

# Embodied Carbon of Building Materials

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## Introduction and Overview

*Senate Energy and Environment Committee*

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Oregon Department of Environmental Quality

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# Embodied carbon 101



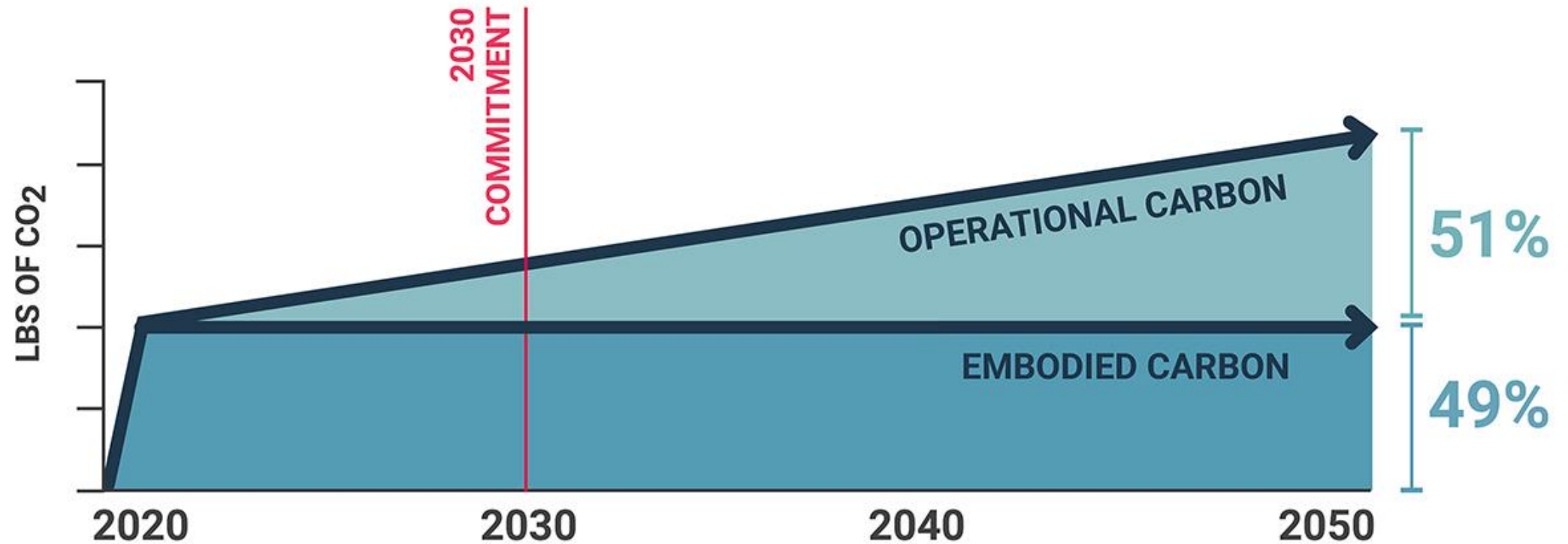
# What is embodied carbon?

*Greenhouse gas emissions from the manufacture, transport, installation, and disposal/recovery of construction materials*

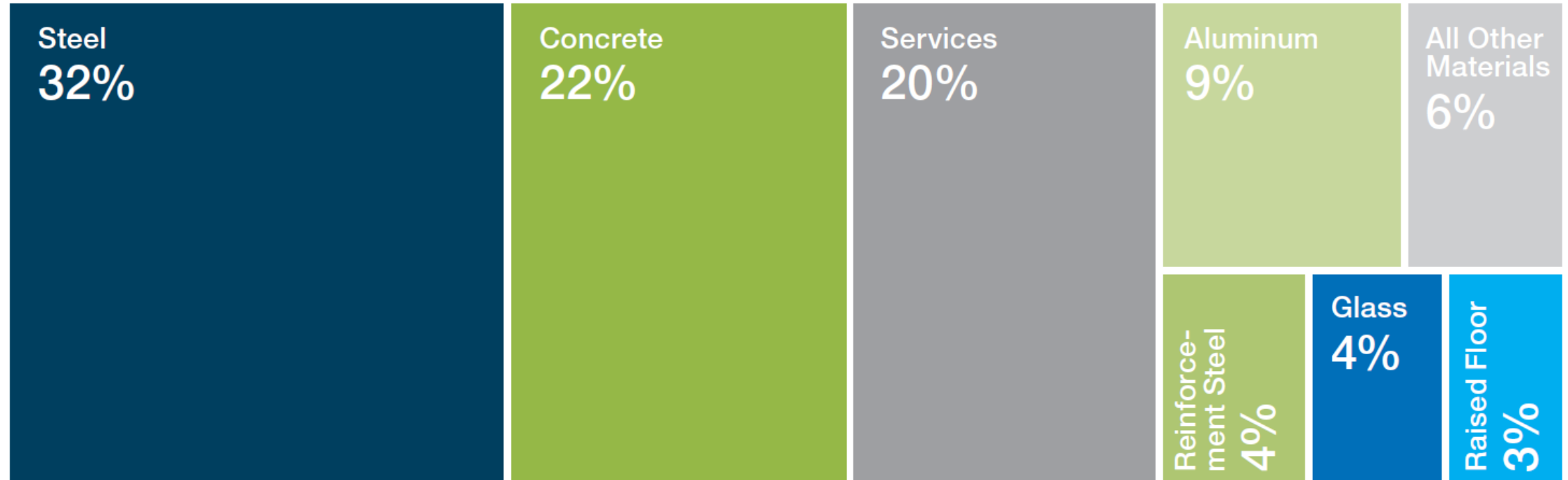
# What is embodied carbon?



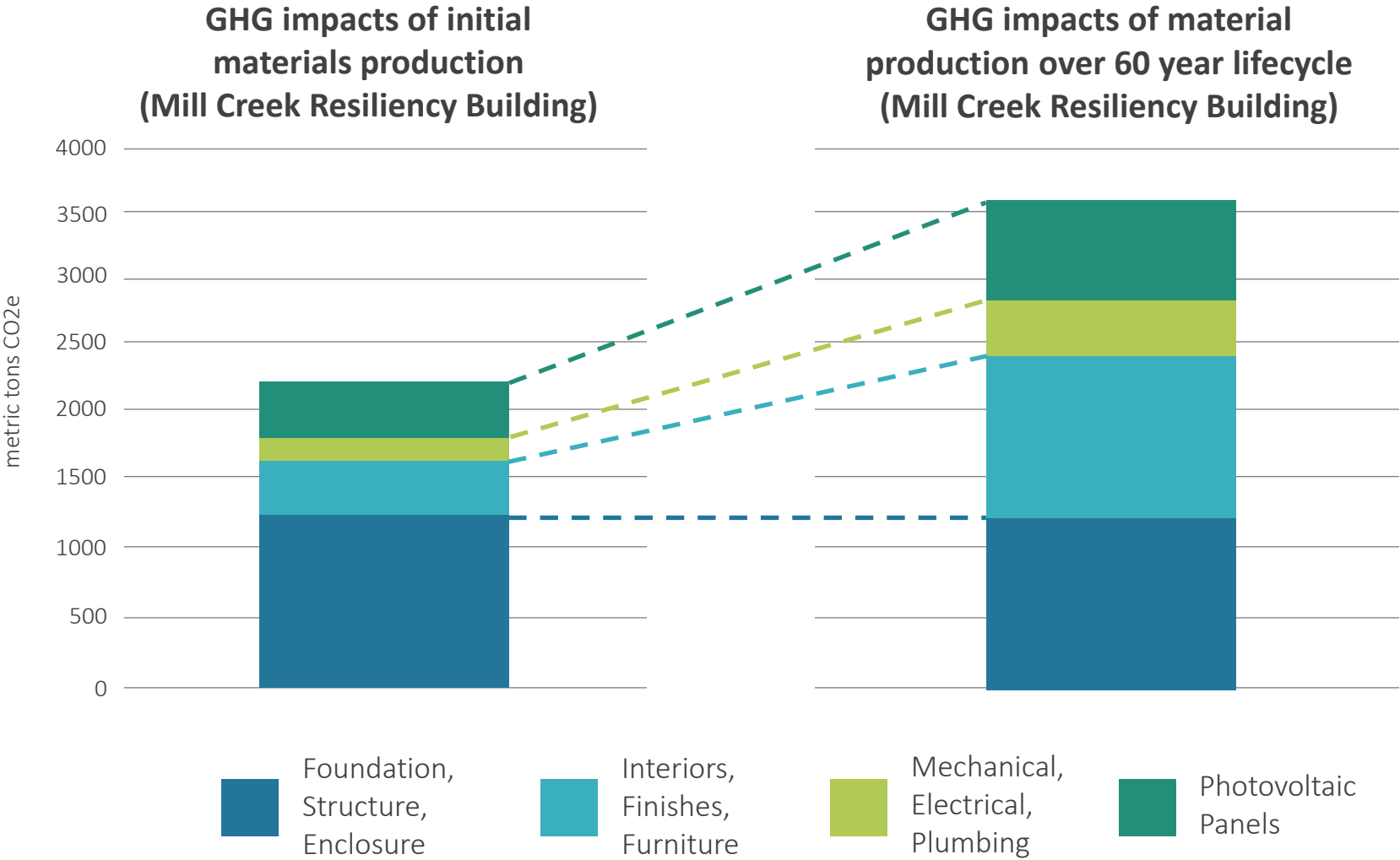
# Embodied and operational carbon



# Embodied carbon profiles of typical building



# Embodied carbon profiles over 60 year building lifecycle



# How do we measure embodied carbon?

## Environmental Product Declarations (EPDs)

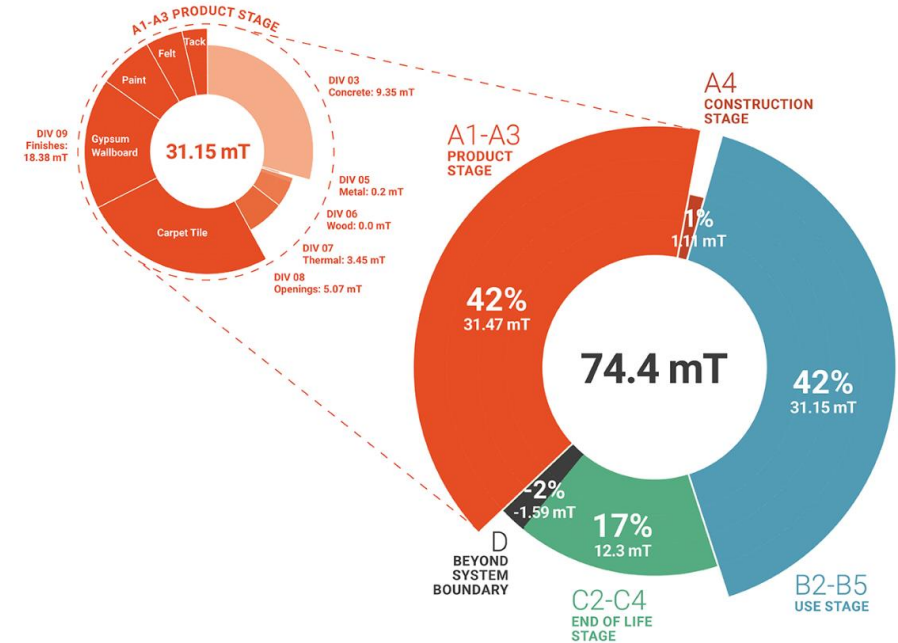
- Disclosure that reports environment impacts of products
- Typically includes impacts of raw material extraction, transportation, and manufacturing
- Third party certified following ISO standards

ENVIRONMENTAL IMPACTS	
<b>Declared Product:</b> Mix 45SS420A • Bend Plant Exterior SOG Compressive strength: 4000 PSI at 28 days	
<b>Declared Unit:</b> 1 m <sup>3</sup> of concrete	
Global Warming Potential (kg CO <sub>2</sub> -eq)	387
Ozone Depletion Potential (kg CFC-11-eq)	9.8E-6
Acidification Potential (kg SO <sub>2</sub> -eq)	2.42
Eutrophication Potential (kg N-eq)	0.47
Photochemical Ozone Creation Potential (kg O <sub>3</sub> -eq)	58.0
Abiotic Depletion, non-fossil (kg Sb-eq)	1.2E-6
Abiotic Depletion, fossil (MJ)	1,229
Total Waste Disposed (kg)	2.76
Consumption of Freshwater (m <sup>3</sup> )	2.89
<b>Product Components:</b> natural aggregate (ASTM C33), Portland cement (ASTM C150), batch water (ASTM C1602), slag cement (ASTM C989), admixture (ASTM C260)	

Additional detail and impacts are reported on page three of this EPD

## Whole Building Life Cycle Assessment (WBLCA)

- Analysis that reports environmental impacts of whole buildings across the full life cycle

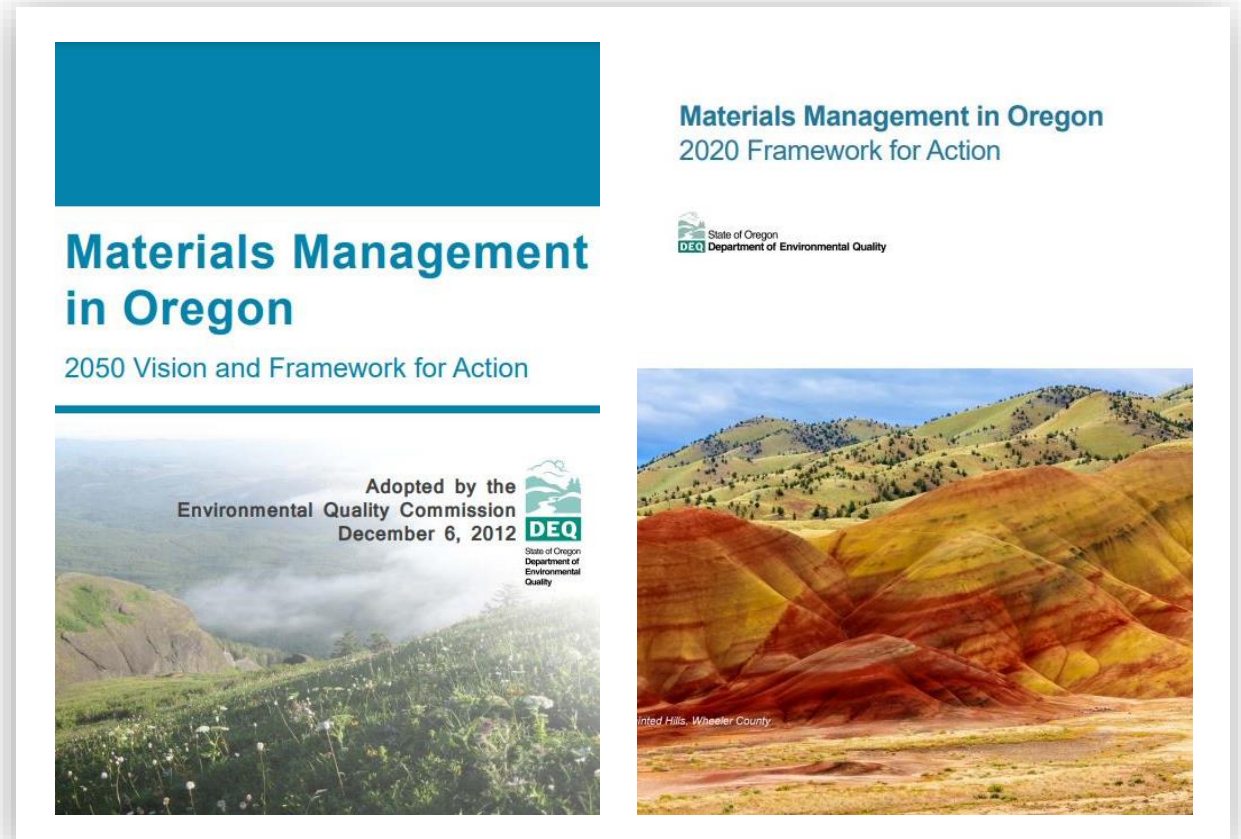


Source: Mahlum Architects

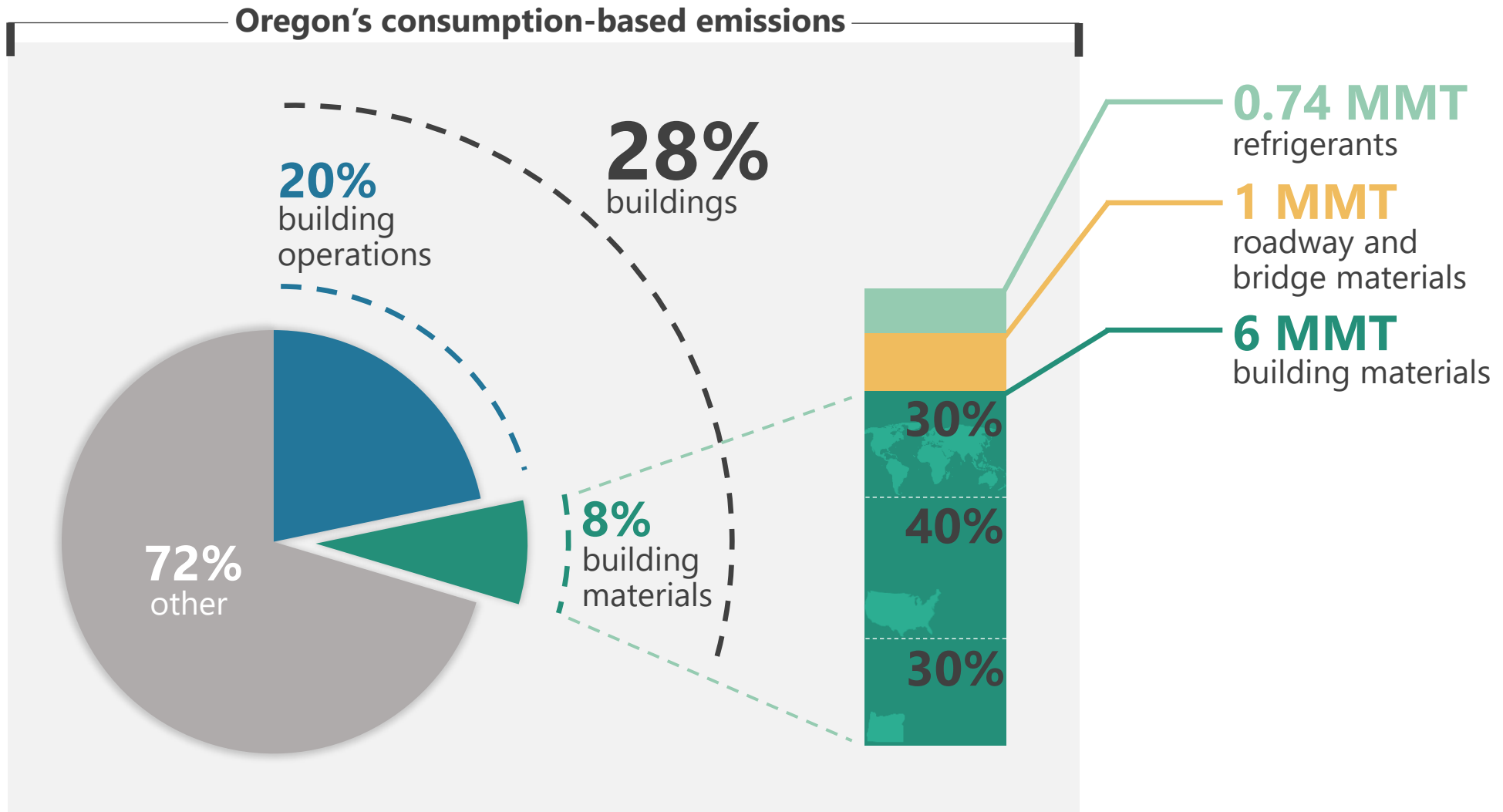
# Embodied carbon and the 2050 Vision for Materials Management in Oregon

# 2050 Vision and 2020 Framework for Action

*Oregonians in 2050  
produce and use  
materials responsibly –  
conserving resources,  
protecting the  
environment, and  
enhancing wellbeing*



# Embodied carbon of building materials in Oregon



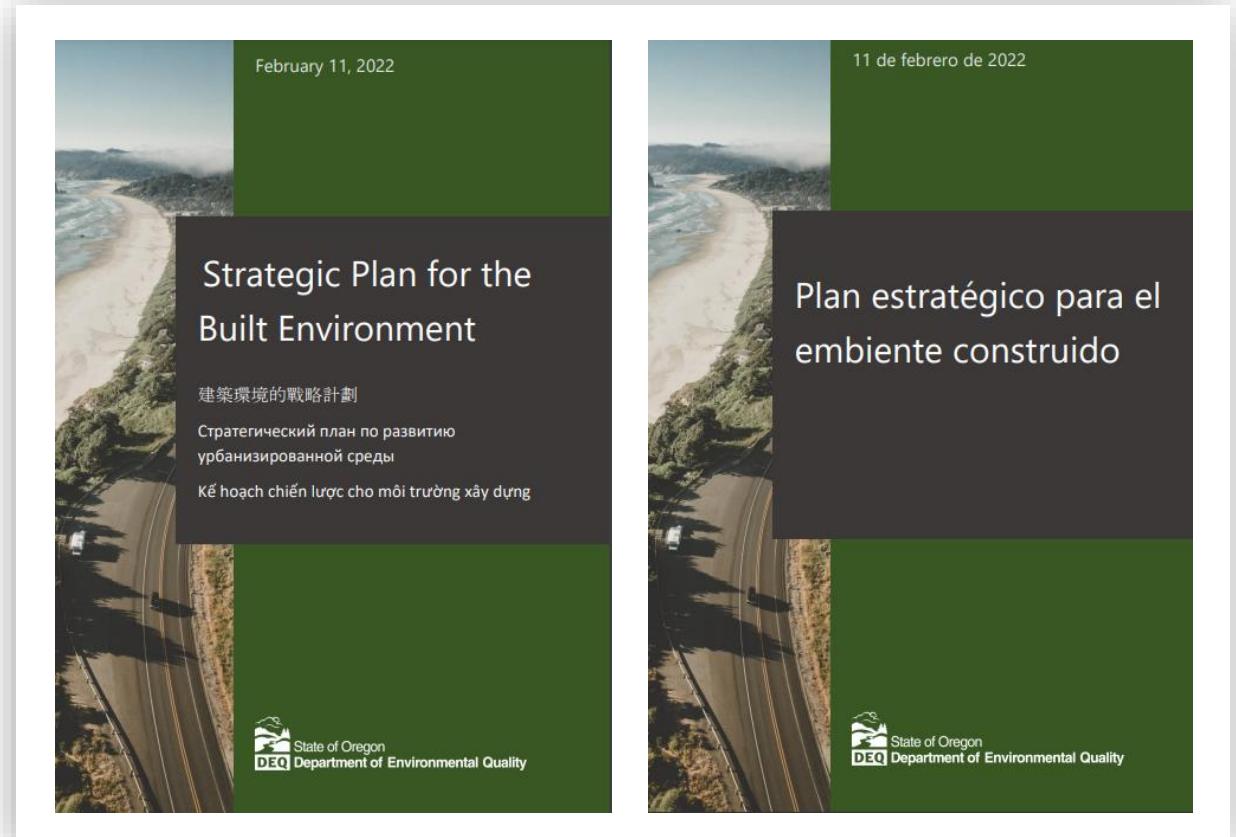
# DEQ's embodied carbon work



# Built Environment program

## Priority areas of work

- Building relationships and capacity
- Climate and resilience
- Design justice and stewardship
- Housing
- Infrastructure



<https://www.oregon.gov/deq/mm/production/Pages/Strategic-Plan.aspx>

# Environmental Product Declarations (EPDs)

- Developed Oregon Concrete EPD Program (2017-2020)
  - Over 1500 EPDs produced
- Developing expanded transparency disclosure program (in progress)
  - Available to additional building material producers and other sectors of the built environment industry
  - Additional transparency disclosure labels will be included such as Health Product Declarations (HPDs), Declare, and JUST
- Supported City of Portland Low Carbon Concrete Initiative
  - Embodied carbon thresholds for concrete mixes on City projects
- Participation on Product Category Rule (PCR) committees
  - Concrete and asphalt

# Life Cycle Assessment (LCA)

- As directed in EO 17-20, consult on state building projects to reduce embodied carbon of building materials
- Provided grant funding to support trainings for designers across Oregon to learn about Whole Building LCA and receive a one-year license for Whole Building LCA software
- Reports:
  - Mill Creek Resiliency Building (2021)
  - Deconstruction vs. Demolition Life Cycle Assessment (2019)
  - Residential Life Cycle Assessment (2010)



## Additional research, pilots, and partnerships

- HB 4139, 2022 (Buy Clean), technical support
- City of Portland low carbon concrete sidewalk pilot project, partner
- Pacific Coast Collaborative Low Carbon Construction Task Force
- Statewide sustainable building standards, researcher, collaborator (DAS and ODOE)
- Sustainable Buildings for All (SB4A) incentive framework, convenor
- Industrial hemp research, advisor (PSU and City of Portland)
- Mapping the impacts of building materials produced and consumed in Oregon, UO course co-instructor

*questions?*

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<https://www.oregon.gov/deq/mm/production/Pages/Built-Environment.aspx>

