SWEEP2	1.1 kg (30 yrs)
SQ SWEEP3	1.1 kg (30 yrs)
SQ SWEEP4	1.1 kg (30 yrs)
TRIM AT PARAPET	0.1 kg (30 yrs)
Walls 9	0.8 kg (30 yrs)

Used in the following Tally entries:
Steel, sheet, carbon steel

Description:
Silicone-based metal paint, with a default coating thickness of 100 microns

LCI Data (continued)

Life Cycle Inventory:
23% Binding agent
35% Pigments and fillers
40% Water
1.5% 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 coating silicone (building, exterior, white) ts (2017)

Paint, interior acrylic latex **434.5 kg**

Used in the following Revit families:

Exterior - 3 1/2" Wood Studs 2	195.6 kg (7 yrs)
Exterior - 3 1/2" Wood Studs 3	0.8 kg (7 yrs)
GWB on 2X4 Wood Joists	22.4 kg (7 yrs)
Interior - 1.5" Furring Wall	35.4 kg (7 yrs)
Interior - Double - Flush	4.9 kg (7 yrs)
Interior - Non-rated - 3 1/2" Wood Studs	144.1 kg (7 yrs)
Interior - Non-rated - 5.5 actual	1.8 kg (7 yrs)
Interior - Non-rated - 5.5"	26.5 kg (7 yrs)
Interior - Single - Flush	2.9 kg (7 yrs)

Used in the following Tally entries:
Door, interior, wood, MDF core, flush
Wall board, gypsum

Description:
Acrylic-based paint for interior applications

Life Cycle Inventory:
21% Binding agent
35% Pigments and fillers
42% Water
2% 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, interior, white, wear resistant) ts (2017)

Polyurethane floor finish, water-based **35.9 kg**

Used in the following Revit families:

Generic - 1"	2.3 kg (10 yrs)
Interior - 2x10 over crawl 2	33.6 kg (10 yrs)

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

Description:
Water-based polyurethane wood stain for wood products, inclusive of catalyst

Life Cycle Inventory:
97.7% Stain (50% water, 35% polyurethane dispersions, 5% dipropylene glycol dimethyl ether, 5% tri-butoxyethyl phosphate, 5% dipropylene glycol methyl ether)
2.3% Catalyst (75% polyfunctional aziridine, 25% 2-propoxyethanol)
24.5% NMVOC emissions during application

Product Scope:
Cradle to gate, including emissions during application

Transportation Distance:
By truck: 642 km

End-of-Life Scope:
26.7% solids to landfill (plastic waste)

LCI Source:
DE: Ethylene glycol butyl ether ts (2017)
US: Epichlorohydrin (by product calcium chloride, hydrochloric acid) ts (2017)
DE: Propylenglycolmonomethylether (Methoxypropanol) PGME ts (2017)
US: Tap water from groundwater ts (2017)
DE: Polyurethane (copolymer-component) (estimation from TPU adhesive) ts (2017)
US: Electricity grid mix ts (2014)

Red oak lumber, 1 inch **576.2 kg**

Used in the following Revit families:

Fence - Horizontal tall	576.2 kg (50 yrs)

Used in the following Tally entries:
Domestic hardwood

Description:
Kiln-dried American Red Oak hardwood lumber of 1" nominal thickness as produced in the eastern United States, focusing on the main production technologies and region-specific characteristics. Red Oak is frequently used for moulding, 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% Red 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: Red Oak lumber, 1 inch (705 kg/m^3), kiln-dried ts/AHEC (2017)

EPD Source:
Information

EPD Designation Holder:
American Hardwood Export Council (AHEC)

Spray polyurethane foam, closed cell (HFC blowing agent), SPFA - EPD **357.7 kg**

Used in the following Revit families:

Exterior - 3 1/2" Wood Studs 2	356.2 kg (60 yrs)
Exterior - 3 1/2" Wood Studs 3	1.5 kg (60 yrs)

Used in the following Tally entries:
Wood framing with insulation

Description:
Two-component polyurethane mixture insulation spray applied at installation site. Closed-cell, or medium density foam, (ccSPF) provides a water-resistant insulation, air-sealing, water vapor control and delivers added structural performance to the building envelope. HFC blowing agent is used. R Value: 6.2 (ft^{2}hr°F/Btu)/in

Life Cycle Inventory:
For information and quantities, see EPD

Product Scope:
Cradle to gate, includes emission of blowing agent during use (24% of total blowing agent)

Transportation Distance:
By truck: 1683 km

End-of-Life Scope:
100% landfilled (plastic), including emission of blowing agent (16% of total blowing agent
50% of blowing agent remains in product after disposal)

Module D Scope:
Energy recovered from landfilling of packaging waste

LCI Source:
EPD (US), SPFA (2018)

EPD Source:
ASTM-EPD087

LCI Data (continued)

EPD Designation Holder:
Spray Polyurethane Foam Alliance

EPD Program Operator:
ASTM International

EPD Expiration:
10/29/2023

Stainless steel door hinge **11.1 kg**

Used in the following Revit families:

Interior - Double - Flush	7.0 kg (30 yrs)
Interior - Single - Flush	4.1 kg (30 yrs)

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

Description:
Stainless steel and aluminum door and window hinge. Data based on product-specifc EPD from FSB.

Life Cycle Inventory:
See EPD

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 a 0% scrap input while remainder is processed and credited as avoided burden.

LCI Source:
DE: Door and window hinge - FV S+B PE-EPD (2009)
RER: Stainless steel flat product (304) - value of scrap Eurofer (2010)

EPD Source:
EPD-FSB-2010111-D

EPD Designation Holder:
Franz Schneider

EPD Program Operator:
Institut Bauen und Umwelt (IBU)

EPD Expiration:
1/14/2016

Steel door hinge **16.8 kg**

Used in the following Revit families:

Door-Exterior-Single-Entry-Half Flat Glass-Wood_Clad	3.5 kg (30 yrs)
Door-Passage-Single-Full_Lite	6.9 kg (30 yrs)
Exterior - Glazed	3.5 kg (30 yrs)
Exterior - Single - Flush	2.9 kg (30 yrs)

Used in the following Tally entries:
Door, exterior, glass
Door, exterior, steel
Door, interior, wood, MDF 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 und Umwelt (IBU)

EPD Expiration:
9/13/2021

Steel, reinforcing rod **2,259.0 kg**

Used in the following Revit families:

6" Conc	531.2 kg (60 yrs)
Basement	240.0 kg (60 yrs)
Exterior - Uninsulated Slab	60.6 kg (60 yrs)
Foundation - 6" Concrete	498.5 kg (60 yrs)
Generic - 12"	748.3 kg (60 yrs)
Generic - 6"	162.2 kg (60 yrs)
Monolithic Stair (Residential)	18.2 kg (60 yrs)

Used in the following Tally entries:
Cast-in-place concrete, structural concrete, 2500 psi

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)

Steel, sheet **8,567.6 kg**

Used in the following Revit families:

Generic - 1"	736.1 kg (45 yrs)
ROOF CAP	2,794.4 kg (45 yrs)
SQ SWEEP2	1,336.0 kg (45 yrs)
SQ SWEEP3	1,401.5 kg (45 yrs)
SQ SWEEP4	1,401.5 kg (45 yrs)
TRIM AT PARAPET	530.8 kg (45 yrs)
Walls 9	367.3 kg (45 yrs)

Used in the following Tally entries:
Steel, sheet, carbon steel

Description:
Steel sheet

Life Cycle Inventory:
100% Steel sheet

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 418 km

End-of-Life Scope:
98% Recovered
2% 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:
RNA: Steel finished cold rolled coil worldsteel (2007)
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)

Structural concrete, 2500 psi, Pacific Northwest regional average **7,340.9 kg**

Used in the following Revit families:

6" Conc	1,878.6 kg (60 yrs)
Basement	848.8 kg (60 yrs)
Exterior - Uninsulated Slab	163.3 kg (60 yrs)
Foundation - 6" Concrete	1,762.8 kg (60 yrs)
Generic - 12"	2,015.6 kg (60 yrs)
Generic - 6"	573.6 kg (60 yrs)
Monolithic Stair (Residential)	98.1 kg (60 yrs)

Used in the following Tally entries:
Cast-in-place concrete, structural concrete, 2500 psi

Description:
Structural concrete, 2500 psi, Pacific Northwest regional average. Mix design matches National Ready-Mix Concrete Association (NRMCA) Industry-wide EPD.

Life Cycle Inventory:
Coarse aggregate: 46%, Sand: 35%, Portland cement PCA - EPD: 9%, Water: 8%, Fly ash: 2%, Expanded slag: <1%, Admixture: <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)

Stucco, portland cement **3,229.0 kg**

Used in the following Revit families:

Exterior - 3 1/2" Wood Studs 2	3,215.5 kg (60 yrs)
Exterior - 3 1/2" Wood Studs 3	13.5 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 Source:
US: Silica sand (Excavation and processing) ts (2017)
US: Portland cement PCA/ts (2015)
US: Lime (CaO) calcination ts (2017)

Underlayment, foam **13.8 kg**

Used in the following Revit families:

Interior - 2x10 over crawl 2	13.8 kg (20 yrs)

Used in the following Tally entries:
Flooring, resilient

Description:
Polyurethane foam flooring underlayment, appropriate for foamed plastic backing for vinyl or rubber or to be used as acoustic foam flooring underlayment. Default value of 2 mm thickness appropriate for acoustic foam underlayment.

Life Cycle Inventory:
100% Polyurethane rigid foam

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 1299 km

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

LCI Source:
DE: Polyurethane rigid foam (PUR) (EN15804 A1-A3) ts (2017)

Vinyl composition tile, ERFMI - EPD **756.7 kg**

Used in the following Revit families:

Interior - 2x10 over crawl 2	756.7 kg (20 yrs)

Used in the following Tally entries:
Flooring, resilient

Description:
Vinyl composite tile (VCT) flooring. Entry does not include backing (if any) or adhesive (urethane typical). Industry-wide EPD from the European Resilient Flooring Manufacturers Institute.

Life Cycle Inventory:
For information and quantities, see EPD

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 805 km

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

LCI Source:
EU-25: Flooring PVC flex boards (VCT) EN 654 ERFMI (2005)

EPD Source:
EPD-ERF-2013111-EN

EPD Designation Holder:
European Resilient Flooring Manufacturers' Institute (ERFMI)

EPD Program Operator:
Institut Bauen and Umwelt (IBU)

EPD Expiration:
12/31/2018

Wall board, gypsum, natural **4,932.6 kg**

Used in the following Revit families:

Exterior - 3 1/2" Wood Studs 2	2,261.8 kg (30 yrs)
Exterior - 3 1/2" Wood Studs 3	9.5 kg (30 yrs)
GWB on 2X4 Wood Joists	258.8 kg (30 yrs)
Interior - 1.5" Furring Wall	409.1 kg (30 yrs)
Interior - Non-rated - 3 1/2" Wood Studs	1,666.2 kg (30 yrs)
Interior - Non-rated - 5.5 actual	21.2 kg (30 yrs)
Interior - Non-rated - 5.5"	306.0 kg (30 yrs)

LCI Data (continued)

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 **298.0 kg**

Used in the following Revit families:

Awning	30.7 kg (30 yrs)
Standard Window - Double Stacked	44.4 kg (30 yrs)
Standard Window - Single	222.9 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 **2.5 kg**

Used in the following Revit families:

Door-Passage-Single-Full_Lite	2.5 kg (10 yrs)

Used in the following Tally entries:
Door, interior, wood, MDF 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)