

EARLY CARBON STUDIES: BOWDOIN COLLEGE & THE BLAKE SCHOOL

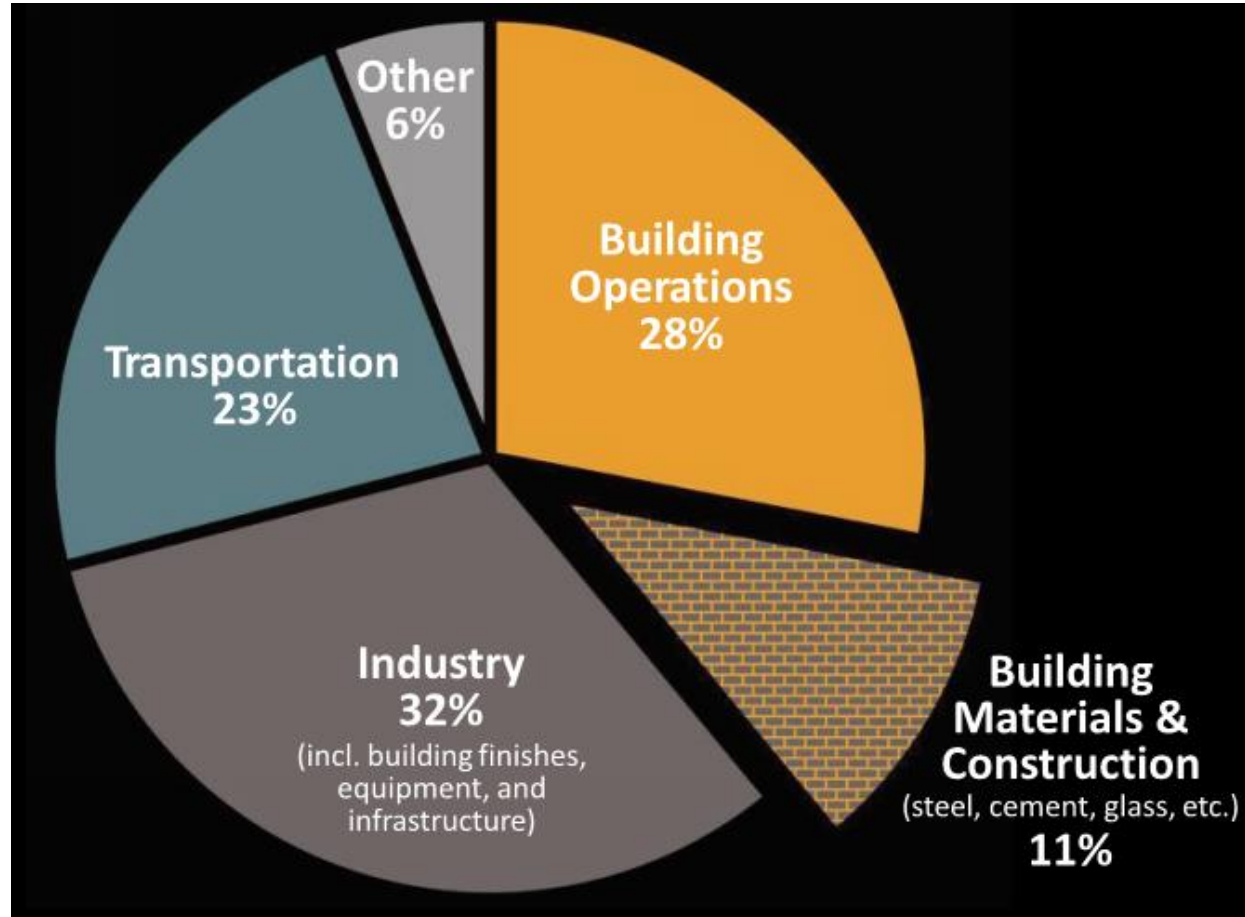
Presented by Lauren Piepho, PE




Disclaimer: This presentation was developed by a third party and is not funded by Woodworks or the Softwood Lumber Board

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Global CO2 Emissions by Sector



2018 Global ABC Report



Building structure and sub-structure represent about
of a commercial building's embodied carbon footprint.

55%

Building enclosure and construction represent about
of a commercial building's embodied carbon footprint.

33%

Source: De-Wolf, et.al; Structural Material Quantities And Embodied Carbon Coefficients: Challenges And Opportunities, April 2014



Early Life Cycle Analysis

- Decision making tool
- PD or SD phase
- “Carbon cost” vs. monetary cost – every client has a different threshold

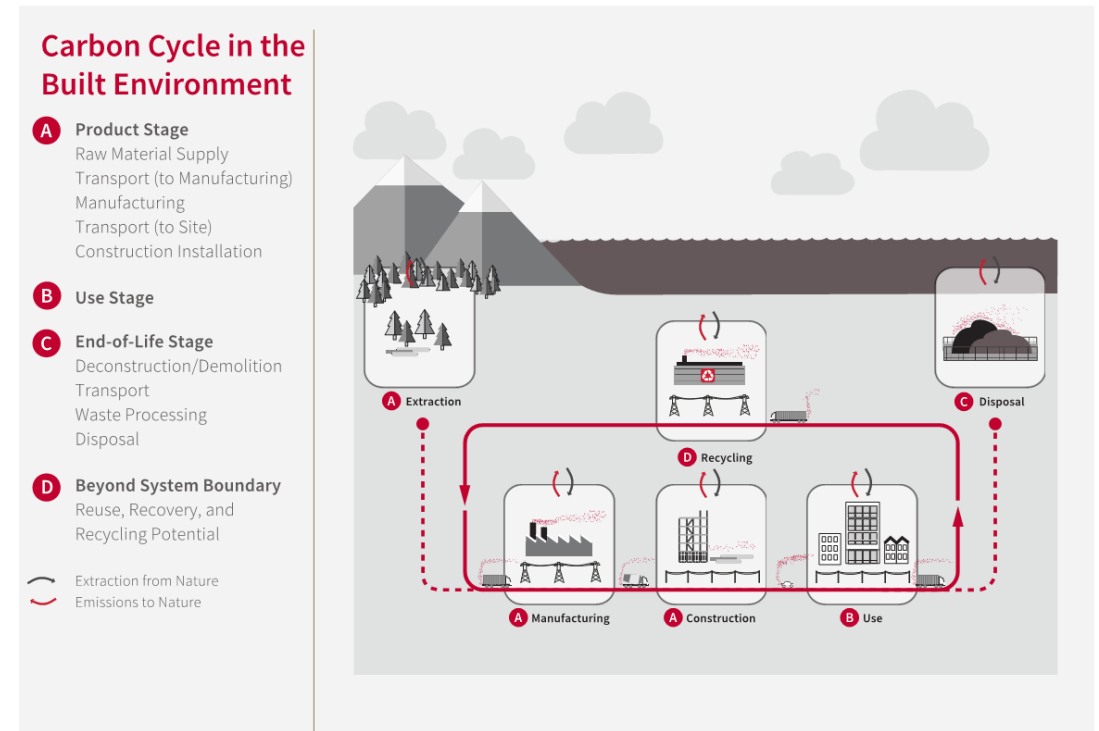


Figure 1. Sources of emissions by life cycle stage (A, B, C, D) of a building based on stage definitions from European Standard (EN) 15978 (credit: Meghan Lewis).

Assumptions

- National averages (transportation distance, etc.)
- Representative bay or slice
- Structural system only
- Sustainably-source lumber on a case-by-case basis

Tally® Environmental Impact Tool - S19-Bowdoin-438700100.rvt

Help Define Scope Refresh Save Report

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LCA Data by thinkstep

Project Browser

Model > Category > Family > Material Legend Display: Revit Materials

- ▲ S19-Bowdoin-438700100.rvt
 - ▶ Floors
 - ▲ Structural Columns
 - ▶ Concrete-Rectangular-Column - HGA: 18" x 18"
 - ▶ Glulam-Western Species-Column: 12.25x12
 - ▲ Glulam-Western Species-Column: 12.25x13.5
 - WD-6(CLT)
 - ▲ Glulam-Western Species-Column: 12.25x13.5
 - Wood - Glue-Laminated
 - HSS Round-Column: HSS6x.312
 - HSS Square-Column: HSS4X4X1/4
 - HSS-Round Hollow Structural Section-Column: HSS6.625x0.500
 - HSS-Round Hollow Structural Section-Column: HSS6x0.250
 - HSS-Round Hollow Structural Section-Column: HSS6x0.500
 - HSS-Round Hollow Structural Section-Column: HSS7.500x0.500
 - HSS-Round Hollow Structural Section-Column: HSS8.625x0.500
 - ▶ Round Bars-Column: RB 3/4
 - ▶ Structural Foundations
 - ▶ Structural Framing
 - ▶ Walls

Information

Display: Metric

Wood - Glue-Laminated
in Glulam-Western Species-Column: 12.25x13.5

Total Instance Count : 7
Total Column Length : 50.86 m
Total Material Volume : 5.427 m³
Modeled Column Section : 0.1067 m²

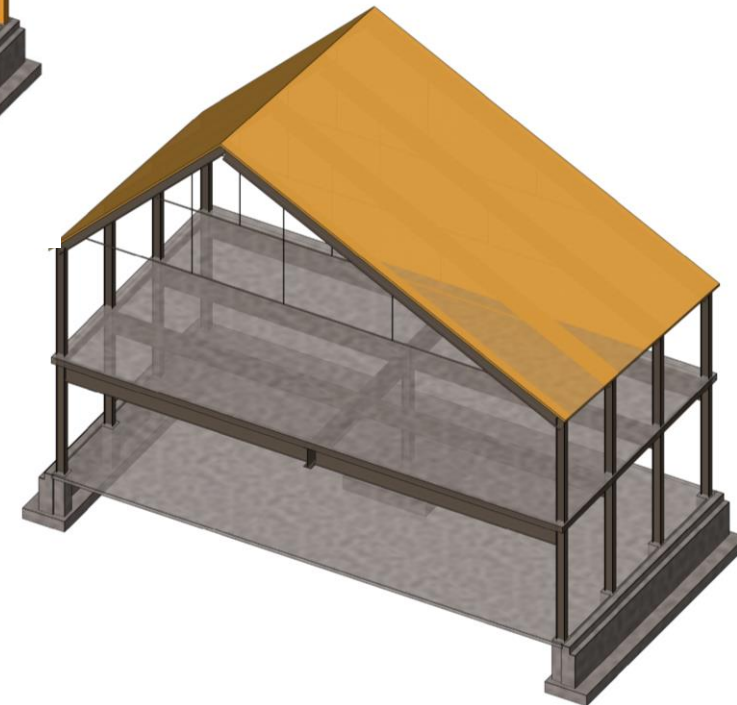
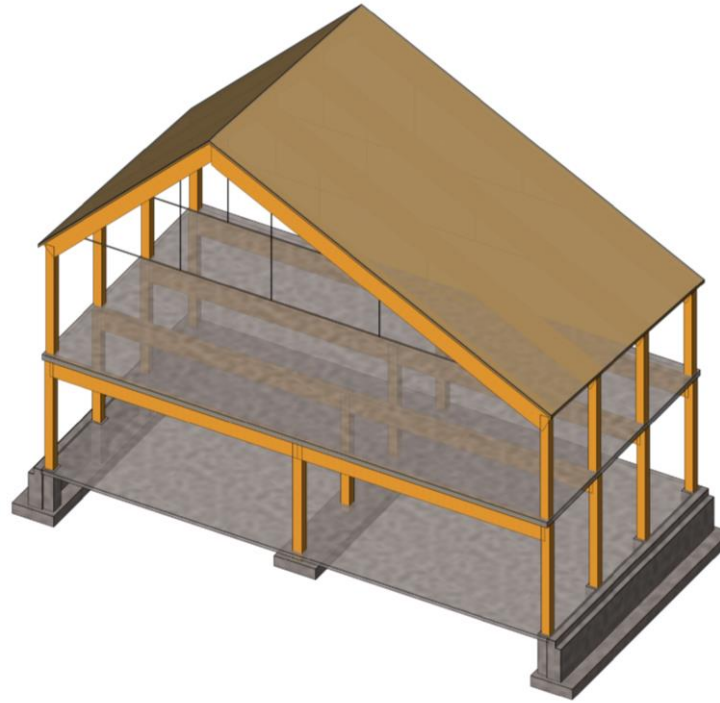
Glue laminated timber (Glulam)
Architectural-grade structural glue-laminated timber, composed of softwood which has been end-joined, laminated, and planed. Entry inclusive of factory-applied sealer.

Components
2,898 kg of Glue laminated timber (Glulam), AWC - EPD
Service life : default to 60 years
Takeoff method : by modeled volume, using a default value of 100% by vol and a density of 533.97 kg/m³

7,510 kg of Wood stain, water based
Service life : default to 10 years
Takeoff method : by modeled area, using a default value of 0.11 kg/m²

Process

- Tally (typically) or One Click
- Revit model for each option
- Carbon social cost numbers from US Government
- Done in conjunction with early cost estimating



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CASE STUDY

Bowdoin College – Mills Hall and The Center for Arctic Studies, Brunswick ME



Bowdoin College



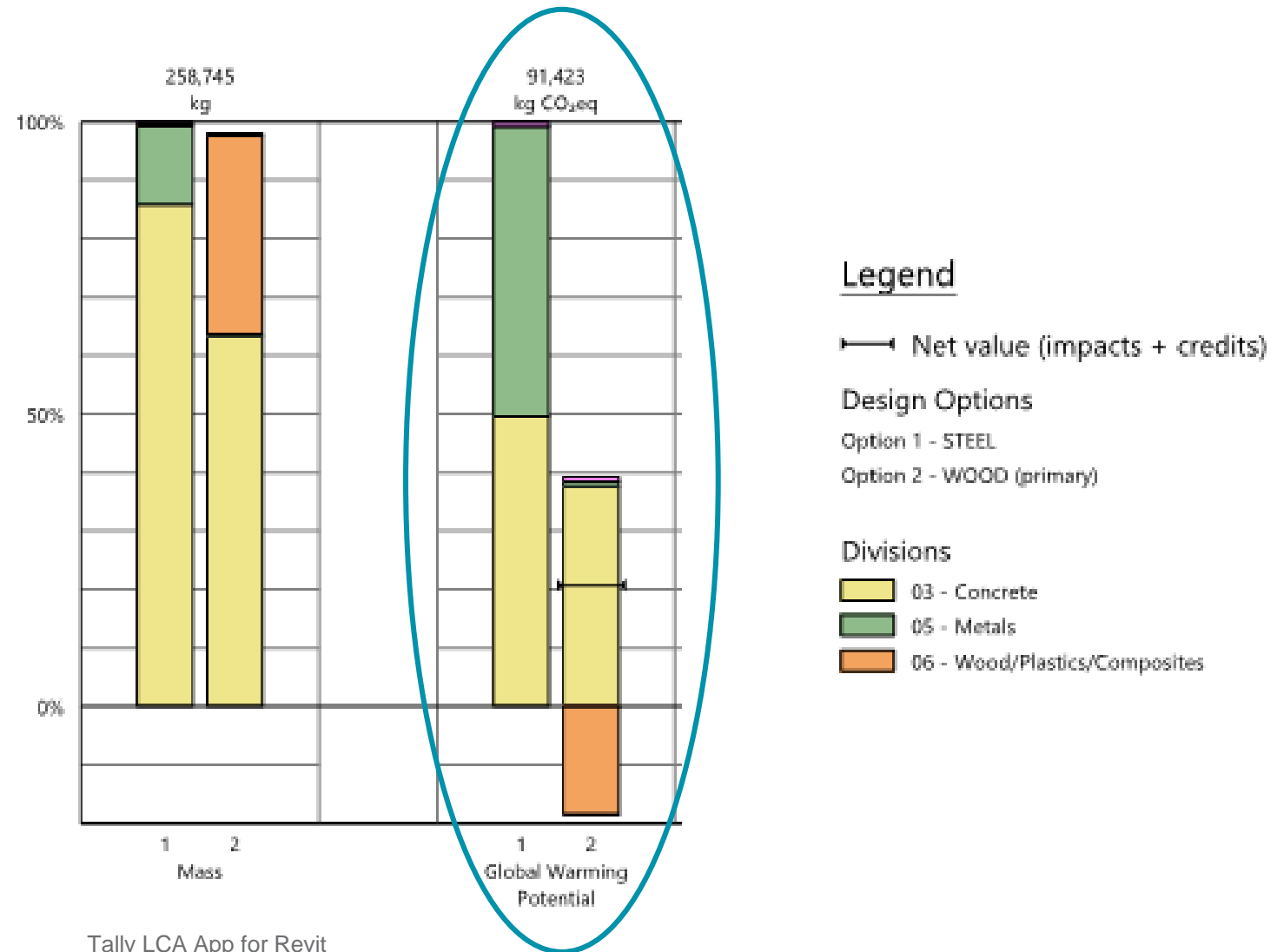
Bowdoin College

- Two buildings with a shared basement
 - Approx. 50,000 sqft
- Offices, classrooms, event space, and museum
- Carbon-neutral campus
- Design team explored both steel and mass timber structures in SD

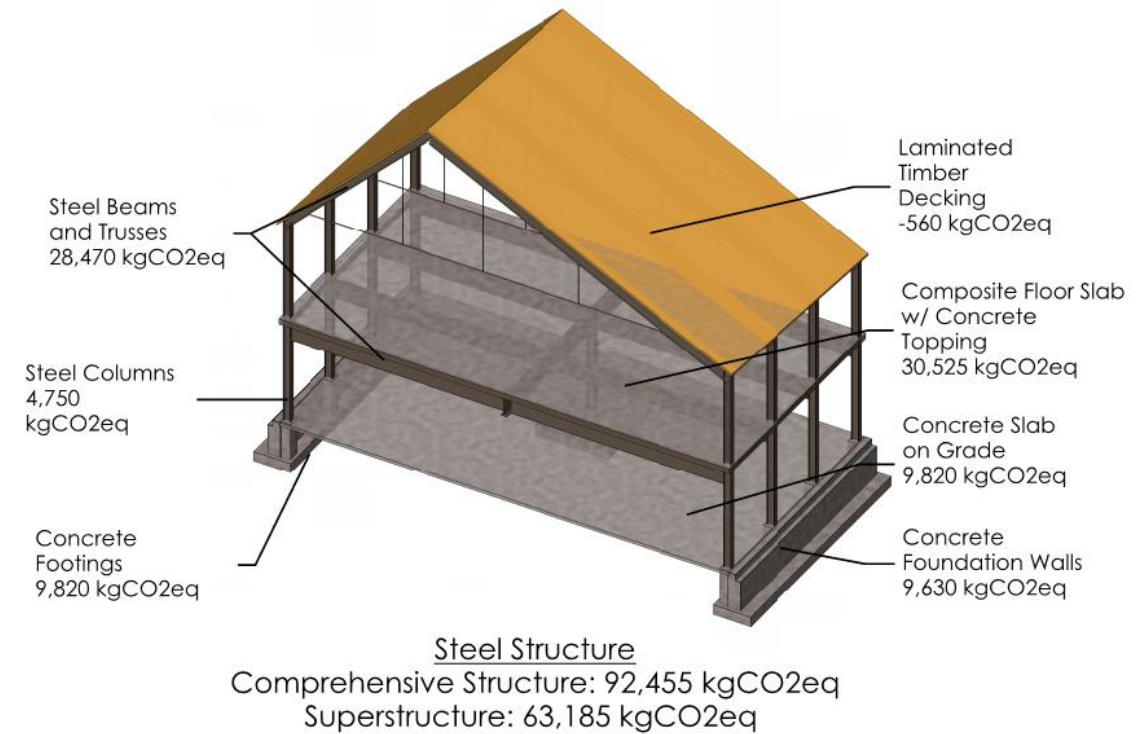
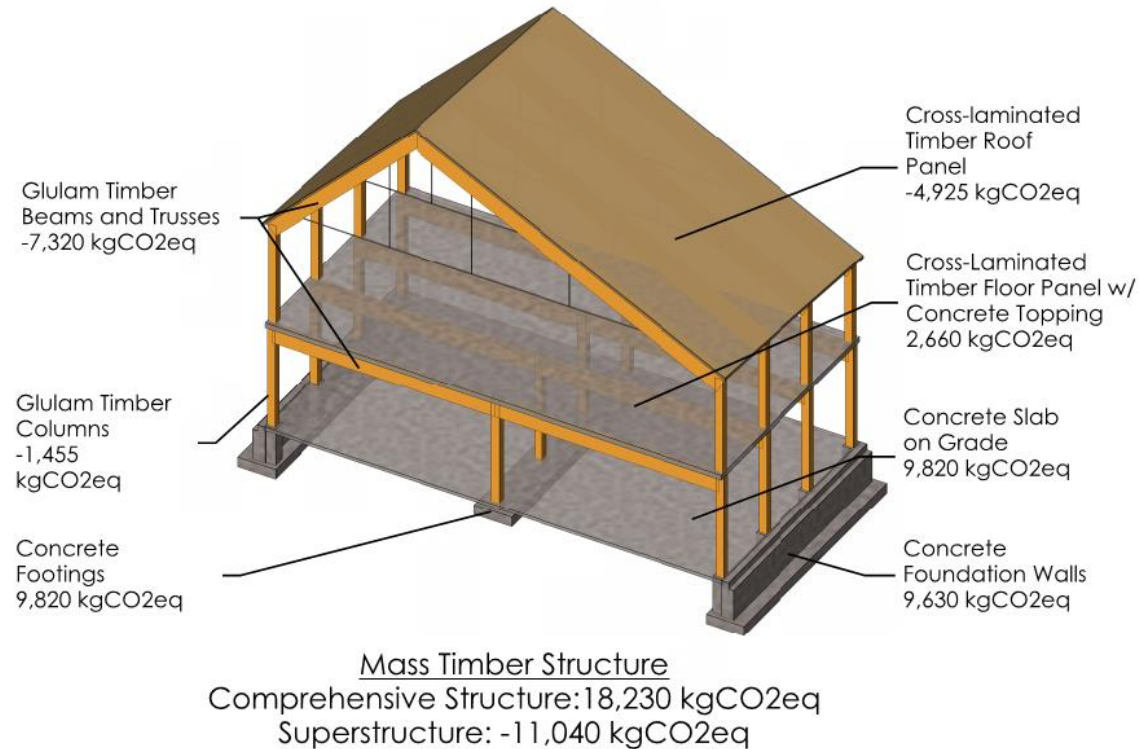


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Results



Case Study – Life Cycle Analysis





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CASE STUDY

The Blake School – Early Learning Center, Hopkins, MN



The Blake School

- Classroom building for Pre-K, Kindergarten, and 1st Grade
- Approx. 35,000 sqft
- Reggio-Emilia
- Classrooms, offices, ICC 500 Storm Shelter (gymnasium)



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Tezuka Architects

Lumber Prices (Last 5 Years)

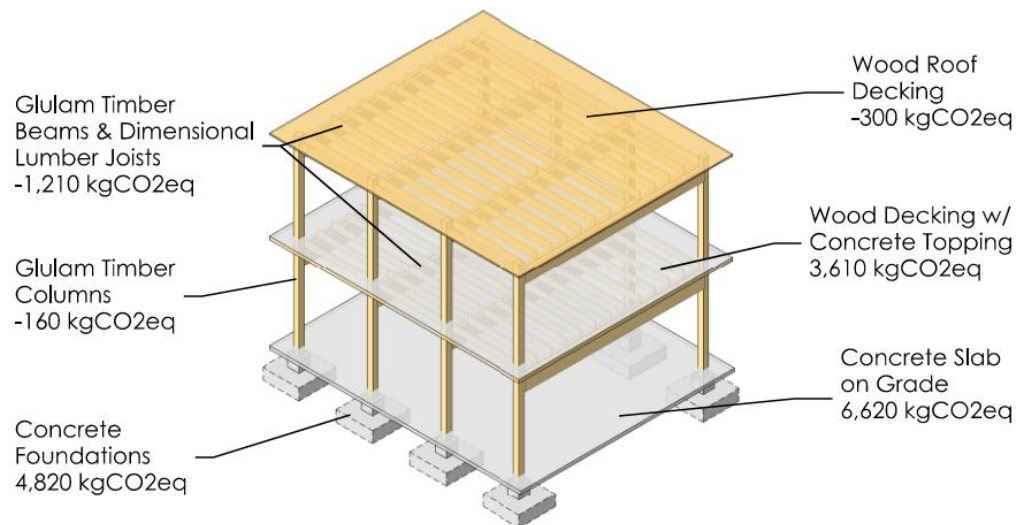


Lumber Prices (Last 5 Years)



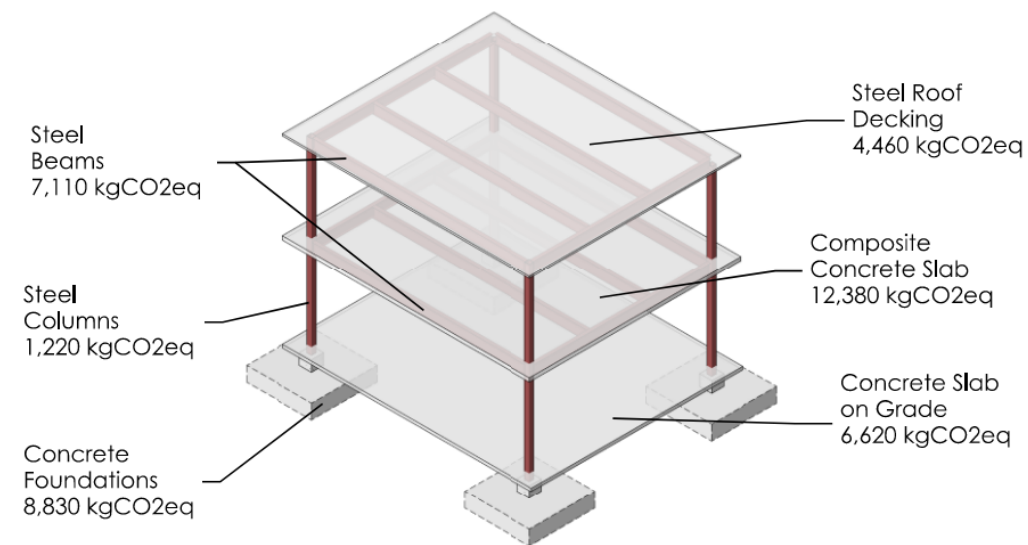


Tezuka Architects



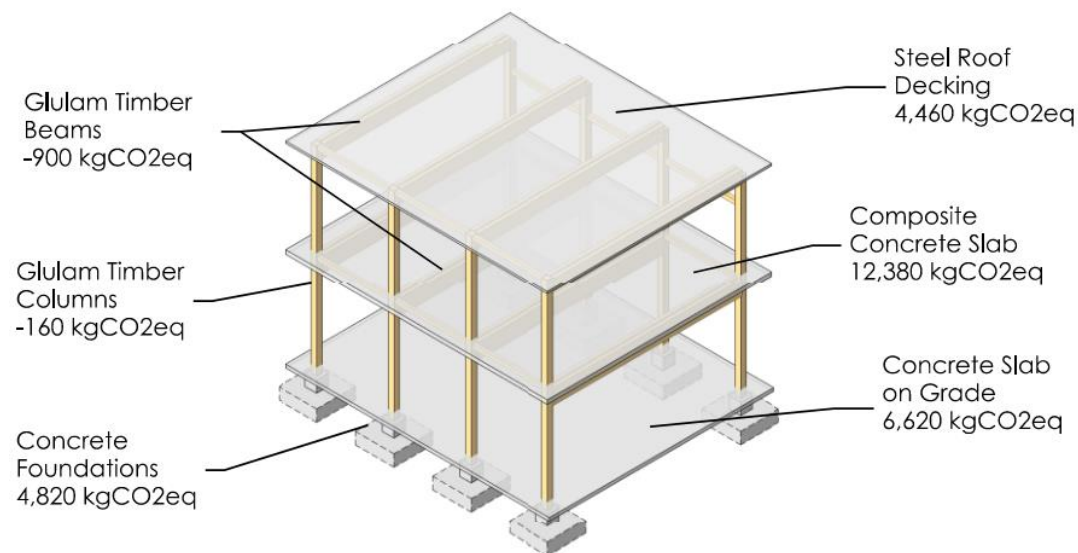
Basis of Design

Comprehensive Structure: 13,380 kgCO₂eq



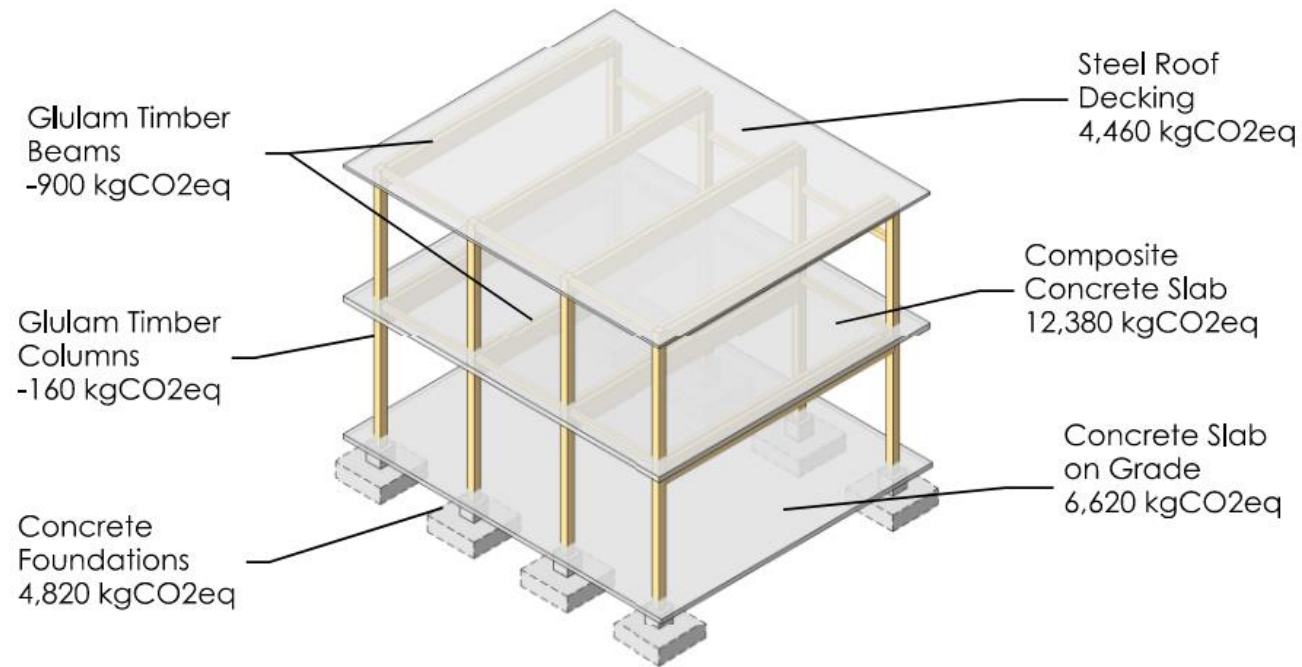
Steel Baseline Structure

Comprehensive Structure: 40,620 kgCO₂eq



Alternate 9A

Comprehensive Structure: 27,220 kgCO₂eq



Alternate 9A
Comprehensive Structure: 27,220 kgCO₂eq

Structural System	Global Warming Potential (kg CO ₂ eq)	Social Cost ¹ (Study Scope)	Social Cost ¹ (Full Building)
Basis of Design	13,380	\$680	\$14,825
Alternate 9A	27,220	\$1,390	\$30,300
Steel Baseline	40,620	\$2,070	\$45,125



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