The Evolving Services of the NRMCA Concrete Design Center

Expanding Consulting Services for:
Architects, Engineers,
Developers, and Contractors

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Agenda

Introduction:

Donn Thompson, AIA, LEED AP, BD+C

Senior Director, Building Innovations NRMCA

Summary of Services

Derek Torres

Project Manager, Concrete Promotion

Build with Strength Case Study – University of Kentucky

Brett Ruffing, LEED Green Associate

Executive Director, Kentucky Concrete Association

Pave Ahead Concrete Design Center

Luke McHugh, P.E.

Senior Director, Local Paving

Q & A

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Introduction

Donn Thompson

Senior Director, Building Innovations

NRMCA

Build with Strength Concrete Design Center

- Structural system recommendations
- First cost comparisons
- Operating cost comparison
- Design/construction collaboration

Build with Strength Concrete Design Center

- Structural system recommendations
- First cost comparisons
- Operating cost comparison
- Design/construction collaboration
- Specification review
- Carbon footprint

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Build with Strength Concrete Design Center

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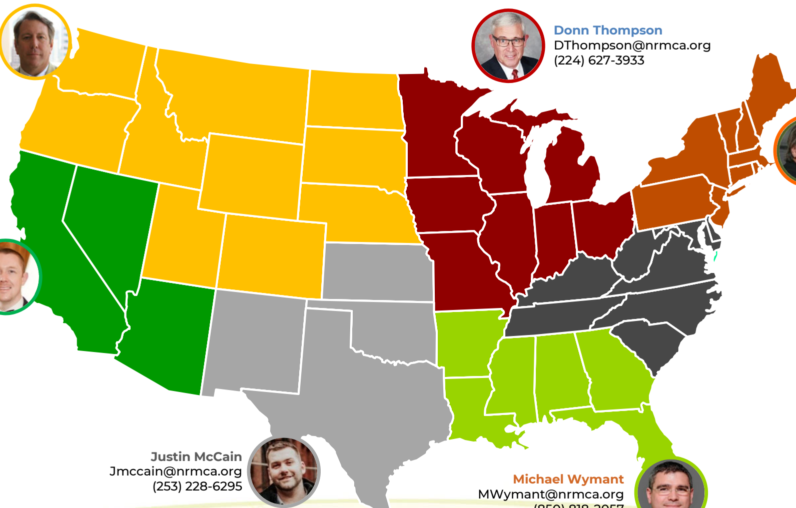

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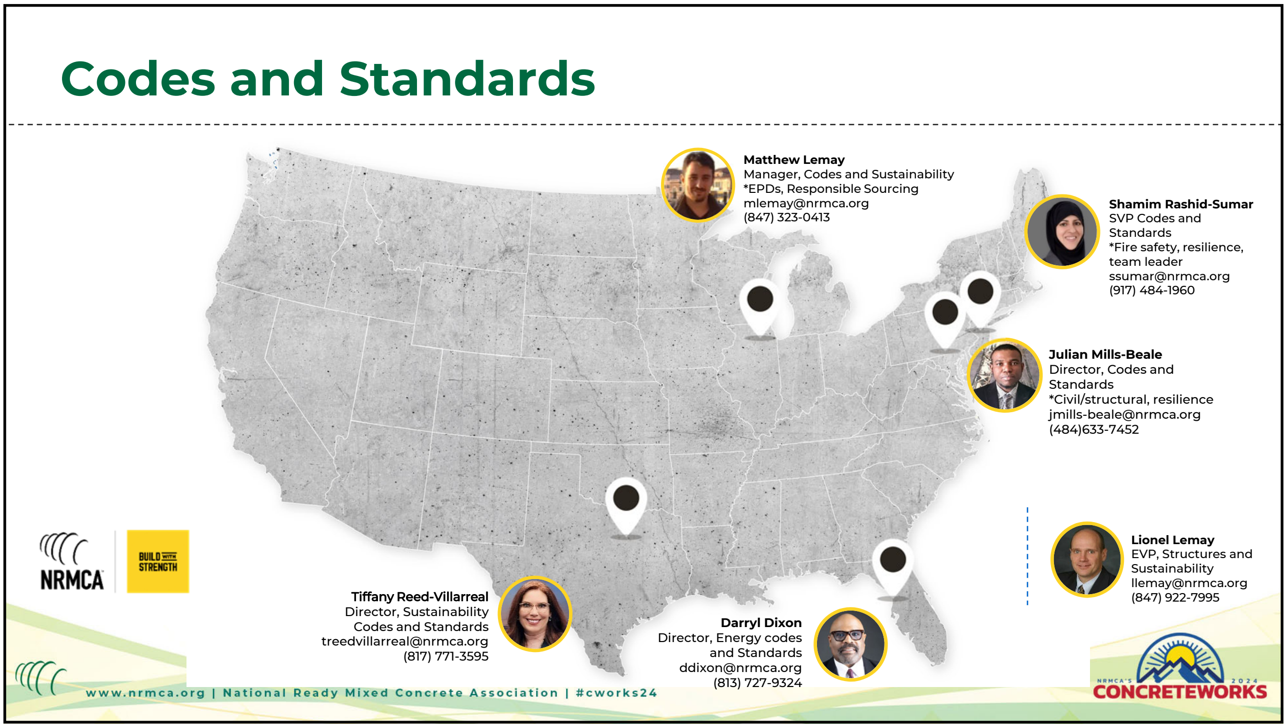
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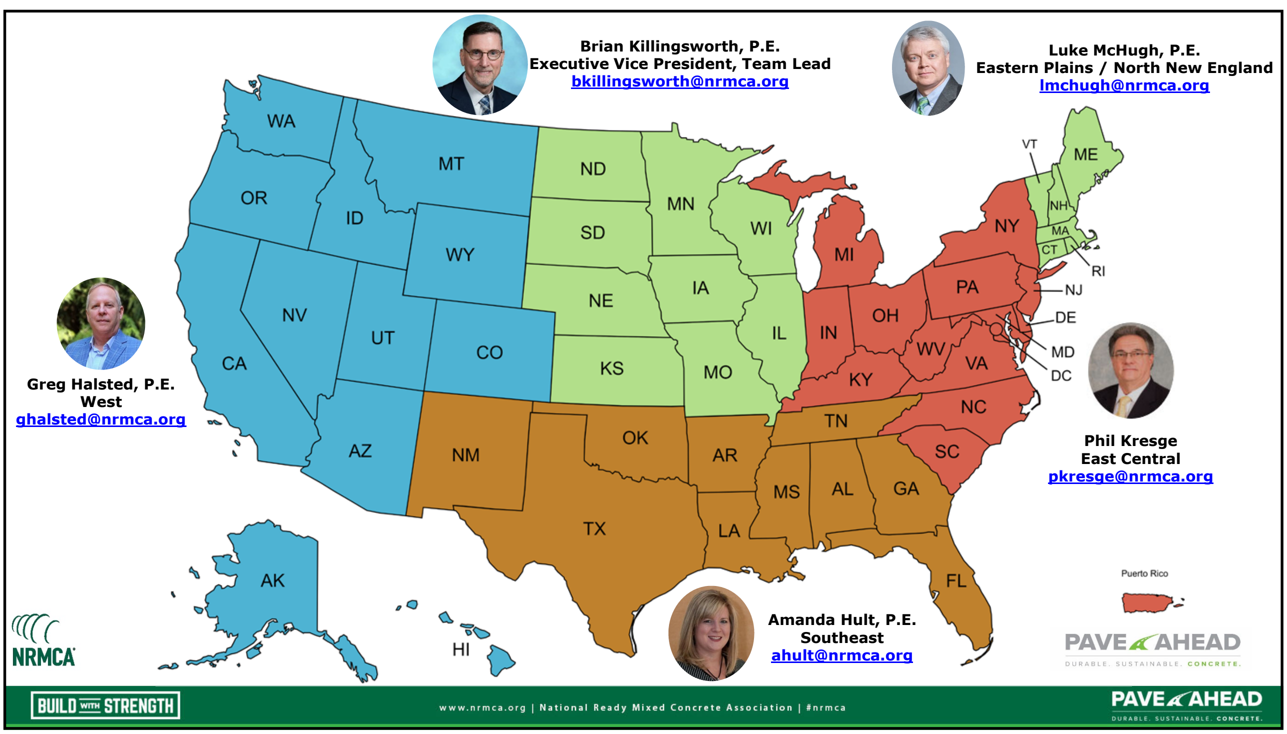
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MI IN OH KY WV VA NC SC PA NY NJ DE MD DC
TX OK AR LA MS AL GA TN FL
VT ME NH MA CT RI
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Summary of Services

Derek Torres

Project Manager, Concrete Promotion

NRMCA

Design Assistance Program

A free service offered by Build With Strength assisting project stakeholders, engineers, and architects to provide detailed estimates highlighting how to make their projects more cost-effective by integrating more concrete.

100,000-square-foot Apartment Building

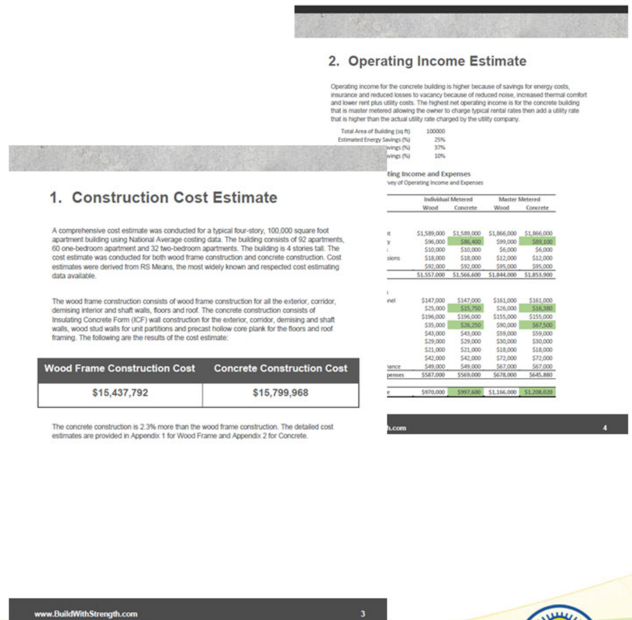
National Average

Design Assistance Program

Projects we work on

- Mid-level rise buildings
- Multifamily apartments
- Mixed-use buildings
- Warehouses
- Retails
- Hotels

https://www.concretetracker.org/



2. Operating Income Estimate

Operating income for the concrete building is higher because of savings for energy costs, insurance and reduced losses to vacancy because of reduced noise, increased thermal comfort and lower rent plus utility costs. The highest net operating income is for the concrete building that is master metered allowing the owner to charge typical rental rates then add a utility rate that is higher than the actual utility rate charged by the utility company.

1. Construction Cost Estimate

A comprehensive cost estimate was conducted for a typical four-story, 100,000 square foot apartment building using National Average costing data. The building consists of 92 apartments, 60 one-bedroom apartment and 32 two-bedroom apartments. The building is 4 stories tall. The cost estimate was conducted for both wood frame construction and concrete construction. Cost estimates were derived from RS Means, the most widely known and respected cost estimating data available.

The wood frame construction consists of wood frame construction for all the exterior, corridor, demising interior and shaft walls, floors and roof. The concrete construction consists of Insulating Concrete Form (ICF) wall construction for the exterior, corridor, demising and shaft walls, wood stud walls for unit partitions and precast hollow core plank for the floors and roof framing. The following are the results of the cost estimate:

Wood Frame Construction Cost	Concrete Construction Cost
$15,437,792	$15,799,968

The concrete construction is 2.3% more than the wood frame construction. The detailed cost estimates are provided in Appendix 1 for Wood Frame and Appendix 2 for Concrete.

www.BuildWithStrength.com 3

Design Assistance Program

Performance Based Specification Reviews

Another free service offered by Build With Strength where we review cast-in-place concrete specifications to provide feedback to promote more sustainable practices to achieve carbon neutrality.

NRMCA Publication 2PE004-21

Guide to Improving Specifications for Ready Mixed Concrete

With Notes on Reducing Embodied Carbon Footprint

2021

NRMCA

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NRMCA Publication 2PE004:

Guide to Improving Specifications for Ready Mixed Concrete

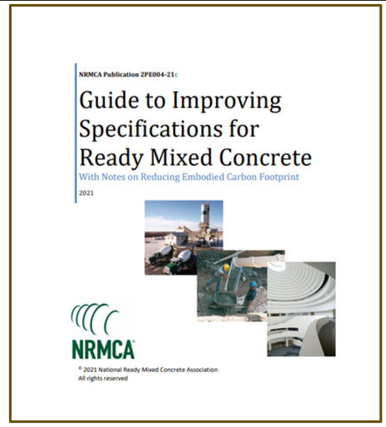
2021

SECTION 033000 – CAST-IN-PLACE CONCRETE

Design Assistance Program

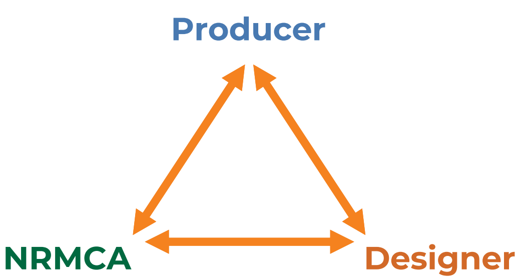
Performance Based Specification Reviews

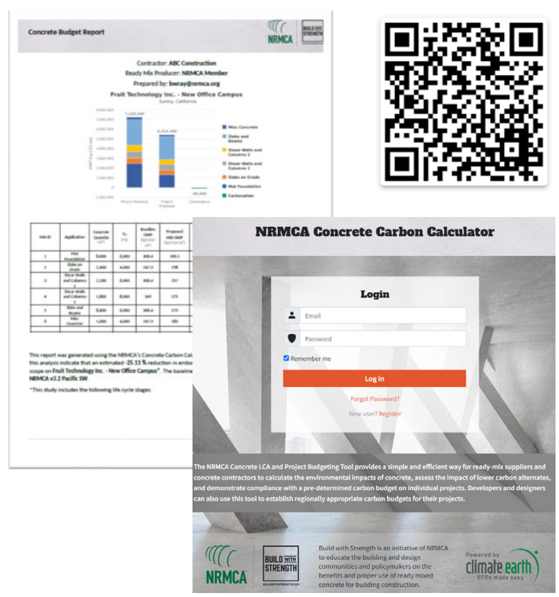
ASTM C94/C94M	ASTM D570
ASTM C494/C494M	ASTM C172/C172M
ASTM C1602/C1602M	ASTM C138/C138M
ASTM C979/C979M	ASTM C39/C39M
ASTM A820/A820M	ASTM C1059/C1059M
ASTM C1116/C1116M	ASTM C33/C33M
ASTM E1745	ASTM C260/C260M



Design Assistance Program

NRMCA Concrete Carbon Calculator





Access at **https://nrmca.climateearth.com/**

Build with Strength Case Study: University of Kentucky Health Education Building Lexington, KY

Brett Ruffing, LEED Green Associate

Executive Director

Kentucky Concrete Association

Project Details

Project Team:

Turner Construction – CM
Lithko – Concrete Contractor
Brown + Kubican – Structural Engineer
JRA Architects – Architect
Paladin KY – LEED Consultant
RM Producer – Harrod Concrete & Stone
Cement Supplier – Heidelberg Materials

\$380 million project & 500,000 ft^2 -
Largest building on campus other than UK Albert B. Chandler Hospital (1.1 million ft^2)

House programs for **colleges of Medicine, Public Health, Health Sciences, & Nursing; Center for Interprofessional & Community Health Education**

FOR UK Healthcare Video

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LEED Requirements

C. Cementitious Materials: Supplier shall coordinate surface treatment compatibility with cementitious materials. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. LEED Requirement: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
2. Fly Ash: 20 percent for Type F or 25% for Type C. Use of fly ash in concrete where incompatible with admixtures or other treatments is prohibited.
3. Combined Fly Ash and Pozzolan: 25 percent.
4. Slag Cement: 50 percent.
5. Combined Fly Ash or Pozzolan and Slag Cement: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
6. Silica Fume: 10 percent.
7. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
8. Combined Fly Ash or Pozzolans, Slag Cement, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.

Mix designs submitted for this project were the same mixes & same mix requirements that were utilized (and approved by same structural engineer) for Commonwealth Stadium project a couple years earlier

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NRMCA'S 2024 CONCRETEWORKS

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Mix Designs

***LEED requirements of prior LEED versions & reference Type I/II cement & not Type IL (95+% of KY market)**

BK REVIEW NOTES:

REVISE AND RESUBMIT MIX DESIGNS TO MEET LEED REQUIREMENTS: REDUCE THE TOTAL AMOUNT OF PORTLAND CEMENT BY NOT LESS THAN 40% (SPEC 033000 2.4 PART B).
SEE SPEC 033000 SECTION 2.8 PART C, #4, #5, AND #8 FOR ACCEPTABLE PORTLAND CEMENT SUBSTITUTES AND PERCENTAGE LIMITS.

RESUBMIT STRENGTH TEST DATA FOR LEED MIX DESIGNS.

INCLUDE MATERIAL CERTIFICATIONS FOR SLAG CEMENT, AND/OR POZZOLAN, AND/OR SILICA FUME.

INCLUDE EPD REPORTS FOR EACH MIX DESIGN. SEE SPEC 033000 SECTION 1.4 PART B, #1.

FINISHEASE-NC WAS SUBMITTED AS PRODUCT DATA BUT WAS NOT LISTED UNDER ANY MIX DESIGNS. INCLUDE IN THE MIX DESIGNS ALL ADMIXTURES TO BE USED AND THE CORRESPONDING DATA SHEETS FOR THOSE ADMIXTURES.

(ALL MIX DESIGNS SUBMITTED IN THIS SUBMITTAL ARE REJECTED.)

LEED Requirement

INGREDIENTS	PERCENT	SSD WTS.	CUBIC FEET
CEMENT	82%	464 LBS.	2.36
FLYASH	18%	100 LBS.	0.64
SILICA FUME	0%	LBS.	0.00
COARSE #1	56.00%	1839 LBS.	10.88
COARSE #2	0.00%	0 LBS.	0.00
LIME SAND	0.00%	0 LBS.	0.00
NATURAL SAND	44.00%	1402 LBS.	8.55
WATER		30.5 GALLONS	4.07
AIR		1.8 PERCENT	0.49
LC500		3.0 OZS./CWT.	0.02
LC-400R		OZS./CWT.	0.00
FINISHEASE		OZS./CWT.	0.00
SUPERFLO 2000RM		OZS./CWT.	0.00
FASTSET 100HE		OZS./CWT.	0.00
LCNC-166		OZS./CWT.	0.00
RUSSTECH RCI		OZS./CWT.	0.00

MOISTURE CONTENTS	PERCENT	YIELD	
COARSE #1	1.00	UNIT WIEGHT	150.36
COARSE #2	1.00	CU. FT./YARD	27.00
NATURAL SAND	5.00		
LIME SAND	0.00		

0.00 Cubic Feet

SPECIFIC GRAVITIES		BATCH WEIGHTS	TRIAL BTCH WTS.
CEMENT	3.15	464 LBS.	0.0 lbs.
FLYASH	2.50	100 LBS.	0.0 lbs.
SILICA FUME	2.20	0 LBS.	0.0 lbs.
COARSE #1	2.71	1858 LBS.	0.0 lbs.
COARSE #2		0 LBS.	0.0 lbs.
NATURAL SAND	2.63	1473 LBS.	0.0 lbs.
LIME SAND		0 LBS.	0.0 lbs.
WATER		19.9 GALLONS	0.0 lbs.
AIR (ESTIMATED STARTING DOSAGE)		0.00 OZS./YD.	0.0 mL
LC500		16.92 OZS./YD.	0.0 mL
LC-400R		0.00 OZS./YD.	0.0 mL
FINISHEASE		0.00 OZS./YD.	0.0 mL
SUPERFLO 2000RM		0.00 OZS./YD.	0.0 mL
FASTSET 100HE		0.00 OZS./YD.	0.0 mL
LCNC-166		0.00 OZS./YD.	0.0 ounces
RUSSTECH RCI		0.00 OZS./YD.	0.0 ounces

WATER/CEMENTITIOUS RATIO 0.450

Build With Strength Involvement

Process:

***trying to urge not requiring use of silica fume in all concrete mixes & to utilize current LEED documents**

1. Harrod Concrete & Stone (& Heidelberg Materials) solicited assistance of KCA & Brett's LEED knowledge
2. Not enough for Brown + Kubican
3. KCA solicited advise from NRMCA's Colin Lobo & Lionel Lemay
4. Colin & Lionel's responses not satisfactory
6. Donn Thompson reached out to KCA offering assistance from BWS Design Center – gladly accepted!
7. Virtual meeting held with all project partners, KCA & BWS
8. FINALLY! Paladin & Brown + Kubican understood!

Heidelberg Materials

Environmental Product Declaration (EPD) for Cement

GENERAL INFORMATION

This cradle to gate Environmental Product Declaration covers five cement products produced at the Mitchell, IN Cement Plant. The Life Cycle Assessment (LCA) was prepared in conformity with ISO 21930, ISO 14025, ISO 14040, and ISO 14044. This EPD is intended for business-to-business (B-to-B) audiences.

Heidelberg Materials
Mitchell Cement Plant and Terminal
200 Mill Creek Rd.
Mitchell, IN 47446

NRMCA CERTIFIED EPD

PROGRAM OPERATOR
National Ready Mixed Concrete Association
66 Canal Center Plaza, Suite 250
Alexandria, VA 22314
https://www.nrmca.org/

NRMCA EPD: 20144

Environmental Impacts
Mitchell Plant: Product-Specific Type III EPD
Declared Cement Products (five): Type IL; Type III; Masonry Type M; Masonry Type N; Masonry Type S
Declared Unit: One metric tonne of cement

	Type IL	Type III	Masonry Type M	Masonry Type N	Masonry Type S
Global Warming Potential (kg CO_2-eq)	798	842	554	413	498
Ozone Depletion Potential (kg CFC-11-eq)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Eutrophication Potential (kg N-eq)	0.84	0.86	0.75	0.70	0.72
Acidification Potential (kg SO_2-eq)	1.66	1.75	1.24	0.99	1.14
Photochemical Ozone Creation Potential (kg O_3-eq)	19.47	20.31	14.36	11.48	13.21
Abiotic Depletion, nonfossil (kg Sb-eq)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Abiotic Depletion, fossil (MJ, NCV)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Product Components:					
Clinker	88%	93%	57%	40%	51%
Limestone, Gypsum and Others	12%	7%	43%	60%	49%

Additional details and impacts are reported on page 5 and 6.

DATE OF ISSUE
May 17, 2024 - this is a 6 month version (valid for only 1 year or until the a 12 month version is developed May 17, 2025)

ISO 21930:2017 Sustainability in Building Construction-Environmental Declaration of Building Products: serves as the core PCR NSF PCR for Portland, Blended, Masonry, Mortar, and Plastic (Stucco) Cements V3.2: serves as the sub-category PCR
Sub-category PCR review was conducted by Thomas P. Gloria, PhD. (t.gloria@industrial-ecology.com) • Industrial Ecology Consultants
Independent verification of the declaration, according to ISO 21930:2017 and ISO 14025:2006.: ☐ internal ☑ external
Third party verifier • Denice Viktoria Staaf • Labelling Sustainability
For additional explanatory material Manufacture Representative: Jeff Hook (jeff.hook@heidelbergmaterials.com) This EPD was prepared using the pre-verified GCCA Tool by: Athena Sustainable Materials Institute
EPDs are comparable only if they comply with ISO 21930 (2017), use the same, sub-category PCR where applicable, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works.

Concrete Budget Report

NRMCA | BUILD WITH STRENGTH

Contractor: **Lithko Contracting, Inc.**
Ready Mix Producer: **Herrod Concrete**
Prepared by:

Mix ID	Application	Concrete Quantity (yd³)	f'c (PSI)	Proposed MIX GWP (kgCO2e/yd³)	Project GWP Budget (kgCO2e/project)	Total Project Proposed GWP (kgCO2e/project)	Difference from Project Budget
UKHEB - Type 2	Basement Int. Walls/Columns/Piers	1	4000	229.1		229.1	
					293.3	229.1	-21.9%

This report was generated using the NRMCA's Concrete Carbon Calculator, powered by Climate Earth. The results of this analysis indicate that an estimated **-21.9%** reduction in embodied carbon could be achieved for the concrete scope on **UKHEB Comparison GWP UKHEB - Type 2 4000 psi Mix***.

*This study includes the following life cycle stages.

PRODUCTION Stage (Mandatory)			CONSTRUCTION Stage		USE Stage					END-OF-LIFE Stage				BENEFITS BEYOND SYSTEM BOUNDARY
Extraction and upstream production	Transport to factory	Manufacturing	Transport to site	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	De-construction/ Demolition	Transport to waste processing or disposal	Waste processing	Disposal of waste	Reuse, Recovery, Recycling Potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4	D
X	X	X	-	-	-	-	-	-	-	-	-	-	-	-

NRMCA's 2024 CONCRETEWORKS

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Results:

INGREDIENTS	PERCENT	SSD WTS.	CUBIC FEET
CEMENT	80%	450 LBS.	2.29
FLYASH	20%	114 LBS.	0.73
SILICA FUME	0%	LBS.	0.00
COARSE #1	56.00%	1841 LBS.	10.89
COARSE #2	0.00%	0 LBS.	0.00
LIME SAND	0.00%	0 LBS.	0.00
NATURAL SAND	44.00%	1404 LBS.	8.55
WATER		30.0 GALLONS	4.00
AIR		1.8 PERCENT	0.49
LC500		OZS./CWT.	0.00
LC-400R		OZS./CWT.	0.00
FINISHEASE		OZS./CWT.	0.00
SUPERFLO 2000RM		8.0 OZS./CWT.	0.05
FASTSET 100HE		OZS./CWT.	0.00
LCNC-166		OZS./CWT.	0.00
RUSSTECH RCI		OZS./CWT.	0.00

MOISTURE CONTENTS	PERCENT	YIELD	
COARSE #1	1.00	UNIT WIEGHT	150.31
COARSE #2	1.00	CU. FT./YARD	27.00
NATURAL SAND	5.00		
LIME SAND	0.00		

0.00 Cubic Feet

SPECIFIC GRAVITIES		BATCH WEIGHTS	TRIAL BTCH WTS.
CEMENT	3.15	450 LBS.	0.0 lbs.
FLYASH	2.50	114 LBS.	0.0 lbs.
SILICA FUME	2.20	0 LBS.	0.0 lbs.
COARSE #1	2.71	1859 LBS.	0.0 lbs.
COARSE #2		0 LBS.	0.0 lbs.
NATURAL SAND	2.63	1474 LBS.	0.0 lbs.
LIME SAND		0 LBS.	0.0 lbs.
WATER		19.4 GALLONS	0.0 lbs.
AIR (ESTIMATED STARTING DOSAGE)		0.00 OZS./YD.	0.0 mL
LC500		0.00 OZS./YD.	0.0 mL
LC-400R		0.00 OZS./YD.	0.0 mL
FINISHEASE		0.00 OZS./YD.	0.0 mL
SUPERFLO 2000RM		45.12 OZS./YD.	0.0 mL
FASTSET 100HE		0.00 OZS./YD.	0.0 mL
LCNC-166		0.00 OZS./YD.	0.0 ounces
RUSSTECH RCI		0.00 OZS./YD.	0.0 ounces

WATER/CEMENTITIOUS RATIO 0.443

BUILD WITH STRENGTH:

Utilizing Donn's knowledge and the NRMCA Carbon Calculator to document GWP for proposed mix designs. This demonstrated that by utilizing Type IL cement & flyash, carbon reduction goals were met.

CONTRACTOR:

By not requiring use of silica fume in all concrete mixes, **contractor saved over $100,000 in costs!**

Contractor hadn't considered in their bid price the cost of silica fume & additional admixtures needed to get the concrete to work as intended (slabs, foundations, equipment bases, columns, etc.)

Contractor also didn't consider the additional work needed to finish the concrete – labor, water cure, etc.

RM PRODUCER (Harrod Concrete & Stone):

Brent Hourigan – brenth@harrodconcrete.com; 859-338-8331

Extremely appreciative of the support that Heidelberg Materials provided.

Can't thank Donn & BWS enough for this assistance!

"Assistance from Donn on this project justified their membership with NRMCA just on this one project."

NRMCA's 2024 CONCRETEWORKS

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Evolving Services of the NRMCA Concrete Design Center

Pavements

Presented by
Luke McHugh, PE
Senior Director Local Paving

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Asphalt to Concrete

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CONCRETEWORKS

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Local Roads & Parking Lots

Source: L. McHugh

Source: L. McHugh

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PavementDesigner.org

Recommended for Optimization

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Alternative Pavement Designs

- Replace or bid both asphalt and concrete pavement sections.
- Request credit for reduced excavation and any subgrade improvements.
- Allow owner to make an informed decision on pavement type.
- Sustainable and more environmentally friendly paving product

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Resilience & Sustainability

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Pavement Sustainability - Definition

Refers to system characteristics that encompasses a pavement's ability to:

1. achieve the engineering goals for which it was constructed,
2. preserve and (ideally) restore surrounding ecosystems,
3. use **financial**, **human (social)**, and **environmental** resources economically, and
4. meet basic human needs such as health, safety, equity, employment, comfort, and happiness.

Source: FHWA-HIF-15-002, Towards Sustainable Pavement Systems: A Reference Document, January 2015

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Pavement Sustainability Considerations

- **greenhouse gas (GHG) emissions**
- energy consumption
- impacts on habitat
- water quality
- changes in the hydrologic cycle
- air quality
- mobility
- access
- freight
- community
- depletion of non-renewable resources
- economic development

FHWA-HIF-15-002, Towards Sustainable Pavement Systems: A Reference Document, January 2015

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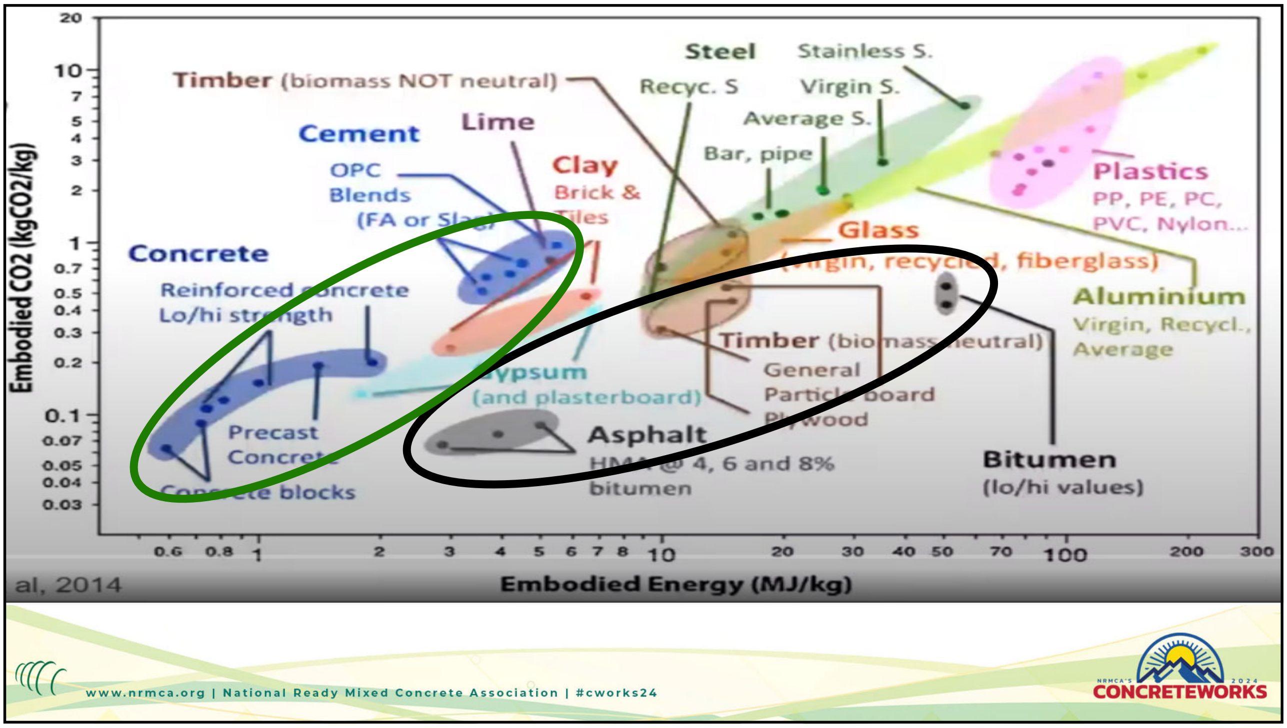
Embodied CO2 (kgCO2/kg)
Embodied Energy (MJ/kg)
al, 2014
Timber (biomass NOT neutral)
Steel
Stainless S.
Recyc. S
Virgin S.
Average S.
Bar, pipe
Cement
OPC
Blends
Lime
Clay
Brick &
Plastics
PP, PE, PC,
PVC, Nylon...
Glass
Aluminium
Virgin, Recycl.,
Average
Concrete
Lo/hi strength
Precast
(and plasterboard)
Timber
General
Asphalt
bitumen
Bitumen
(lo/hi values)
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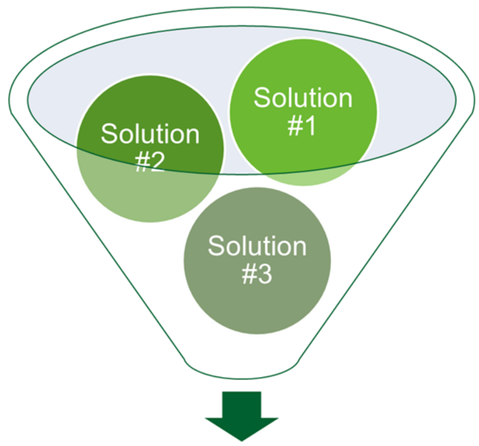
A Combination of Solutions Required to Reach the Goal



Greener Pavements

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The Top 10 Ways to Reduce Concrete's Carbon Footprint

- Communicate Carbon Reduction Goals
- Ensure Good Quality Control and Assurance
- Optimize Concrete Design
- Specify Innovative Cements
- Specify Supplementary Cementitious Materials
- Specify Admixtures
- Don't Limit Ingredients
- Set Targets for Carbon Footprint
- Sequester Carbon Dioxide in Concrete
- Encourage Innovation

Webinar: buildwithstrength.com/education/

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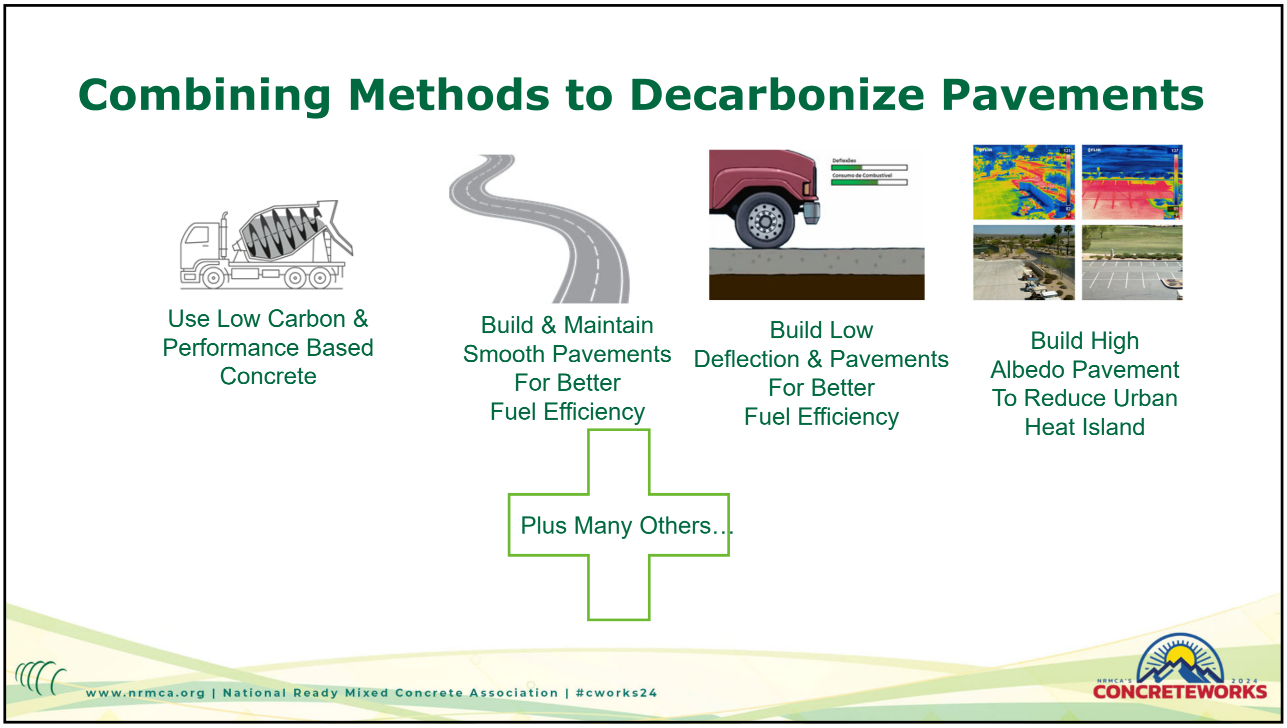
Combining Methods to Decarbonize Pavements
Use Low Carbon & Performance Based Concrete
Build & Maintain Smooth Pavements For Better Fuel Efficiency
Build Low Deflection & Pavements For Better Fuel Efficiency
Build High Albedo Pavement To Reduce Urban Heat Island
Plus Many Others...
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CONCRETEWORKS

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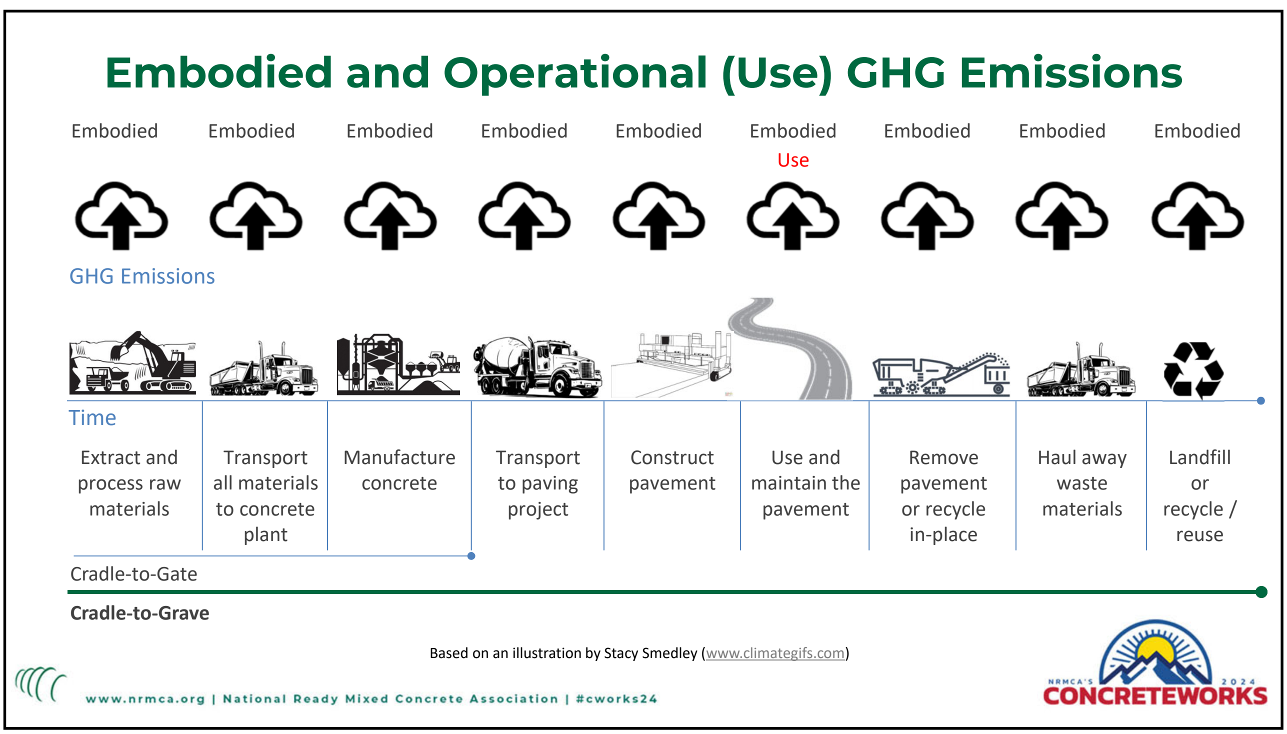
Embodied and Operational (Use) GHG Emissions
Embodied
Embodied
Embodied
Embodied
Embodied
Embodied
Use
Embodied
Embodied
Embodied
GHG Emissions
Time
Extract and process raw materials
Transport all materials to concrete plant
Manufacture concrete
Transport to paving project
Construct pavement
Use and maintain the pavement
Remove pavement or recycle in-place
Haul away waste materials
Landfill or recycle / reuse
Cradle-to-Gate
Cradle-to-Grave
Based on an illustration by Stacy Smedley (www.climategifs.com)
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EPDs Start the Process

- Just the start
- Incomplete story
- Material production GWP
- Does not consider use
- Requires broader messaging
- Correct messaging

ENVIRONMENTAL IMPACTS

Declared Product:
Mix 6113021 • Yard 32 Plant
Description: 14000psi @ 56 days NA HRWR
Compressive strength: 14000 PSI at 56 days

Declared Unit: 1 m^3 of concrete

Global Warming Potential (kg CO_2-eq)	537
Ozone Depletion Potential (kg CFC-11-eq)	1.21E-5
Acidification Potential (kg SO_2-eq)	1.48
Eutrophication Potential (kg N-eq)	0.63
Photochemical Ozone Creation Potential (kg O_3-eq)	29.6
Abiotic Depletion, non-fossil (kg Sb-eq)	2.96E-4
Abiotic Depletion, fossil (MJ)	1,238
Total Waste Disposed (kg)	158
Consumption of Freshwater (m^3)	3.81

Product Components: crushed aggregate (ASTM C33), Portland cement (ASTM C150), admixture (ASTM C494), fly ash (ASTM C618), silica fume (ASTM C1240), batch water (ASTM C1602)

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

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EV v. ICE

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NRMCA'S 2024 CONCRETEWORKS

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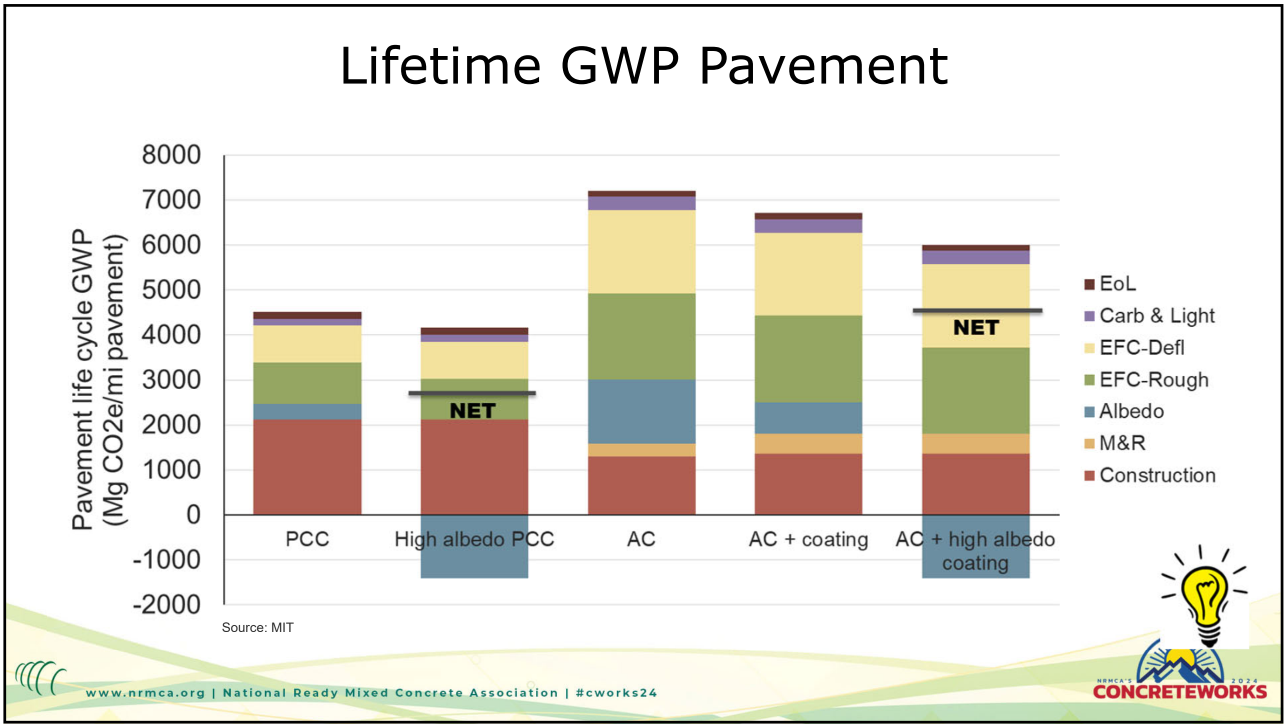
Lifetime GWP Pavement
Pavement life cycle GWP (Mg CO2e/mi pavement)
8000
7000
6000
5000
4000
3000
2000
1000
0
-1000
-2000
PCC
High albedo PCC
AC
AC + coating
AC + high albedo coating
NET
NET
EoL
Carb & Light
EFC-Defl
EFC-Rough
Albedo
M&R
Construction
Source: MIT
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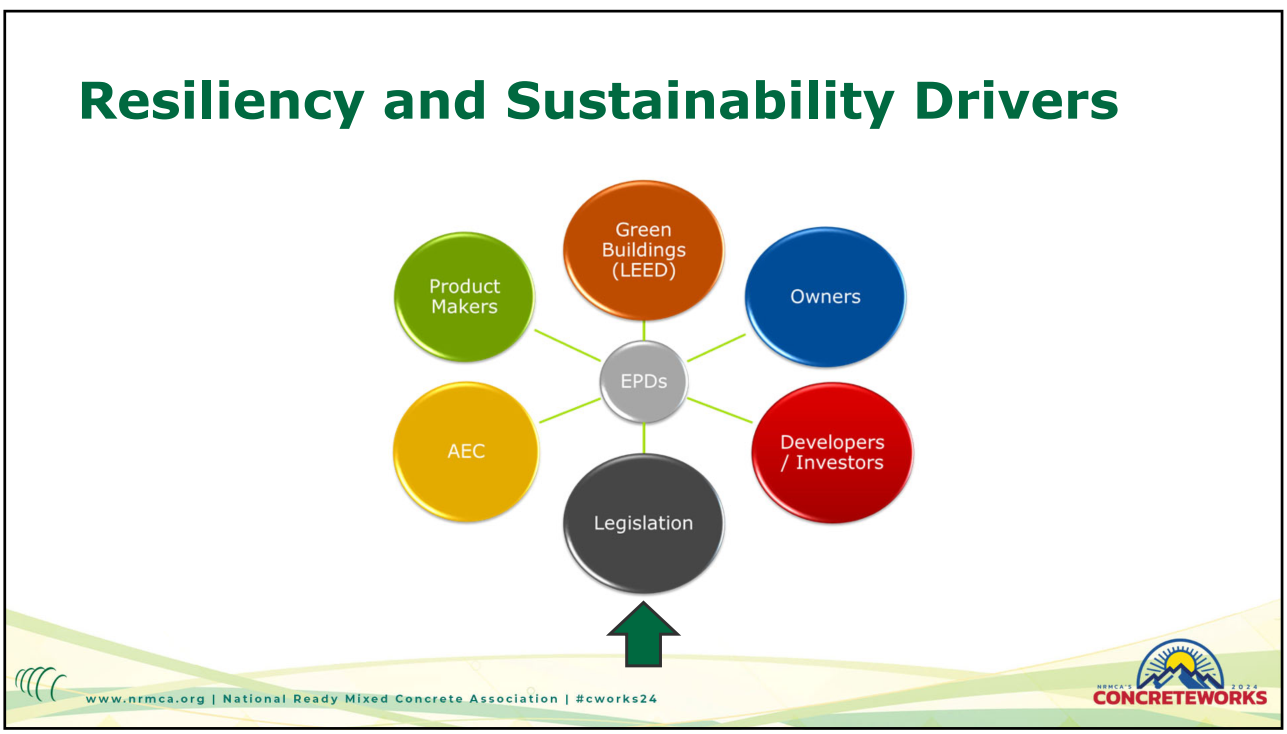
Resiliency and Sustainability Drivers
Green Buildings (LEED)
Product Makers
Owners
EPDs
AEC
Developers / Investors
Legislation
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H.R.3684 - Infrastructure Investment and Jobs Act (2021)

- **Water:** Deliver clean water to all American families and eliminate the nation's lead service lines.
- **Roads & Bridges:** Repair and rebuild our roads and bridges with a focus on climate change mitigation, resilience, equity, and safety.
- **Transit:** Improve transportation options and reduce greenhouse emissions through investment in public transit.
- **Airports & Ports:** Upgrade airports and ports to improve competitiveness, create more and better jobs at these hubs, and reduce emissions.
- **Rail:** Invest in passenger rail to create safe, efficient, and climate-friendly alternatives for moving people and freight.
- **Electric Vehicles:** Build a national network of electric vehicle (EV) chargers.
- **Power:** Upgrade power infrastructure to deliver clean, reliable energy and deploy cutting-edge energy technology to achieve a zero-emissions future.
- **Resiliency:** Make our infrastructure resilient against the impacts of climate change, cyber-attacks, and extreme weather events.
- **Pollution:** Tackle legacy pollution by cleaning up Superfund and brownfield sites, reclaiming abandoned mines, and capping orphaned oil and gas wells.

Source: The White House (Nov 6, 2021) - https://www.whitehouse.gov/briefing-room/statements-releases/2021/11/06/fact-sheet-the-bipartisan-infrastructure-deal/

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Saving on Carbon Emissions with Concrete

Assuming a 1:1 relationship between Cement and CO2 savings

1. Use of SCMs (fly ash and slag)	up to 80% cement reduction
2. CarbonCure	up to 7%
3. Admixtures	up to 8%
4. Portland Limestone Cement (PLC)	additional 10%
5. Fuel Savings	see next slide

Source: Carboncure

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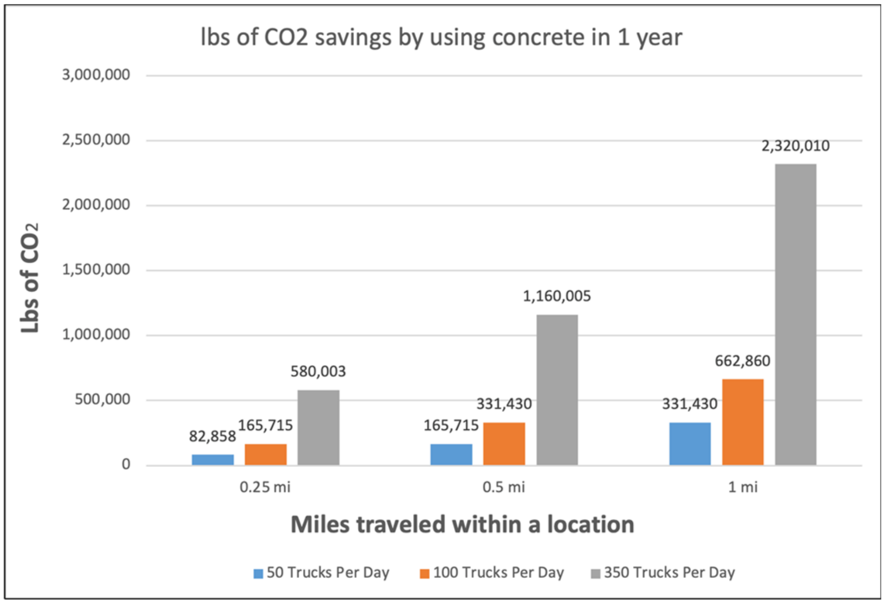

savings based on assumed 262 working days in the year

sources: EPA & MIT

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SWOT Concrete Pavements

STRENGTHS
- Durable
- Low Maintenance
- Heat Island Mitigation
- Reflectivity (Safety)
- Carbon Sink
- Sustainable

WEAKNESSES
- Cost / Funding – Short term strategy
- Perception
- Cement is a dirty word
- Product Category Rules (PCR)
- Cradle-to-Gate

OPPORTUNITIES
- Sustainability / Cradle-to-Grave
- Use phase
- Education – design, construction, maintenance
- Climate change
- Earn trust /time

THREATS
- Ignorance/Apathy
- Overdesign
- Politics
- Poor construction / premature failures

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Summary & Key Take-Aways

- The cement and concrete industries worldwide are committed to combat climate change, but we cannot do it ourselves
- There are a variety of levers in-use and immediately available to lower concrete's CO_2 emissions
- The emissions of the pavement system are the most important
- Results from a full life cycle perspective should drive decisions

The Evolving Services of the NRMCA Concrete Design Center

Questions?

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