Embodied Carbon

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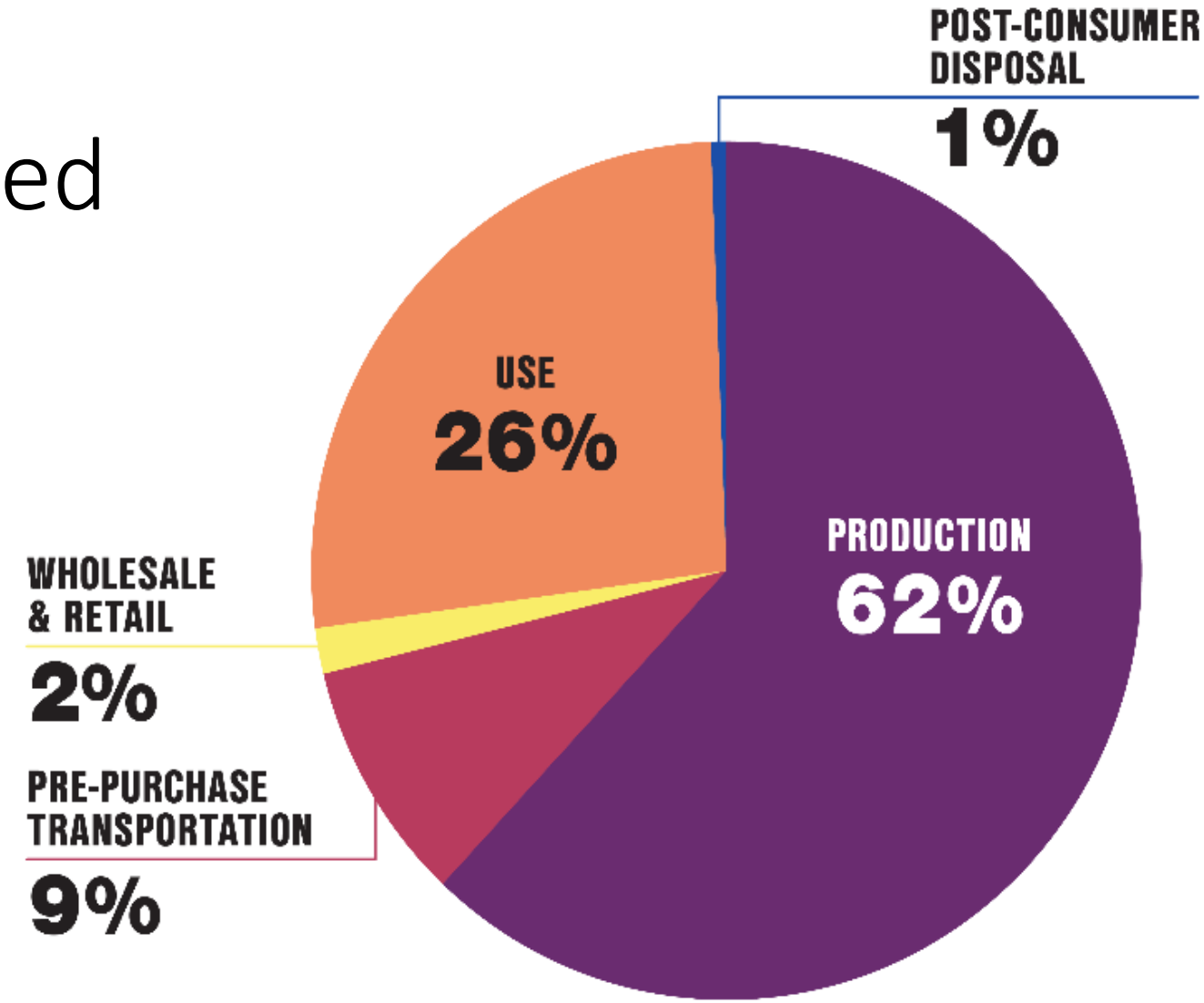
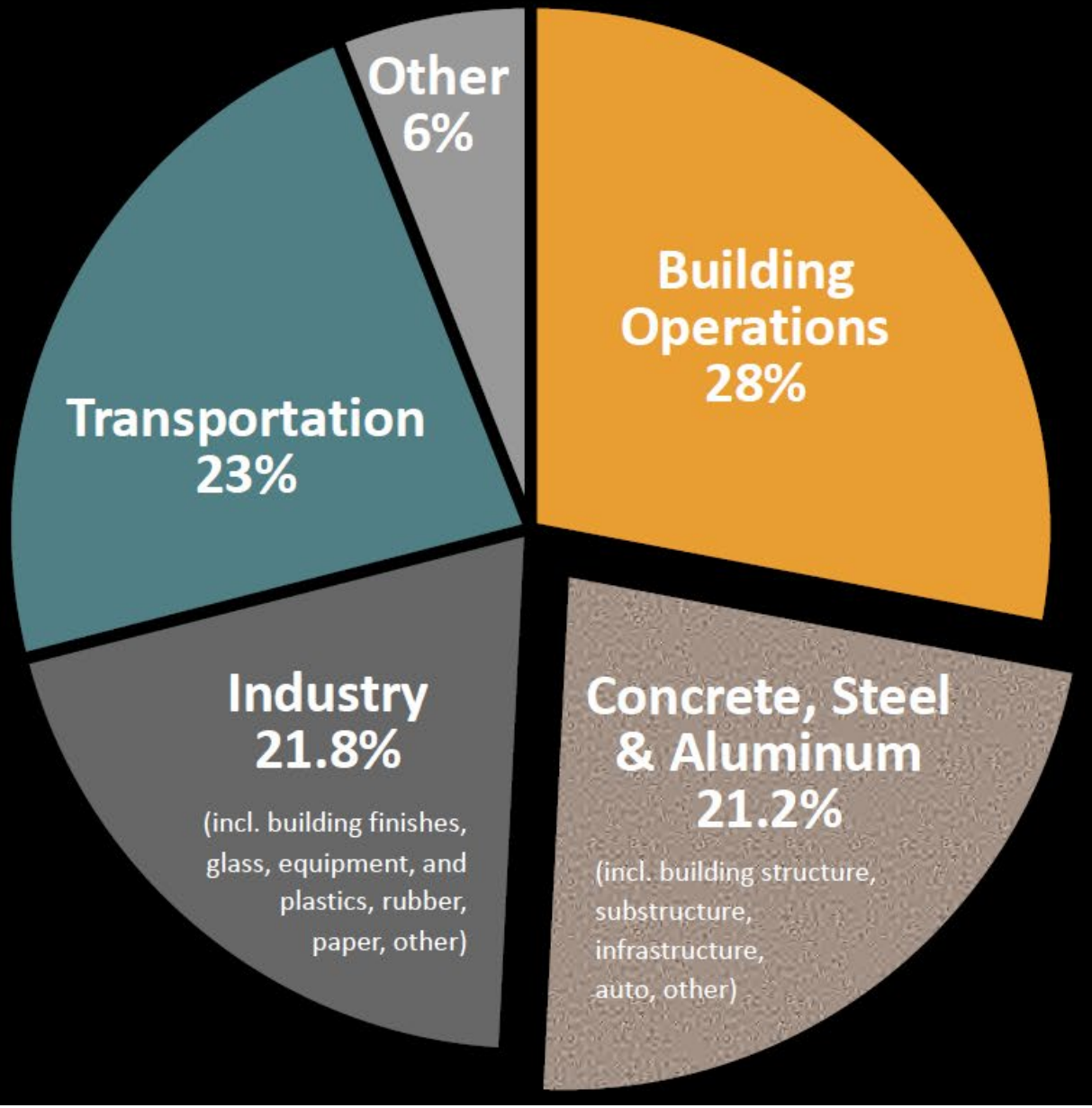
Agenda

- Embodied carbon overview (5 min)
- Portland low carbon concrete initiative (10 min)
- Marin Low carbon concrete code (2 min)
- C40 Clean Construction Declaration (3 min)
- Q&A (10 min)

What is embodied carbon?

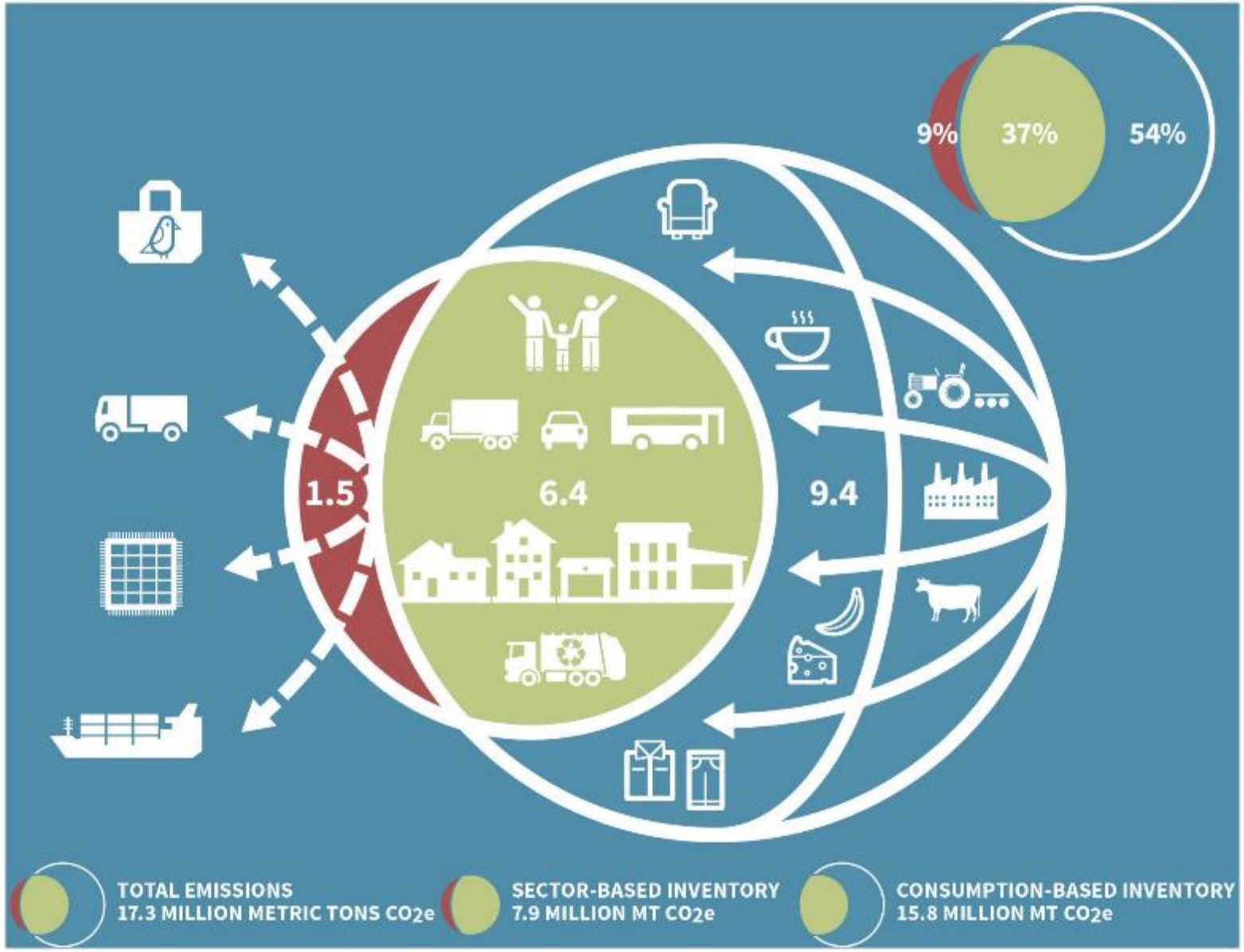


Global CO_2 Emissions by Sector

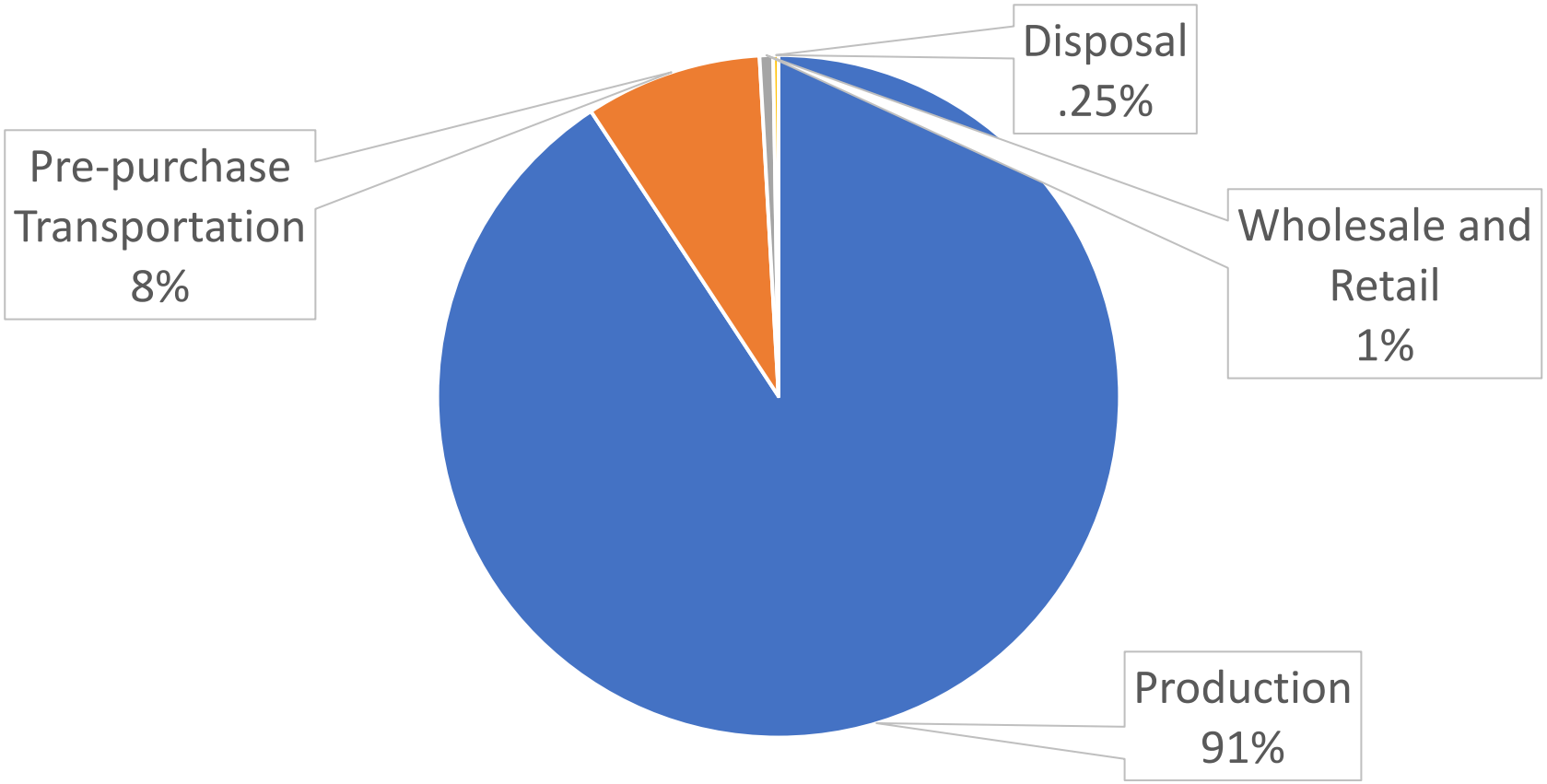


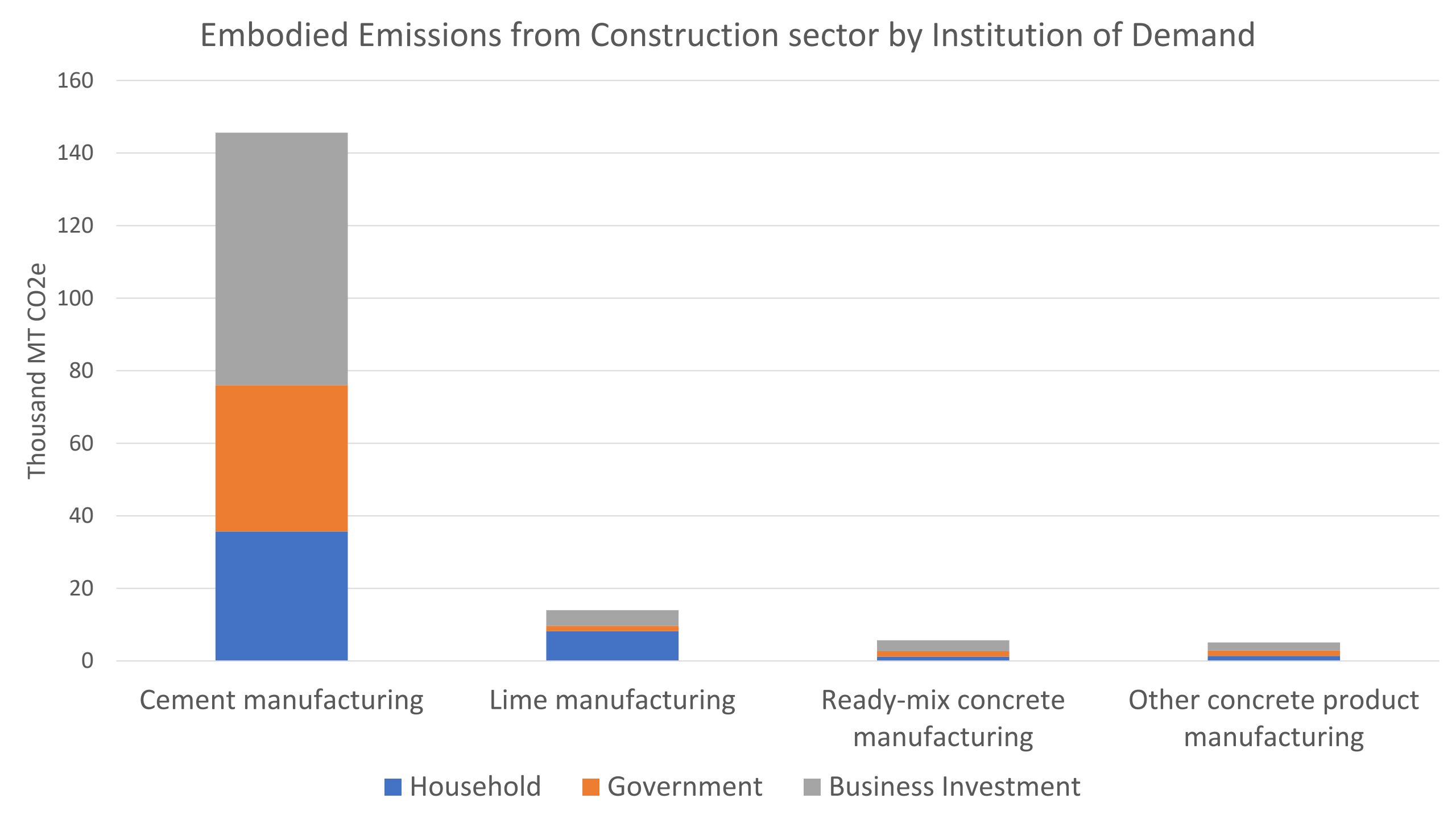
Source:
2018 Global ABC Report; IEA

Global emissions as a result of local consumer demand are more than twice the volume of emissions produced locally.



Construction Sector Emissions by Lifecycle Phase




Embodied Emissions from Construction sector by Institution of Demand
160
140
120
100
80
60
40
20
0
Thousand MT CO2e
Cement manufacturing
Lime manufacturing
Ready-mix concrete manufacturing
Other concrete product manufacturing
Household
Government
Business Investment

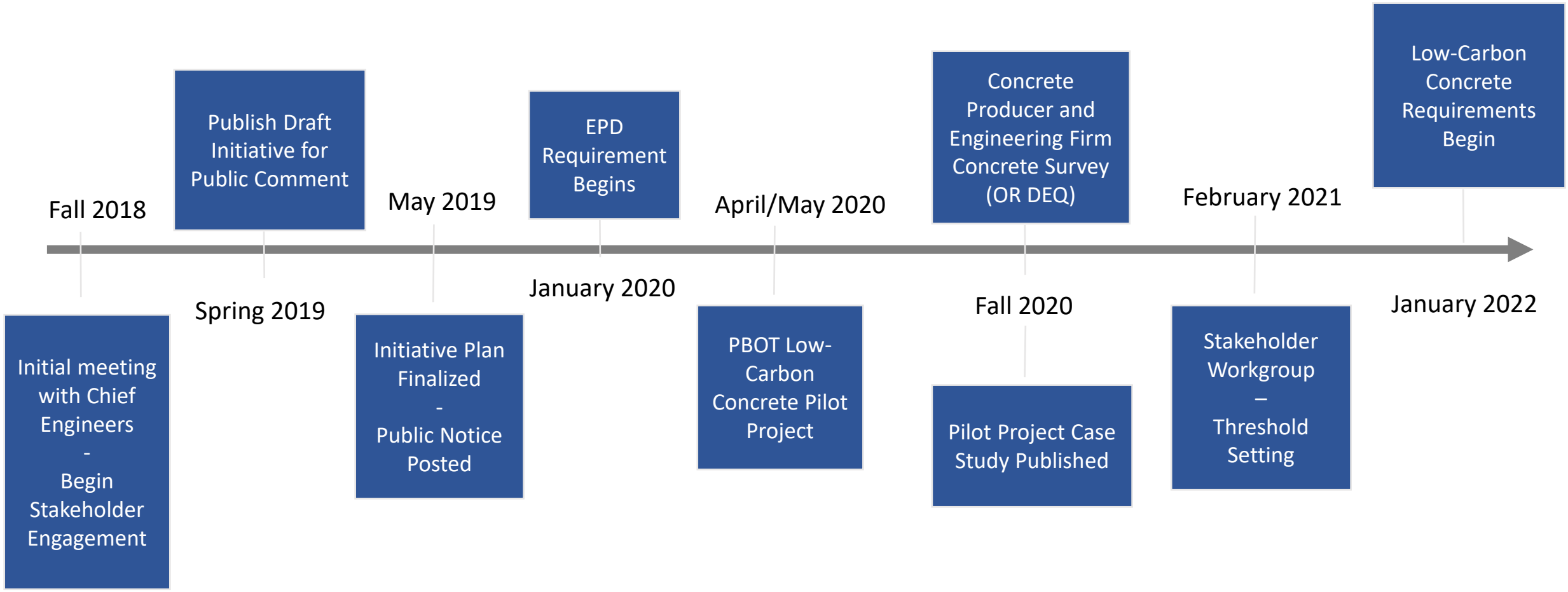
Low-Carbon Concrete Initiative

City of Portland
Sustainable Procurement Program

Why City Project Focus?

- 2016 Sustainable Supply Chain Analysis
  - Greenhouse gases (GHG) largest supply-chain environmental impact
  - Construction is largest category of spend contributing to GHG
- Within construction, concrete is a large GHG contributor
- Walk our talk; proof of concept
- Understand challenges, supply constraints, equity impacts, etc. at a small scale first
- Send market signal that this is of interest, this is happening

Timeline

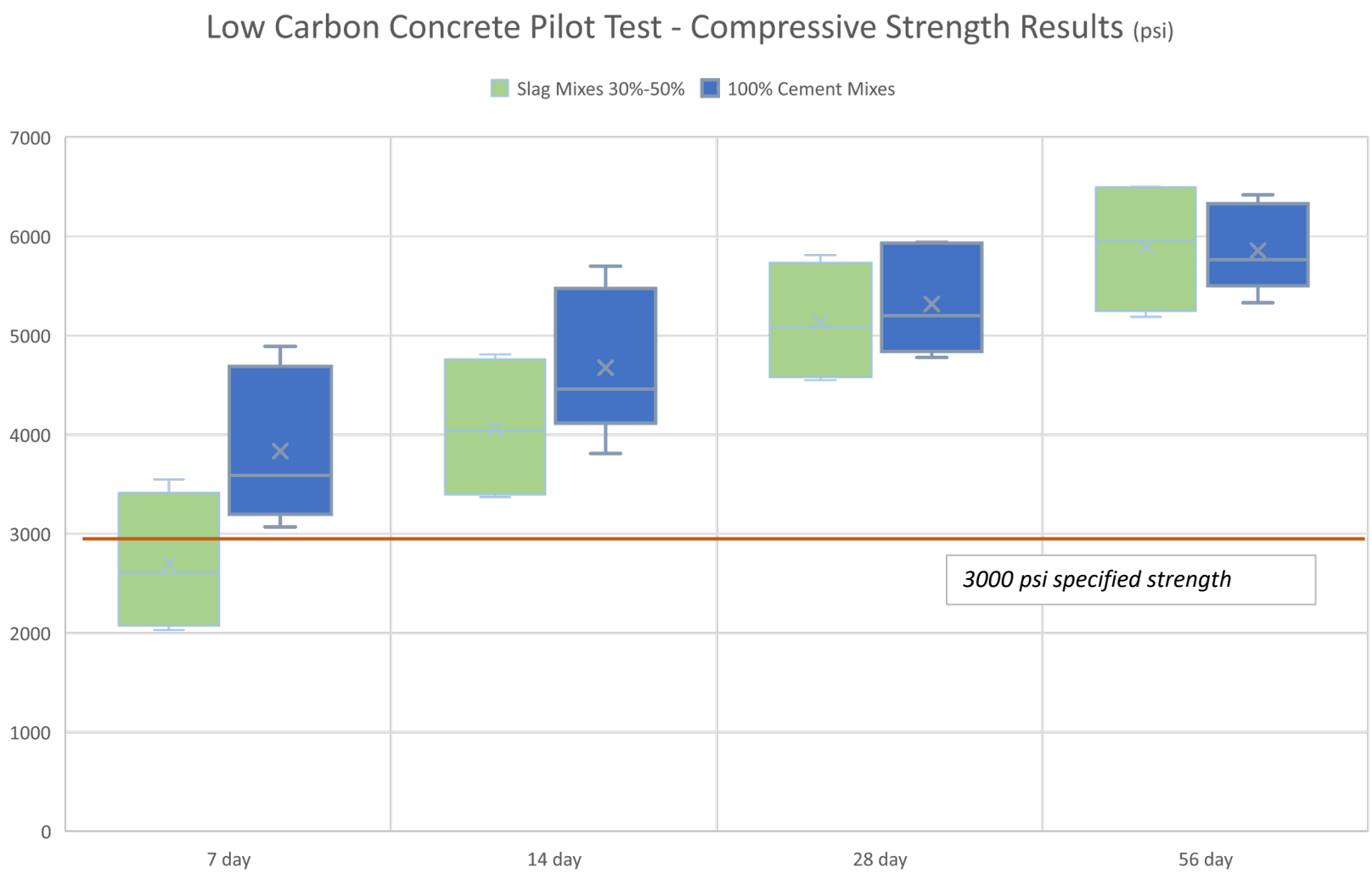

Fall 2018
Initial meeting with Chief Engineers - Begin Stakeholder Engagement
Spring 2019
Publish Draft Initiative for Public Comment
May 2019
Initiative Plan Finalized - Public Notice Posted
January 2020
EPD Requirement Begins
April/May 2020
PBOT Low-Carbon Concrete Pilot Project
Fall 2020
Concrete Producer and Engineering Firm Concrete Survey (OR DEQ)
Pilot Project Case Study Published
February 2021
Stakeholder Workgroup – Threshold Setting
January 2022
Low-Carbon Concrete Requirements Begin

Low-Carbon Concrete Initiative

- Phase 1 – Require Environmental Product Declarations (EPDs)
  - Embodied carbon data
- Phase 2 – Get Baseline, Cement Use, & Performance Data
  - Historical City Project Data
  - Pilot Project(s)
  - Concrete Producer Data (average mix quantities per strength class)
  - Engineering Firm Survey (specified concrete mixes in Portland Metro area)
- Phase 3 – Establish Global Warming Potential (GWP) Thresholds
  - Replicate Marin County (CA) stakeholder engagement process

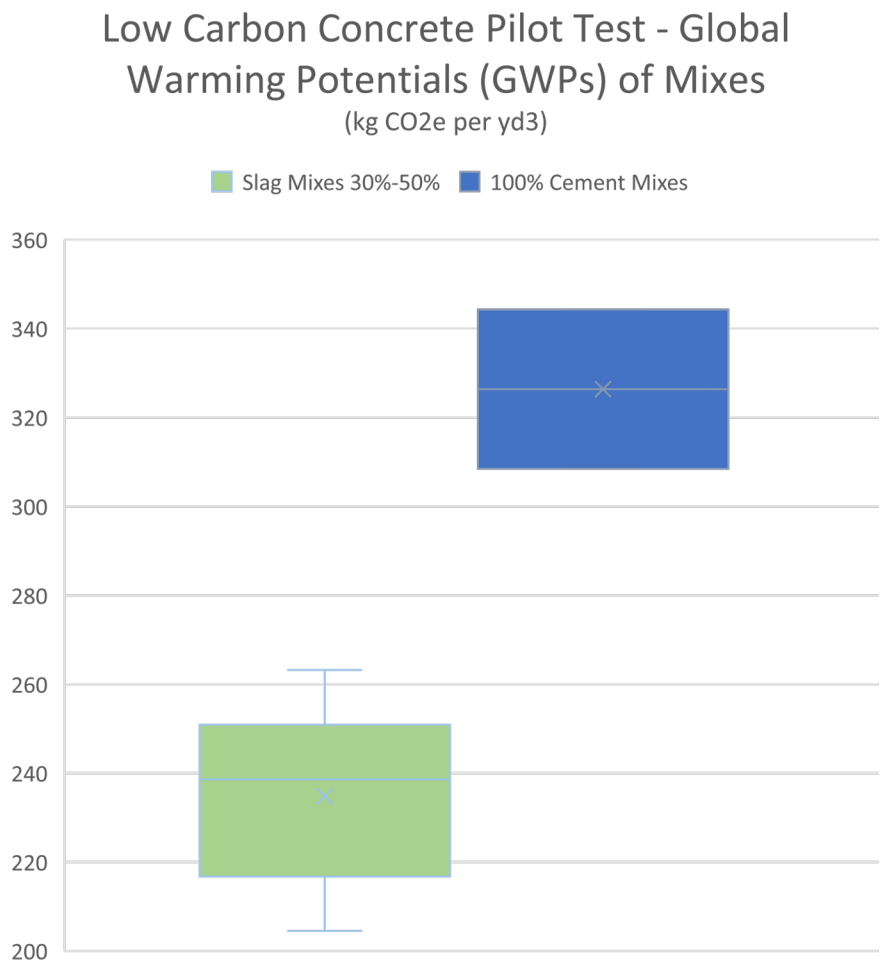
Sidewalk Pilot Test

Pilot Test Results - Strength



Pilot Test Results - GWP

- Lower-carbon mixes lowered the carbon footprint of an average sidewalk ramp by 23-34%.



[Download the case study on the Sustainable Procurement Program Website]

Pilot Test Results - Potential

- Combined use of the lower-carbon concrete mixes resulted in a reduction of 4.5 MT of CO2e compared to a typical project using 100% cement.
- If PBOT used such slag mixes for all 1,000 annual curb replacements, it would lower the carbon footprint of the concrete used in a year by 733-1,211 MT CO2e. This is equivalent to 17%-27% of the CO2e annual emissions associated with the electricity used by PBOT's street lights and traffic signals.

Assuming each curb used 10.5 yd3 of concrete. Electricity data from FY18-19 City of Portland total carbon emissions data

Low-Carbon Concrete Threshold Setting

Phase 3 – Threshold Setting

- Multi-Stakeholder Workgroup Includes:
  - City Staff (one representative each from Water, BES, PBOT)
  - Oregon DEQ Materials Management Program
  - Concrete Producers (including small producer)
  - Engineering Firms
  - Construction Contractors (small & large)
  - Architects
  - Oregon Concrete and Aggregate Producers Assoc.

Phase 3 – Threshold Setting

- Where Discussions Are Going So Far….
  - Set GWP threshold resulting in meaningful carbon reduction for City concrete use
  - Phase-in lower GWP thresholds over time
  - Incentivize mixes that have significantly lower GWPs than threshold
- Why leaning in this direction?
  - Concerns over current supply constraints for alternatives to Type I/II cement *(market is still transitioning)*
  - Constraints with silo/storage capacities at producers' facilities
  - Concerns over project impacts – need to understand these better, do more pilots
  - Concerns over stakeholder awareness/education – need to do more engagement

How You Can Help Support

- Support Implementation of Recommendations from Stakeholder Workgroup
- Support Funding for Low-GWP Mix Incentives
  - Given project-budget/fund constraints, need separate pool of money to fund incentives
- Support the Use of Low-Carbon Concrete on Your Own Projects (as applicable)
  - Report Results & Lessons Learned – Carbon Leadership Forum site

Marin Low Carbon Concrete Code

Concrete performance standards for composition that “maintains adequate strength and durability for the intended application.”

The code covers both residential and commercial construction and includes standards for industry practices, including:

- replacing Portland cement with supplementary cementitious materials (such as fly ash, slag, and ground glass)
- minimizing the amount of cement in mixes
- selecting aggregate
- changing the requirements for how quickly concrete has to cure (which impacts the amount of cement used)

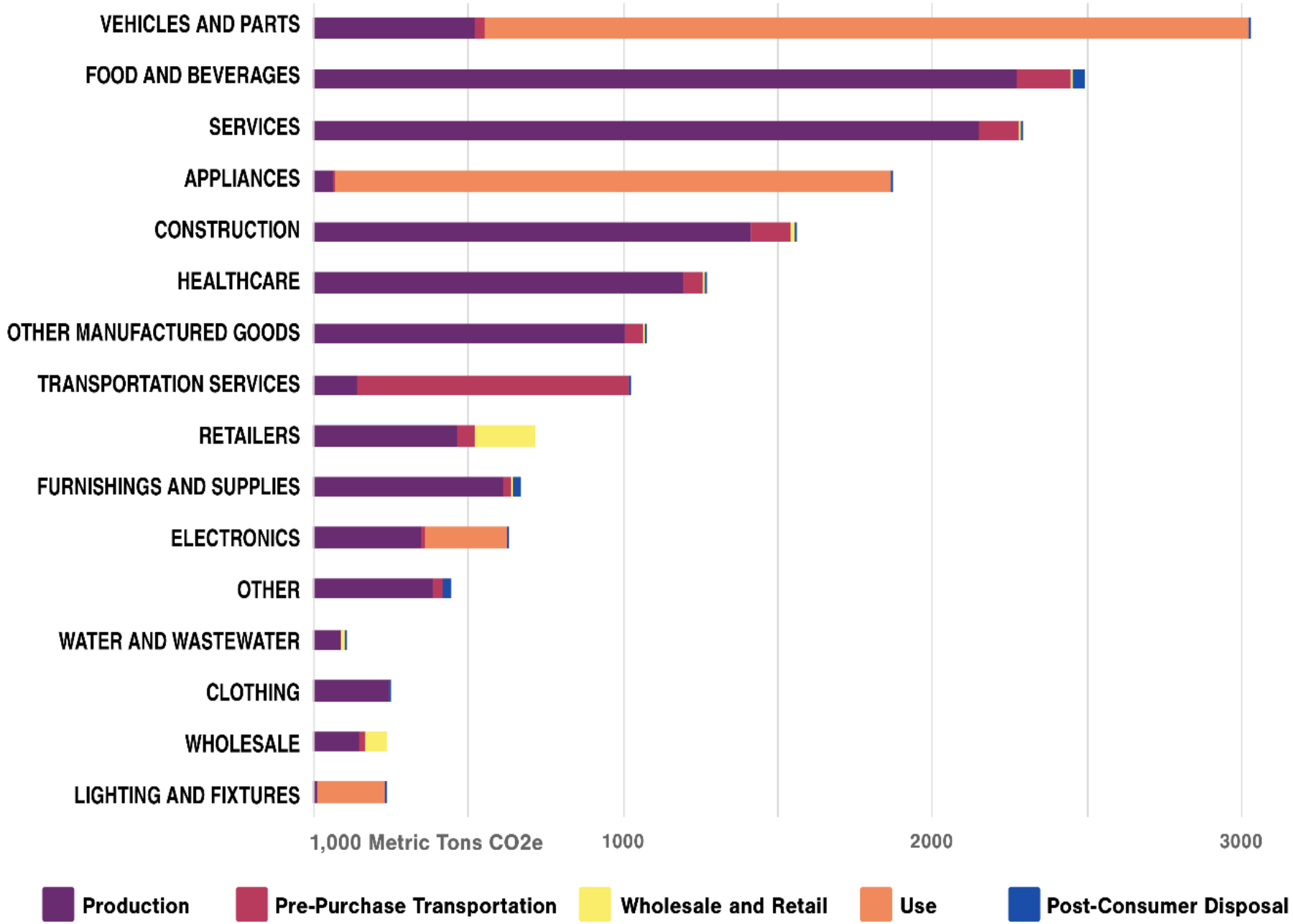
C40 Clean Construction Declaration

- Reduce embodied emissions by at least 50% for all new buildings and major retrofits by 2030, striving for at least 30% by 2025

- Reduce embodied emissions by at least 50% of all infrastructure projects by 2030, striving for at least 30% by 2025

- Procure and, when possible, use only zero emission construction machinery from 2025 and require zero emission construction sites city-wide by 2030

Thank you!


VEHICLES AND PARTS
FOOD AND BEVERAGES
SERVICES
APPLIANCES
CONSTRUCTION
HEALTHCARE
OTHER MANUFACTURED GOODS
TRANSPORTATION SERVICES
RETAILERS
FURNISHINGS AND SUPPLIES
ELECTRONICS
OTHER
WATER AND WASTEWATER
CLOTHING
WHOLESALE
LIGHTING AND FIXTURES
1,000 Metric Tons CO2e
1000
2000
3000
Production
Pre-Purchase Transportation
Wholesale and Retail
Use
Post-Consumer Disposal