

### **TN/AL/MS Tri-State Conference NRMCA Sustainability and Embodied Carbon Up** July 9<sup>th</sup>, 2022 e Poss leed ap bd+c, lfa irector, Sustainability Initiatives



### Agenda

- Introduction and Background
- How to Calculate Embodied Carbon
- Current Landscape of Embodied Carbon and Sustainability
- Reduction Challenges and Opportunities
- NRMCA Support
- Q&A

# Introduction



### Build with Strength | Codes and Standards



#### We must eliminate all GHG emissions from the built environment.

CO



### Embodied

Source: buildingtransparency.org

### Operational

CO2

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### Background

#### Annual Global CO<sub>2</sub> Emissions



 Embodied carbon from building materials and construction is 11% of annual global GHG emissions.

- Concrete, iron, and steel alone produce ~9% of annual global GHG emissions.
- Likely will need to build with more resilient materials like concrete
- How do we minimize environmental impacts?



## **Environmental Product Declaration (EPD)**

#### 3<sup>rd</sup> party verified & registered documents that communicate transparency

		Environmental Product Declaration		
ENVIRONMENTAL IMPACTS				
Declared Product:		Table 8: Impact Assessment results for ready mix concrete produced at Calportland's Live Oak Ready Mix Field		
Mix S62C/50011 • Invine Plant		Calculated Results A1-A3 per yd3 Calculated Results A1-A3 per yd3 Gwp ODP AP EP POCP PEC NRE RE NRM RM Cew Crist Mu Mu kg kg m3 m3 m3 kg kg		
		Indicator/LCI Meetic Access in kg C02 kg CFC-11 kg S02 kg N kg 03 in 1812.3 Mik Name PSI Days 258.73 6.34E-06 0.79 0.31 16.15 1812.3 POlaric Mac - 0.25 0.40 0.01 2.14		
Communication attraction 2500 DOL at 20 days		HGC20P8 000 28 268.25 6386.06 032 034 1791 2014 HYDOX0974 2500 28 292.19 6974.66 038 034 1791 2014 HYDOX0970 2500 28 292.19 6974.66 031 024 18.44 2066 Environmental Data Corporation		
Compressive strength: 3500 PSI at 28 days		HSGRWPA 2500 28 308.93 / Social 17.33 1995 Environmental Impacts		
<b>•</b> • • • • • • • • • • • • • • • • • •		18.87 21 Calle lo Cale (Al-A3) impet routs per 1 metric lan of product an		
<b>Declared Unit:</b> 1 m <sup>3</sup> of concrete		NATIONAL READT THIS 20 CONTROL OF THE 2 Cradie-Gate (A1-A3) impact Results for Association of Table 2 blow. ENRODEMENTA PRODUCT DECAMPTON NATIONAL READT 0.55 Inspect Association of Table 2 blow. ENRODEMENTA PRODUCT DECAMPTON 0.55 Inspect Association of Table 2 blow.		
		Mix security The Antidication (EPO) instants and an anti- and anti- anti- and anti- anti- and anti-		
Global Warming Potential (kg CO <sub>2</sub> -eq)	427	impacts for 1 m of ensolvements in the SECREMON 1 memory in the SECREMO		
Ozone Depletion Potential (kg CPC-TT-eq)	1. IE-0	ASTMUSE Advantage     Astmuster and a second and a s		
Acidification Potential (kg SO2-eg)	1 38	Coll-Window Participation Participa		
	1.50	COMPANY         Accord (accord (b)		
Eutrophication Potential (kg N-eq)	0.51	1062 V CA 014/06         Assist Capitation condition/ value         Internet Capital value         M/I         Lite         Lite           Encline, CA 014/06         Assist Capitation taskin(V)         3.66         hydrodectric and gendermail)         M/I         2.98         2.92         4.21		
Photochemical Ozone Creation Potential (kg $O_3$ -eq)	28.7	PLANI tal main many field to the second seco		
Abiotic Depletion, non-fossil (kg Sb-eq)	7.5E-5	Proc		
Abiotic Depletion, fossil (MJ)	681	OD Ball         Xg         O.03         Clip           Verific Conductoran PA (SLOS)		
Total Waste Disposed (kg)	3.66	04.08/2020 (valid for \$ years		
Consumption of Freshwater (m <sup>3</sup> )	3 16	SO 21500 2017 Subalterability in subarts of the international revolution of the internation of the international revolution of		
	5.10	Sub-campo y ***********************************		
Product Components: crushed accredate (ASTM	C33) natural	Third party verifier: Thomas V: Construction (Parkaneon) (Parkaneon (Parkaneon) (Parkaneon		
1 Todact Components: clushed aggregate (ASTM		Mandballer How CateboorCARTY States Software Took CateboorCARTY States LCA's EPD Developer: Climate Earth (sucport)Biolimatedea receive		
aggregate (ASTM C33), Portland cement (ASTM C150), a	admixture	INCOM.		
(ASTM C494), batch water (ASTM C1602)		HORE Constraint Oral Constrain		
		NATONAL MARY NX 9307 Works Board State 05 form (0.966		
		(pt) / 26 see		

# Drivers of Disclosure in Construction

- <u>Communication</u> and transparency tool between parties in any industry
- Objectively <u>quantify</u> a products environmental impact
- Science-based <u>verification</u> of claims with framework established for creation



# **Product-Specific EPD Process**



# **Reduced EPD Verification Fees**

#### **Verification (Certification) Fees:**

Level 1: NRMCA Verifier Fee for New Customers

Number of plants reported in LCA/EPD	NRMCA Members	Non-members
1 to 3 plants	\$1,250	\$2,000
4 to 10 plants	\$2,500	\$4,000
11 or more plants	Negotiated fee	Negotiated fee

Level 2: Additional Plants within 6 Months of Level 1 Verification

	NRMCA Members	Non-members
Hourly Rate	\$300/hour	\$450/hour

Level 3: New EPDs at Verified Plants or Changes to Existing EPDs

	NRMCA Members	Non-members
Hourly Rate	\$300/hour	\$450/hour

# How to Calculate Embodied Carbon



# **Crash Course in Embodied Carbon**



#### ENVIRONMENTAL IMPACTS

#### **Declared Product:**

Mix BAG05R20 • Centreville RM Plant Description: 3000 AP AE Compressive strength: 3000 PSI at 28 days

Declared Unit: 1 m<sup>3</sup> of concrete

Global Warming Potential (kg CO2-eq)	311
Ozone Depletion Potential (kg CFC-11-eq)	7.31E-6
Acidification Potential (kg SO2-eq)	0.93
Eutrophication Potential (kg N-eq)	0.38
Photochemical Ozone Creation Potential (kg $\mathrm{O}_{3}\text{-}\mathrm{eq})$	20.4
Abiotic Depletion, non-fossil (kg Sb-eq)	6.04E-5
Abiotic Depletion, fossil (MJ)	697
Total Waste Disposed (kg)	89.3
Consumption of Freshwater (m <sup>3</sup> )	3.43

Product Components: crushed aggregate (ASTM C33), natural aggregate (ASTM C33), Portland cement (ASTM C150), batch water (ASTM C1602), admixture (ASTM C494), admixture (ASTM C260)

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

### Material Quantity x GWP = EC $500m^3 \times 311 \text{ kgCO2e/m}^3 = 155,500 \text{ kgCO2e}$

GWP = Global Warming Potential EC= Embodied Carbon EC unit of measure = kgCO2e EPD = Environmental Product Declaration IW = Industry Wide PS = Product Specific

# LCA Software Tools

- WBLCA
  - Athena
  - Tally
  - One Click
- Embodied Carbon Calculators
  - EC3
- In-house SE embodied carbon tools
  - Beacon (Thornton Tomasetti)
  - Concrete LCA Tool (ZGF)



Athena Sustainable Materials Institute



# EC3 Database

State	# Product Specific EPDs in EC3	
California	21,148	
Colorado	651	
Alabama	142	
Connecticut	96	
Texas	95	
Mississippi	0	
Tennessee	0	

## Alabama Comparison



# **Current Landscape of** Sustainability and **Embodied Carbon**

Market Perspective



# Age of Transparency

- "Marketing in the age of transparency"
- Customers / influencers are investigating the risks from the products or companies
- Effort of making more informed and responsible decisions



### Market Outlook



### **The Biden-Harris Administration**



Administration

### Fact Sheet: Biden-Harris Administration Advances Cleaner Industrial Sector to Reduce Emissions and Reinvigorate American Manufacturing

FEBRUARY 15, 2022 • STATEMENTS AND RELEASES

New Pro-Climate, Pro-Worker Actions Create Jobs and Harness the Bipartisan Infrastructure Law, Federal Purchasing Power, and Trade Policy

Source: <u>https://www.whitehouse.gov/briefing-room/statements-releases/2022/02/15/fact-sheet-biden-harris-administration-advances-cleaner-industrial-sector-to-reduce-emissions-and-reinvigorate-american-manufacturing/</u>

### Federal Buy Clean – GSA, DOT, DOD

- GSA standard effective as of March 2022 for Concrete and Asphalt
  - GSA considering setting limits on additional materials
- GSA energy efficiency standard effective as of March 2022
- DOT and DOD likely to follow







## **GSA Embodied Carbon Limits for Concrete**

	Maximum Global Warming Potential Limits for GSA Low Embodied Carbon Concrete (kilograms of carbon dioxide equivalent per cubic meter - CO <sub>2</sub> e kg/m <sup>3</sup> )			
Specified compressive strength (f'c in PSI)	Standard Mix	High Early Strength	Lightweight	
up to 2499	242	326	462	
2500-3499	306	413	462	
3500-4499	346	466	501	
4500-5499	385	519	540	
5500-6499	404	546	N/A	
6500 and up	414	544	N/A	
These numbers reflect a 20% reduction from GWP (CO <sub>2</sub> e) limits in model code language: " <u>Lifecycle GHG Impacts in Building Codes</u> " by the New Buildings Institute, January 2022.				

## **State and Local Policy**

# CA, WA, MN, CO, IL, MA, MO **Buy Clean Bills** HI, NY, NJ, MD, LA Low CO<sub>2</sub> Concrete, Cement Marin, CA, Portland, OR Low CO<sub>2</sub> Concrete

C	03/01/19	REVISOR.	SGS/NB	19-4171
This Docume in alternative	nt can be made available formats upon request	State of Minnesota	a	
	HOUSI	E OF REPRESEN	NTATIVES	
	NINETY-FIRST SESSION		H. F. No	. 2204
03/07/2019	Authored by Hornstein and Ecklum The bill was read for the first time a	d nd referred to the Committee on Governmer	nt Operations	
1.1		A bill for an act		
1.2	relating to state govern	ment; requiring the commission	ner of administration to	adopt
1.3	a maximum acceptabl	on from certain successful bid	ders related to the stan	cts; dard:
1.5	requiring legislative re	ports; proposing coding for ne	w law in Minnesota St	atutes,
1.6	chapter 16C.			
1.7 BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF MINNESOTA:				
1.8 1.9 <b>1</b>	Section 1. [16C.0732] M POTENTIAL.	AXIMUM ACCEPTABLE (	GLOBAL WARMING	2
1.10	Subdivision 1. Definiti	ons. As used in this section, th	e terms in this subdivi	sion have
1.11 <u>t</u>	he meanings given.			
1.12	(1) "Agency" means an	agency as defined in section 16	B.01, subdivision 2, a	nd includes
1.13 <u>t</u>	he Board of Trustees of th	e Minnesota State Colleges an	d Universities and the	University
1.14	of Minnesota.			
1.15	(2) "Eligible material"	means any of the following:		
1.16	(i) carbon steel rebar;			
1.17	(ii) flat glass;			
1.18	(iii) mineral wool boar	d insulation; or		
1.19	(iv) structural steel.			

# What is responsible sourcing?

"Also referred to as supply chain responsibility, responsible sourcing is a voluntary commitment by companies to take into account social and environmental considerations when managing their relationships with suppliers."

Source: International Chamber of Commerce

# Demand for Responsible Sourcing

- Green Public Procurement Initiatives
  - More common in Europe and other parts of the world, but will likely become more prevalent in US
- AEC and Developer Community demonstrating increased demand for responsible sourced materials
  - Introduction of responsible sourcing specification language
- 3<sup>rd</sup> Party Green Rating Systems
  - LEED Responsible Sourcing and Social Equity in the Supply Chain Pilot Credit



### CSC-Certification for Responsibly Sourced Concrete CO<sub>2</sub> Module for Low Carbon Concrete Concrete Sustainability Council https://www.concretesustainabilitycouncil.com/



#### 

- P1 Ethical and Legal Compliance
- P2 Human Rights
- P3 Indigenous People Rights
- P4 Environmental and Social Impact
- P5 Traced Materials

#### e-e MANAGEMENT

- M1 Sustainable Purchasing
- M2 Environmental Management
- M3 Quality Management
- M4 Health & Safety Management
- M5 Benchmark

#### 🖆 ENVIRONMENTAL

- E1 Life Cycle Impact
- E2 Land Use
- E3 Energy & Climate
- E4 Air Quality
- E5 Water
- E6 Biodiversity
- E7 Secondary Materials
- E8 Transport
- E9 Secondary Fuels

#### SOCIAL

- S1 Local Community
- S2 Health Product Information
- S3 Occupational Health & Safety
- S4 Labor Practices

#### 差 ECONOMICS

- **B1** Local Economy
- **B2** Ethical Business
- **B3** Innovation
- B4 Feedback Procedure



C1 Cement C2 Aggregates

# Carbon Reduction Challenges and Opportunities



### The Concrete Industry's Response



# The Top 10 List

BUILD WITH STRENGTH

**Communicate Carbon Reduction** Goals **2.**Ensure Good Quality Control and Assurance **S**.Optimize Concrete Volume **4**-Use Alternative Cements **5**. Use Supplementary **Cementitious Materials** 

**6**.Use Admixtures **Don't Limit Ingredients 8**. Set Targets for Carbon Footprint **Sequester Carbon Dioxide in** Concrete **Encourage Innovation** 

### <u>Challenges</u>

### **Opportunities**

 Prescriptive Specifications

 Low carbon material availability and supply chain variability
 Codes and Standards Acceptance
 Customer Demand

- Market Differentiation
- Increased use of concrete vs. other materials
  - Value add to customers
     Reputation
     Versatile material ripe for
    - innovation



# How Can We Help You?

- EPD and CSC Certification Assistance
- Training for Staff
  - EPDs and Embodied Carbon 101
  - We Have EPDs, Now What?
- Specification Reviews and Design Assistance Center
- Policy and Advocacy Work
- Concrete Innovations Monthly Webinars
- General Consulting

# **Concrete Innovations**

Home

#### **CONCRETE INNOVATIONS**

Schedule Product Spotlights Awards Subscribe

#### LEARNING CENTER

Concrete Innovations Learning Center is designed to bring practitioners, researchers and policy makers together to exchange the latest innovations for sustainable concrete design, construction and manufacturing. <u>Schedule.</u>

#### CONTINUING EDUCATION

Each session of the Concrete Innovations Learning Center offers AIA Continuing Education and Professional Development Hours. Complete the form provided for each session to receive credits.

#### AWARD PROGRAM

The Concrete Innovations Award Program recognizes outstanding achievements in improving concrete performance and sustainability through improved products and processes. <u>More.</u>

#### SCHEDULE FOR UPCOMING SESSIONS

Tentative schedule. All time are shown in U.S. eastern time zone.

VIEW PREVIOUS SESSION ON-DEMAND

#### Concreteinnovations.com

Sponsorship Opportunities

#### PRINCIPAL SPONSORS







### **Build with Strength** GOAL: Increase Market Share from 23% to 30% by 2030 NRMCA + State Affiliates + Sustainability

### COMMUNICATE

- Greater Emphasis on Innovation
- More Paid Media
- More Social Media especially LinkedIn
- More Trade Shows
- More Sponsorships

### ADVOCATE

- Greater Emphasis on Sustainability Codes
- EPD / HPD / CSR
- Focus on Concrete Strengths
- Resilience, LCA, Innovation

#### PROMOTE

- Greater Emphasis on Education
- Focus on Value, Innovation, Resilience
- Sponsored Workshops (AIA/USGBC/SEA)
- More Online

#### CONNECT

- Large, Influential Owners, Specifiers
- Apartments, Hotels, Dormitories, Offices and Schools
- Change Specifications, Low-carbon Concrete, Innovative Cements

