

# Low Embodied Carbon Materials in Construction Resolution- 2nd Read

Lucca Henrion and Alexander Rees – Global CO<sub>2</sub> Initiative

Jan Culbertson – Ann Arbor 2030 District



# Goals of the resolution

- **Highlight the importance of embodied emissions**
- Develop local expertise in low embodied carbon materials
- Communicate methods to reduce embodied emissions

# Understanding Carbon



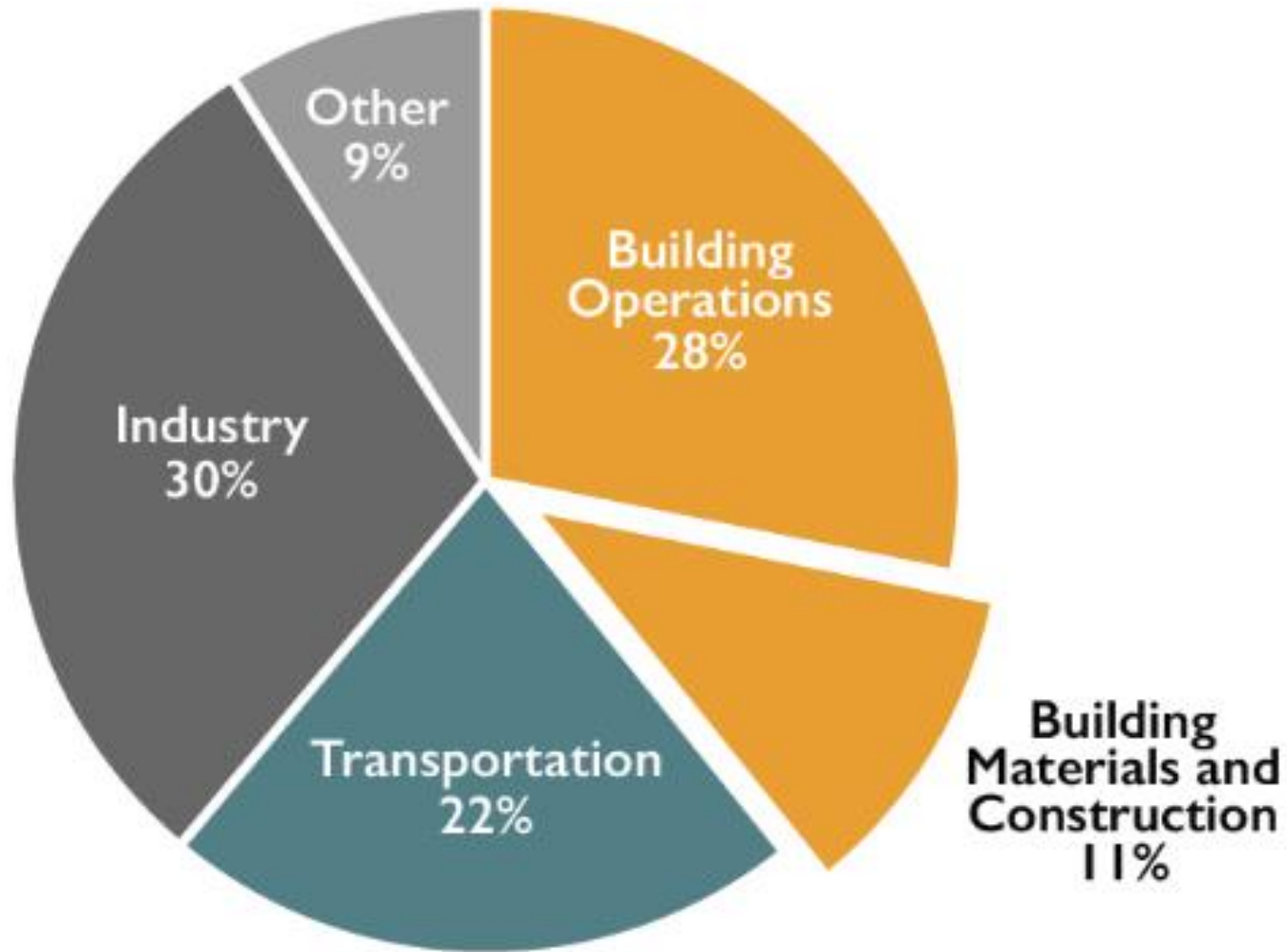
## Embodied Carbon

Manufacture, transport and installation of construction materials

## Operational Carbon

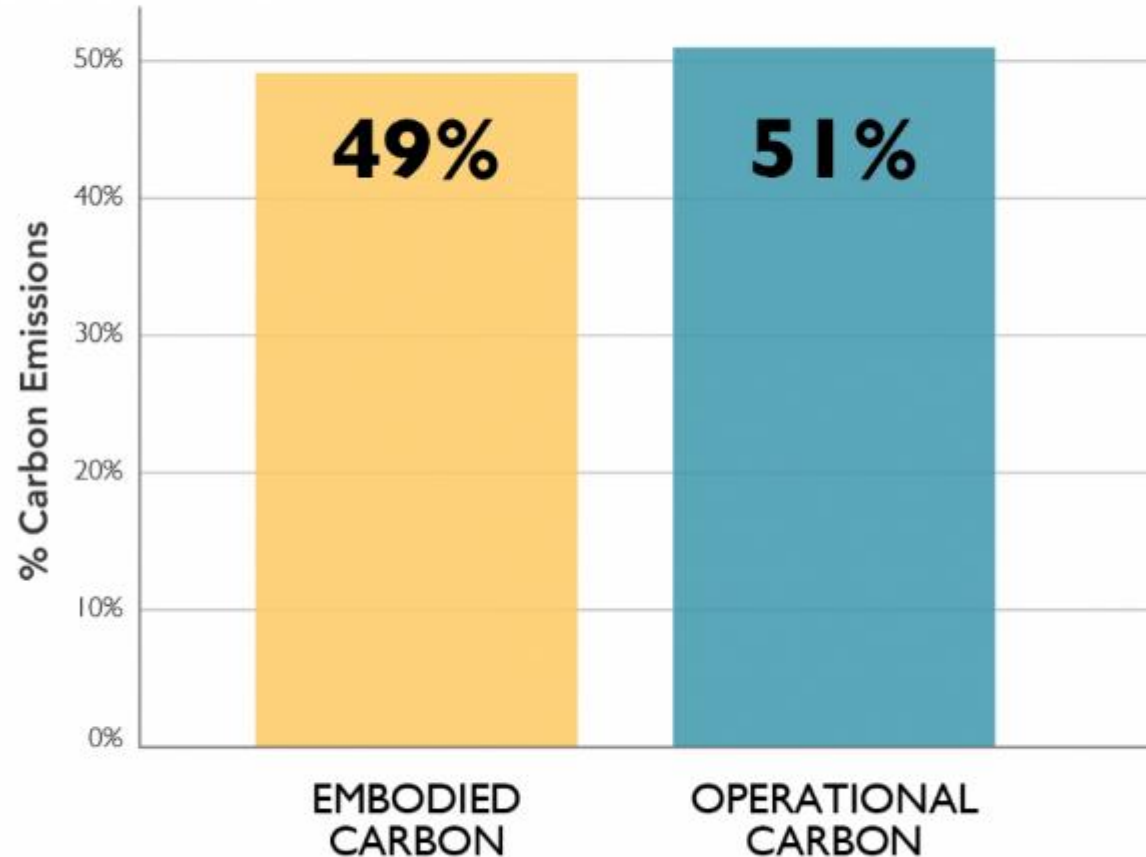
Building energy consumption

## Global CO<sub>2</sub> Emissions by Sector



**Annually, embodied carbon is responsible for 11% of global GHG emissions and 28% of global building sector emissions.**

## Total Carbon Emissions of Global New Construction from 2020-2050 Business as Usual Projection



**Embodied carbon will be responsible for almost half of total new construction emissions between now and 2050.**

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## Low Embodied Carbon Concrete Task Force charge:

- 1) Develop recommendations for Concrete specifications that will lower embodied carbon in concrete that can be implemented immediately in SE MI
- 2) Develop recommendations that may need further research, market transformation or industry & professional education before implementing
- 3) Discuss policies that reinforce & promote these materials

**For initial task force presentation:**

<https://wcaplanroom.app.box.com/s/mno2utkj3qvy0srl2kgo3wvd477gllit>

# Task Force Participants:

## **Owners**

### **University of Michigan AEC**

Marina Roelofs

Jerry Shulte

Patti Spence

### **Ann Arbor Public Schools**

Emile Lauzzana

Jason Bing

### **City of Ann Arbor**

Nick Hutchinson

## **Researchers**

Lucca Henrion, U-M

Jeremy Gregory, MIT

Lawrence Sutter, MTU

## **Facilitator**

Jan Culbertson, A2 2030 District

## **Engineers**

Kevin Maillard, OHM Advisors

Jenna Bresler, Silman

Ian Schmellick, Silman

Christopher Kelley, Silman

## **Supplier**

Christopher Kennedy, St. Mary's Cement

## **Contractors**

Tom McCurry, Doan Companies

Kelli Jenness, Spence Brothers

Stephanie Corona, Gilbane

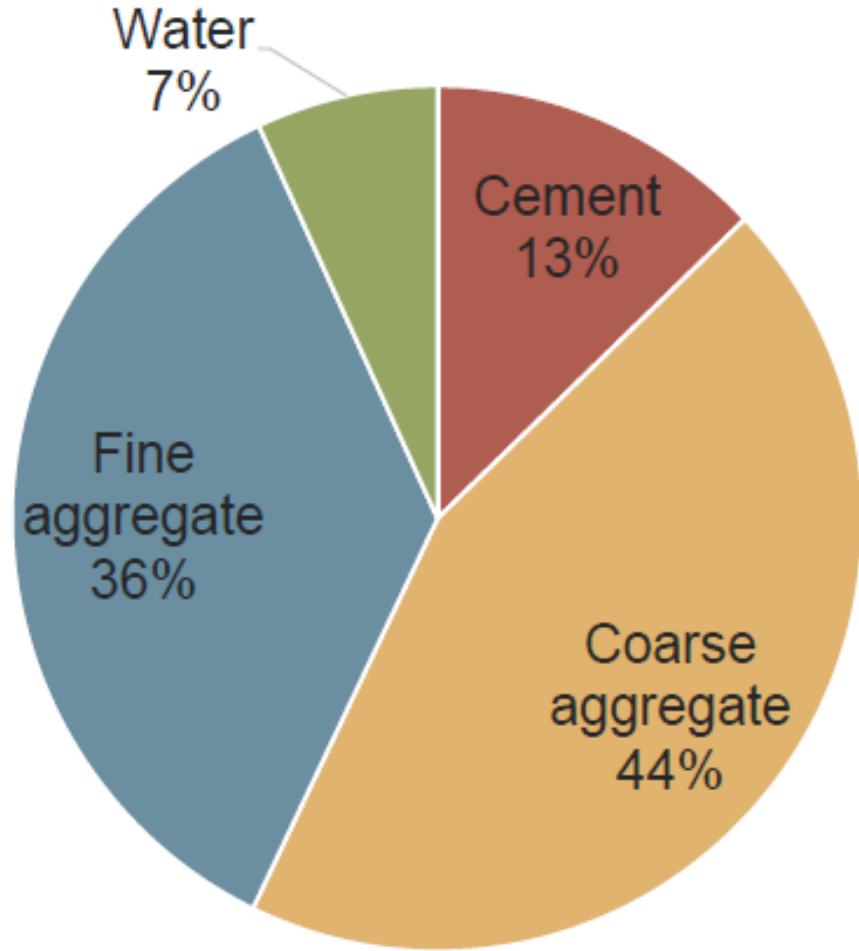
## **Associations**

Dan DeGraaf, Michigan Concrete Assoc.

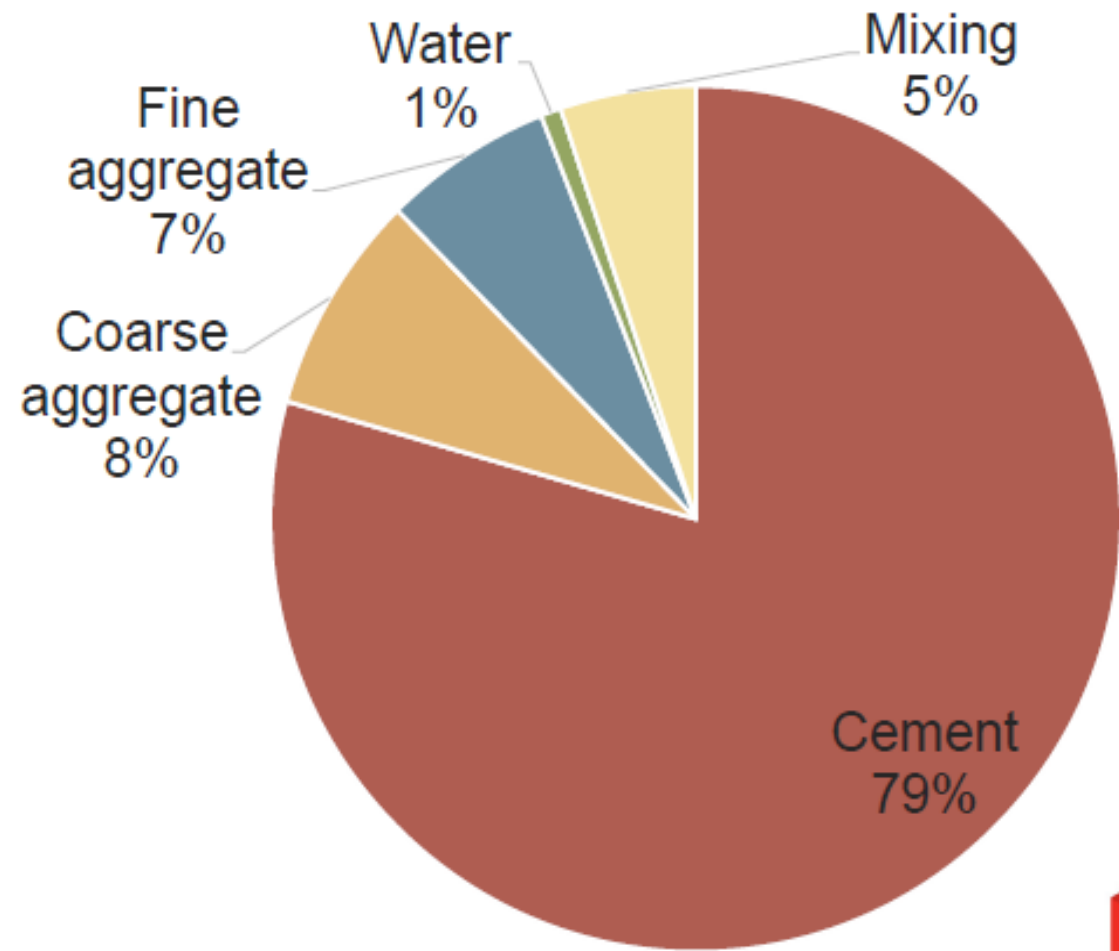
Kerry Sutton, American Concrete Institute



## Constituent contribution by **mass**



## Constituent contribution by **GHG emissions**



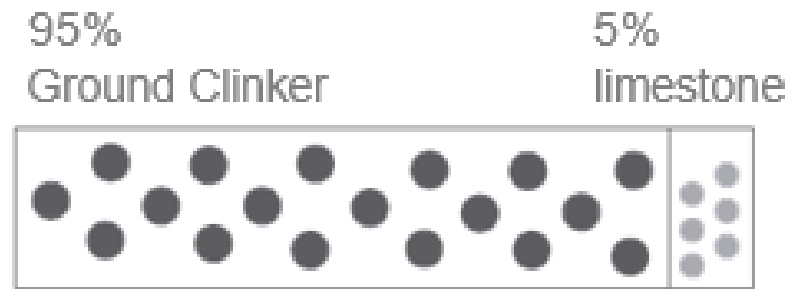
3000 psi mixture with no SCMs

Slide 11

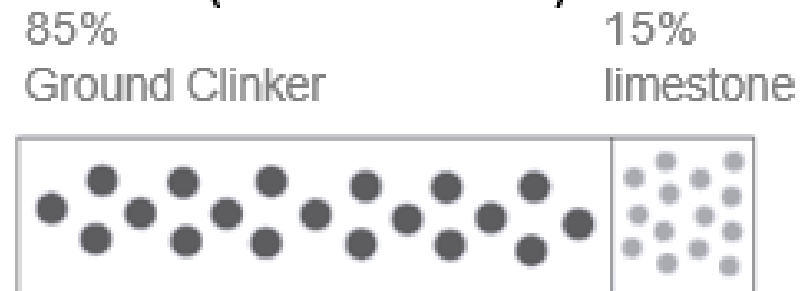


# Specify Portland Limestone Cement

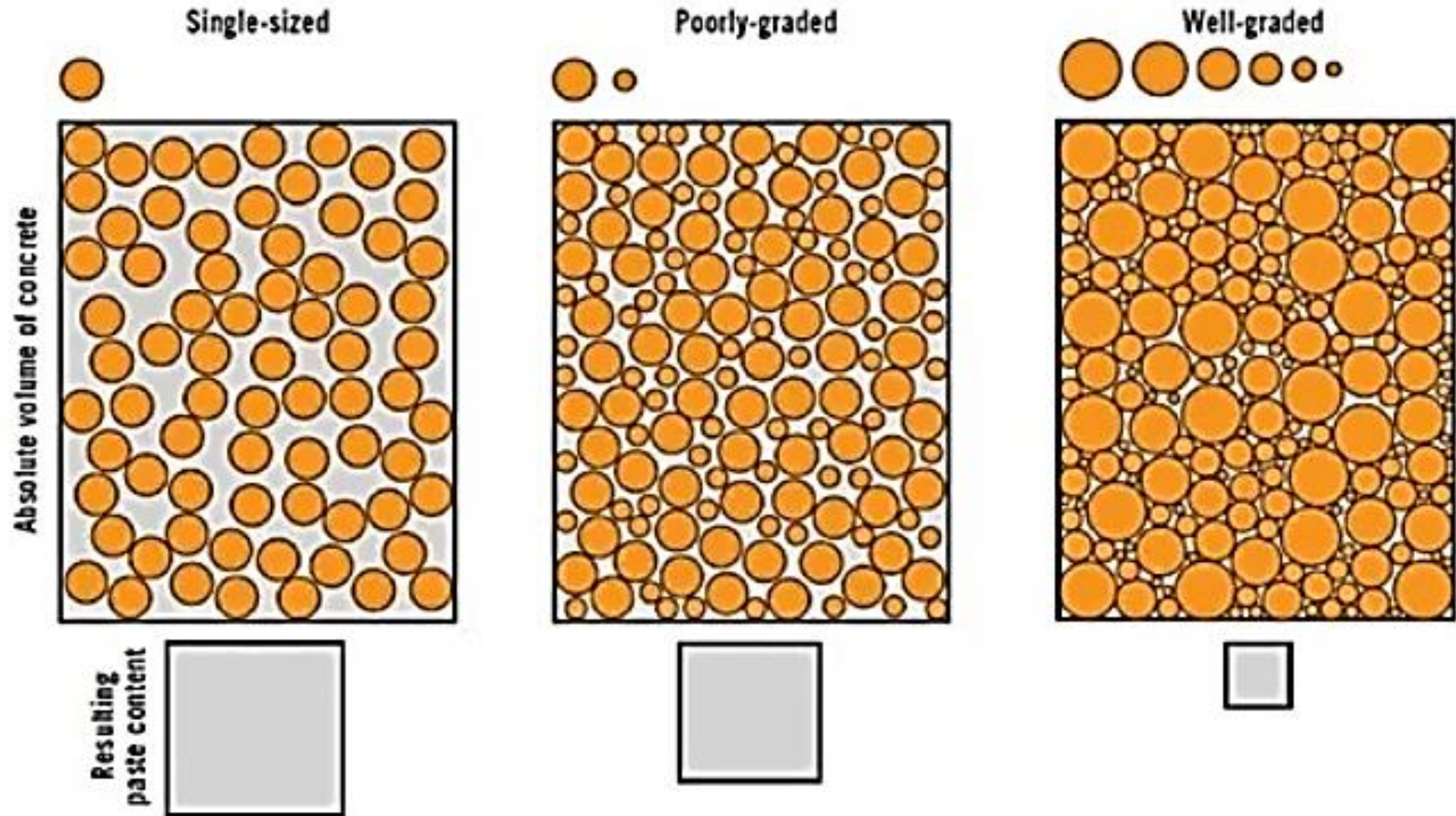
- Type I Portland Cement (ASTM C 150)



- Type II Portland Limestone Cement (ASTM C 595)



# Specify Well Graded Aggregate



# Add Supplementary Cementitious Materials (SCMs)



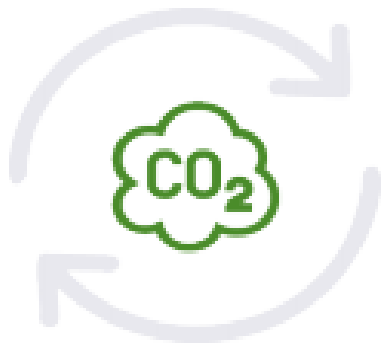
**Fly Ash** is a by-product of coal combustion—**reduced availability as coal plants are closed**



**Slag Cement** is a by-product of steel production. Slag Cement is ground granulated blast furnace slag—**reduced availability as steel production moves to Electric Arc Furnaces**. Even now some slag is imported from overseas.

# Evolve to use Recycled Materials

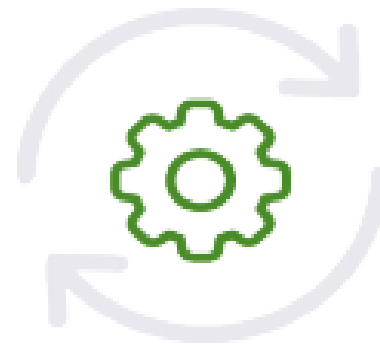
**Ground Glass Pozzolan** can be produced from 100% post-consumer glass, harvested and processed regionally.



**CO<sub>2</sub> Reduction**



**Improved Concrete**

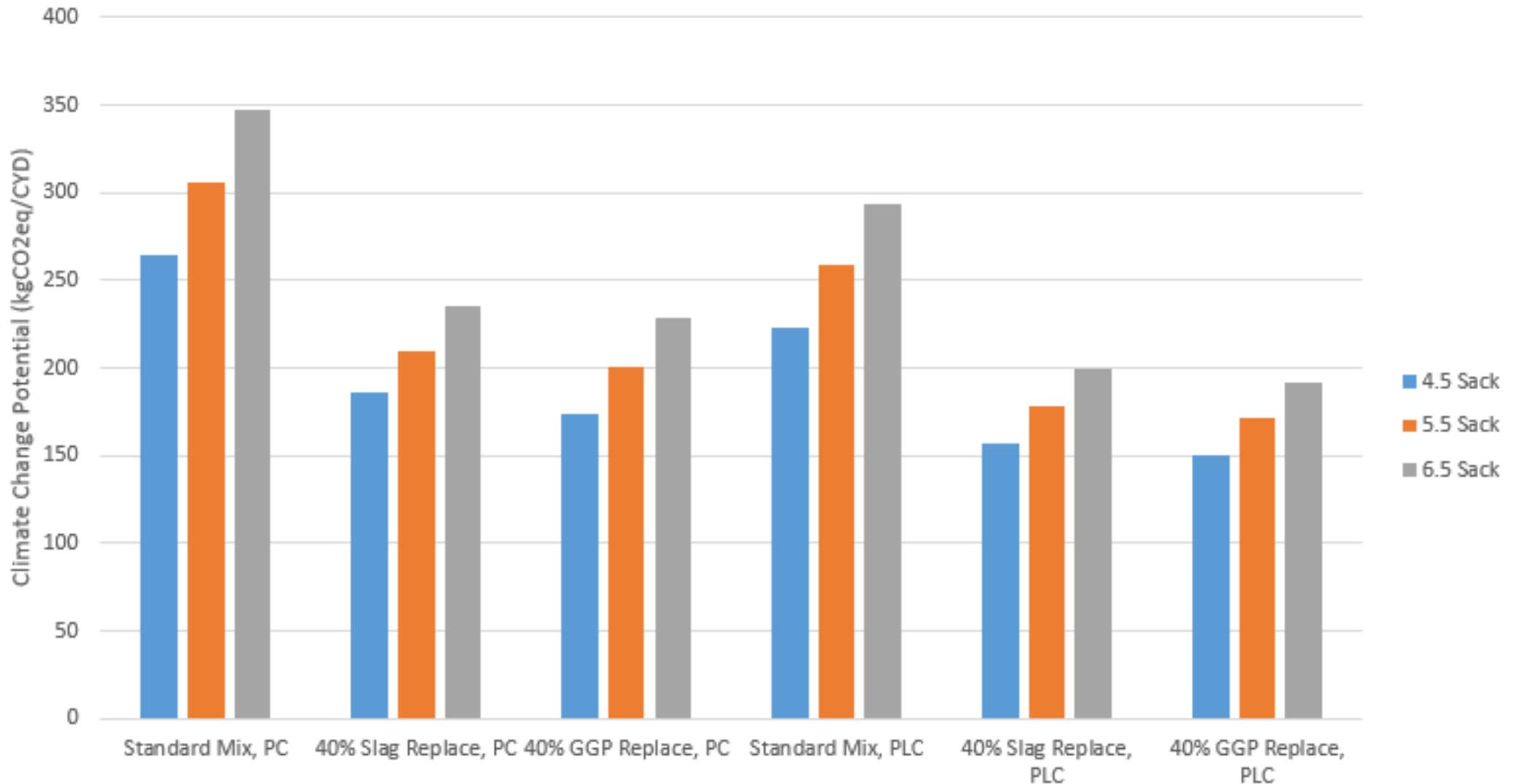


**Circular Economy**



**Safer Material**

# Embodied Carbon Projections for Mixes: 37% reduction now; 50% projected reduction



# LECC Pour at the Tri Delta Sorority (07/09/21)



# A LOT of savings

- Appx. 3000 CYD in a ten-story building
- 40% cement replacement would save this building **375000 kg CO<sub>2</sub>**
- Equivalent to a car circling the earth **38** times!
- Equivalent to powering a mid-sized city of **100,000** people for **11** hours!



VIEW FROM CORNER OF MAIN ST. & WILLIAM ST.



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# Resource Guide

Provide methods to calculate embodied emissions

- EPD collection (EC3)
- EPD creation (ZGF, Athena, Climate Earth)

Outline available and developing technologies and reduction techniques

- Cement Production (e.g. carbon capture)
- Concrete Production (e.g. SCMs, carbon curing, well-graded aggregates)
- Concrete Procurement (e.g. climate impact weighting)

Highlight local projects / research / contacts

Other local policies