

# The Concrete Industry's Perspective on Public Procurement of Low Carbon Construction Materials

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Executive Vice President

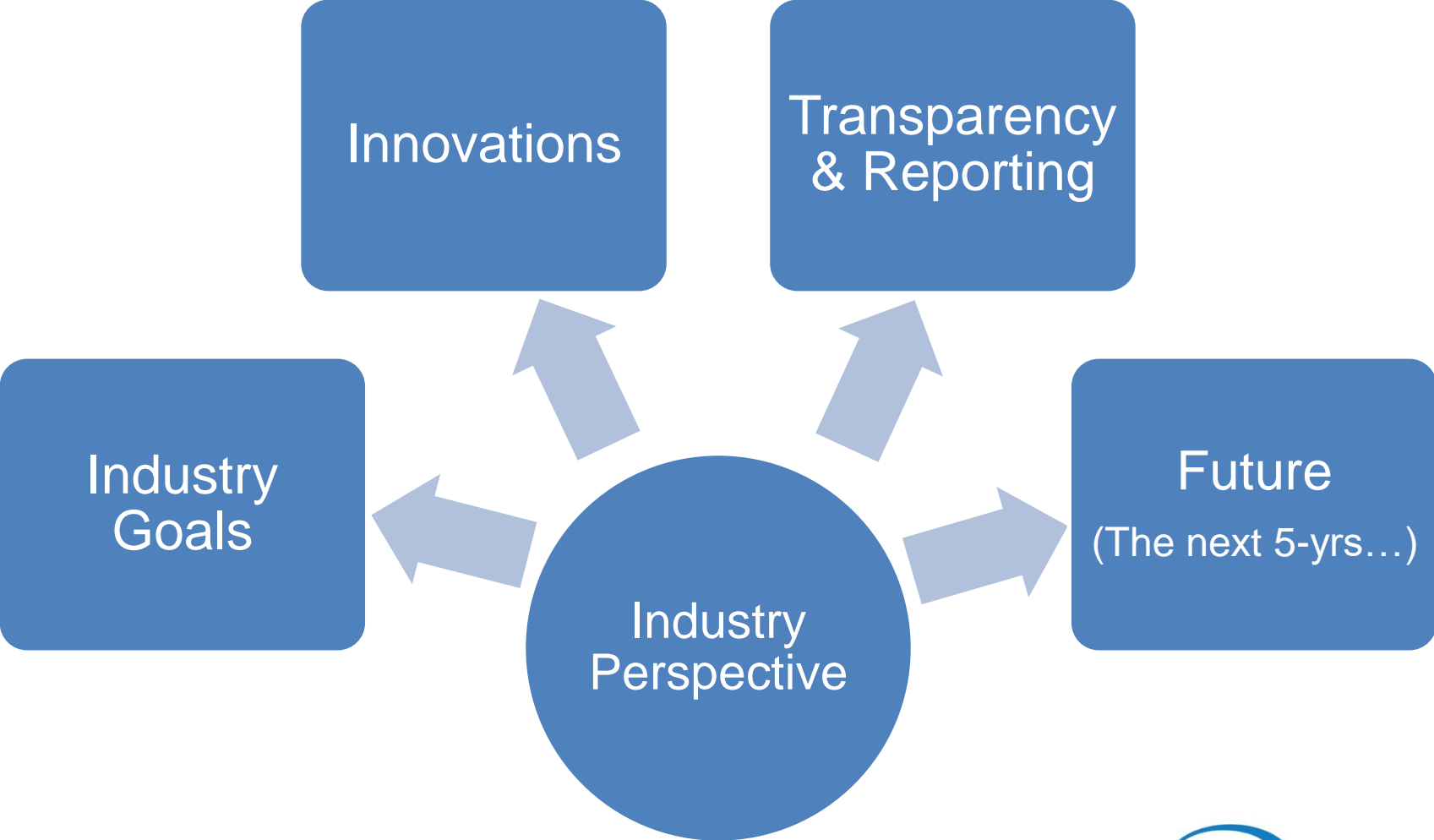
National Ready Mixed Concrete Association (NRMCA)

**ACI Session: Impact of Buy Clean and Low-Carbon Policies on the Sustainability of Concrete**

THE WORLD'S GATHERING PLACE FOR ADVANCING CONCRETE



# Agenda: Concrete Industry's Perspective on Green Public Procurement & Low Carbon Concrete



# Industry Goals

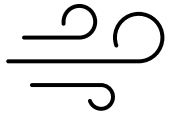
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# Long History of Regulating the Cement and Concrete Industry

Regulations for  
Emissions / Waste / Discharge

Air



Land

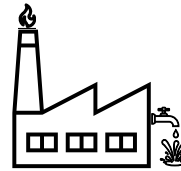


Water

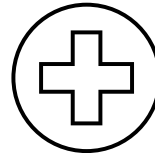


Beneficial Impacts

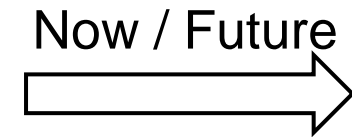
Pollution Reduction



Human Health Improvement

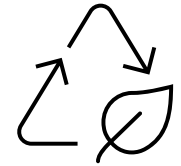


More Recycling

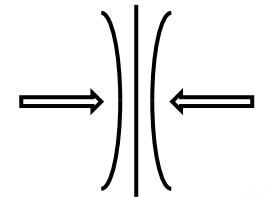


Green Procurement &  
Low Carbon Materials

Sustainability

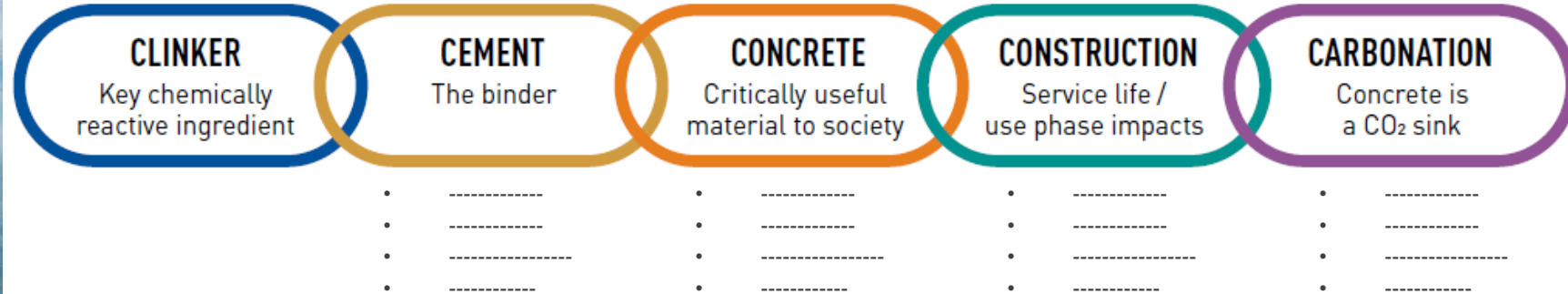
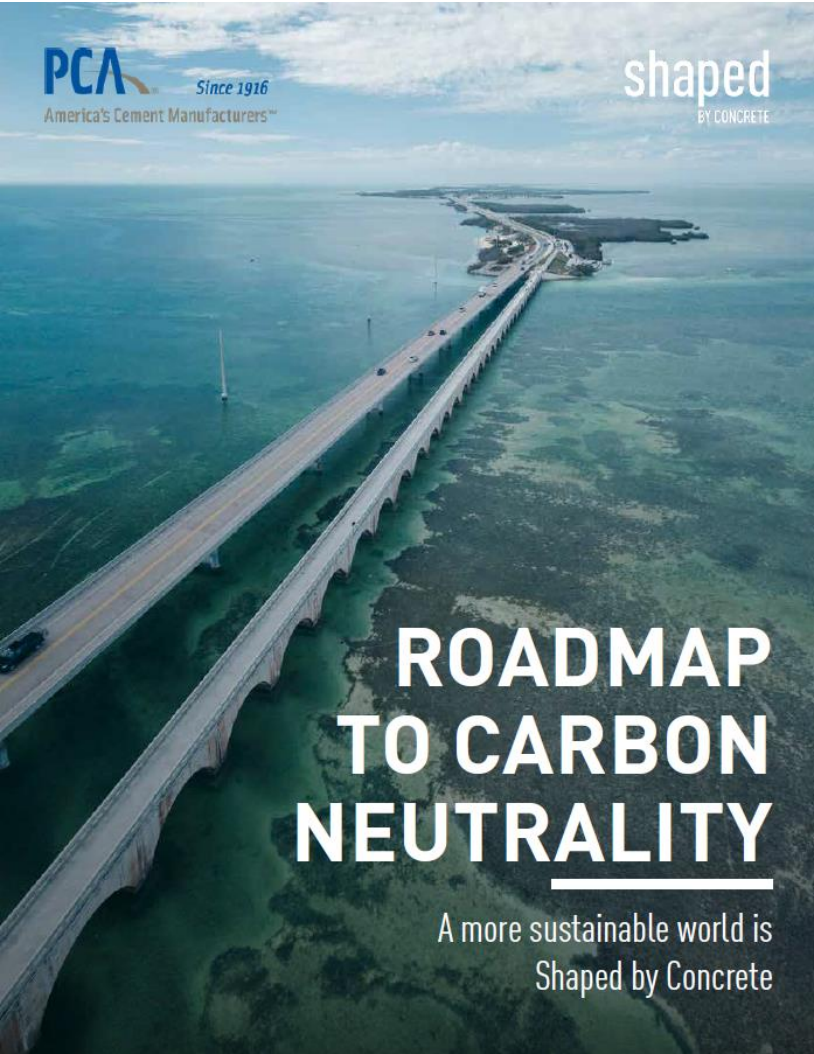


Resilience



# Roadmap to Carbon Neutrality: Cement & Concrete

Source: [PCA](#)



The cement and concrete industries are committed to achieving carbon neutrality across the value chain by 2050.

Achieving carbon neutrality will require combining actions across the supply chain.

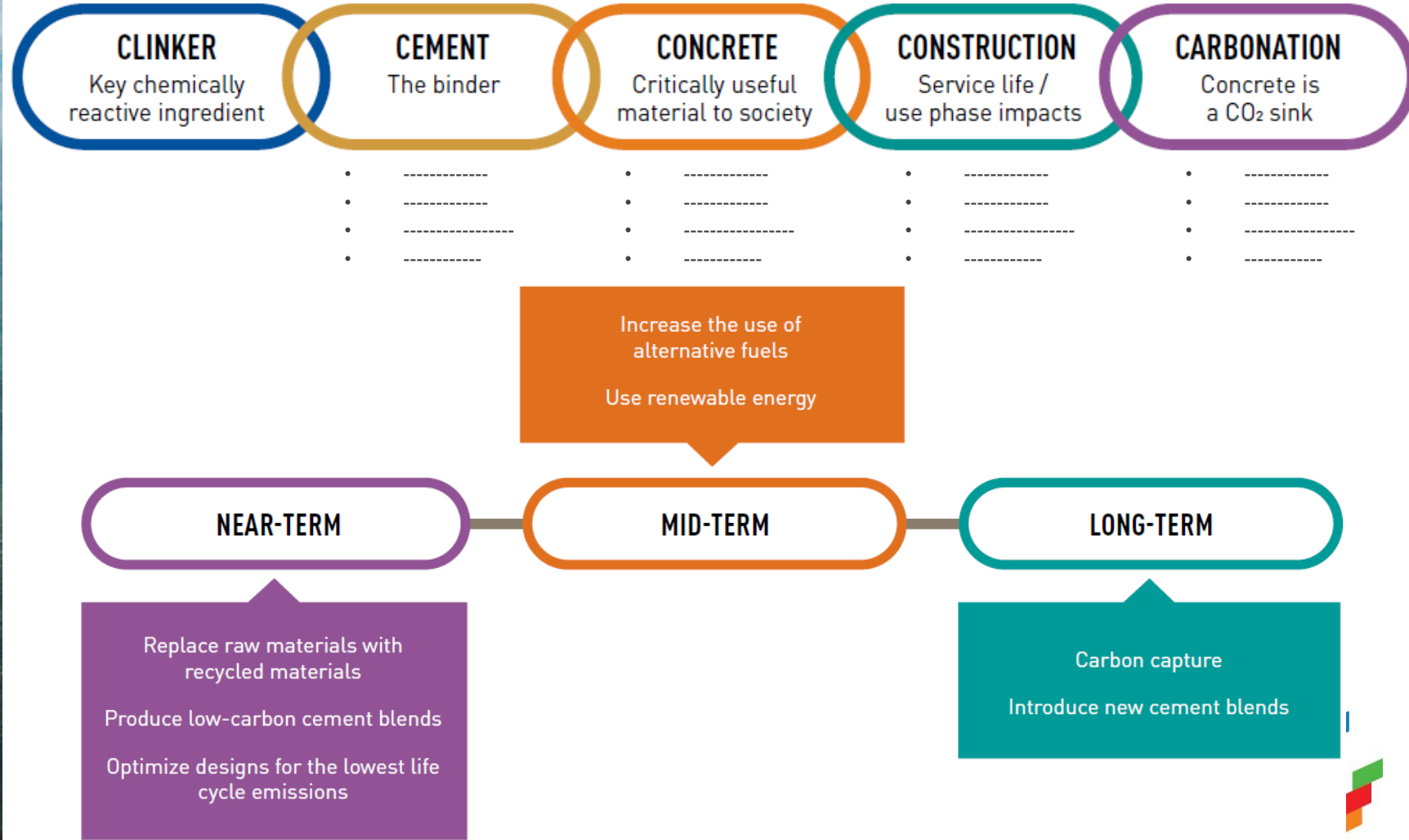
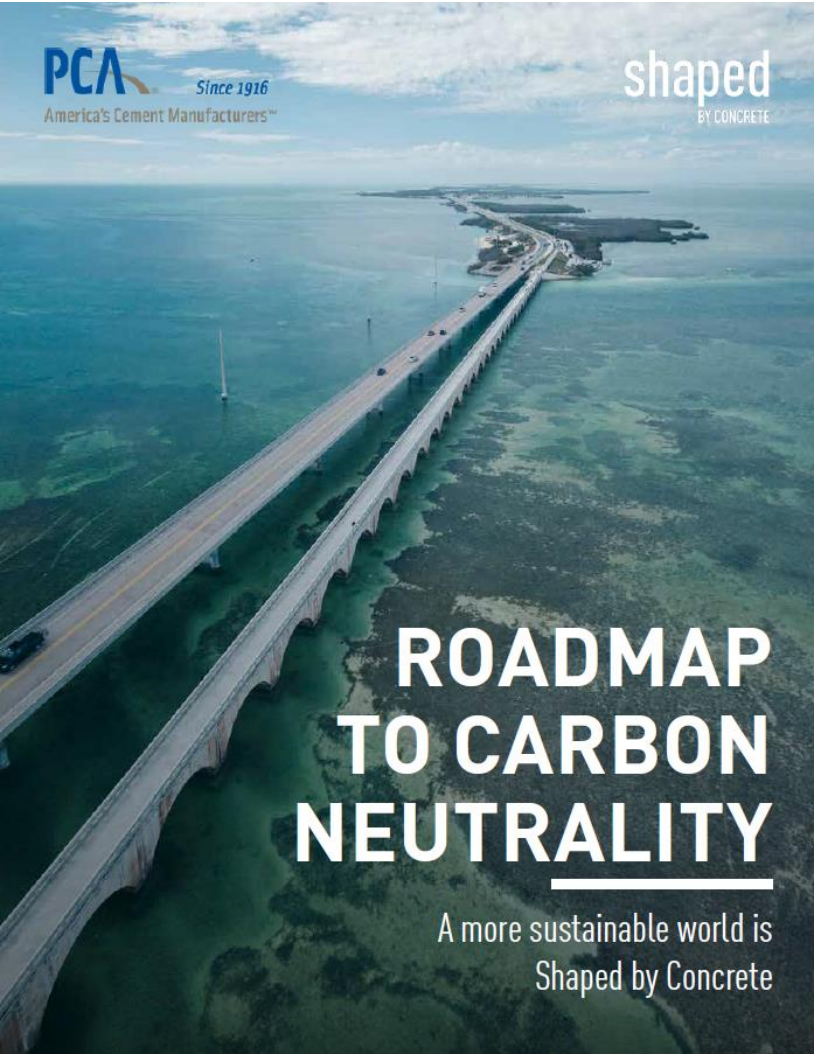
The roadmap highlights these strategies and actions.





# Roadmap to Carbon Neutrality: Cement & Concrete

Source: [PCA](#)



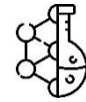
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# Reducing Concrete's Embodied Carbon Emissions (In-Use to Near-Term)



Communicate Carbon Reduction Goals



Specify Admixtures



Ensure Good Quality Control and Assurance



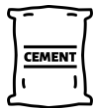
Don't Limit Ingredients (e.g., PEM)



Optimize Concrete Designs & Mixtures



Set Targets for Carbon Footprint



Specify Innovative Cements



Sequester Carbon Dioxide in Concrete



Specify Supplementary Cementitious Materials



Encourage Innovation



# Innovations

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# Cement: Going Beyond ASTM C150

ASTM C595 Standard Specification for Blended Hydraulic Cements

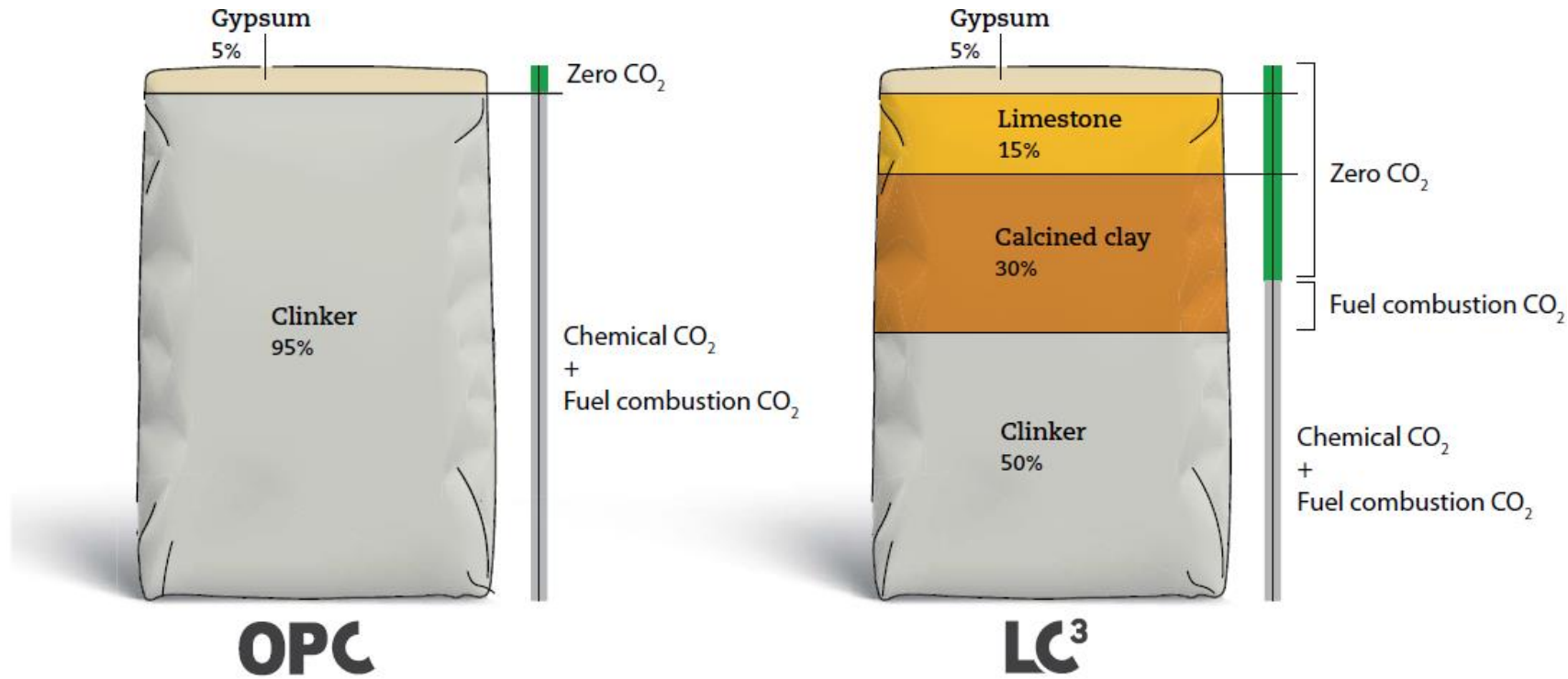
ASTM C595		
Type	Description	Notes
Type IL (X)	Portland-Limestone Cement	Where X can be between 5 and 15% limestone
Type IS (X)	Portland-Slag Cement	Where X can be up to 70% slag cement
Type IP (X)	Portland-Pozzolan Cement	Where X can be up to 40% pozzolan (fly ash is the most common)
Type IT (AX)(BX)	Ternary Blended Cement	Where X can be up to 70% of pozzolan + limestone + slag, with pozzolan being no more than 40% and limestone no more than 15%

ASTM C1157 Standard Performance Specification for Hydraulic Cement

ASTM C1157		
Type	Description	Notes
Type GU (X)	General Use	<p>X is optional but may be designated as <u>R</u> for low reactivity with alkali-silica-reactive aggregates or <u>A</u> for air-entraining cement.</p> <p><u>Performance tests may include:</u></p> <ul style="list-style-type: none"> <li>• Chemical analysis</li> <li>• Fineness</li> <li>• Expansion</li> <li>• Initial set time</li> <li>• Air content</li> <li>• Compressive strength</li> <li>• Heat of hydration</li> <li>• Sulfate resistance</li> <li>• ASR reactivity</li> <li>• Early stiffening</li> </ul>
Type HE (X)	High Early Strength	
Type MS (X)	Moderate Sulfate Resistance	
Type HS (X)	Moderate Sulfate Resistance	
Type MH (X)	Moderate Heat of Hydration	
Type LH (X)	Low Heat of Hydration	

# Alternative Cements: LC3

**LC3:**  
Limestone  
Calcined  
Clay  
Cement



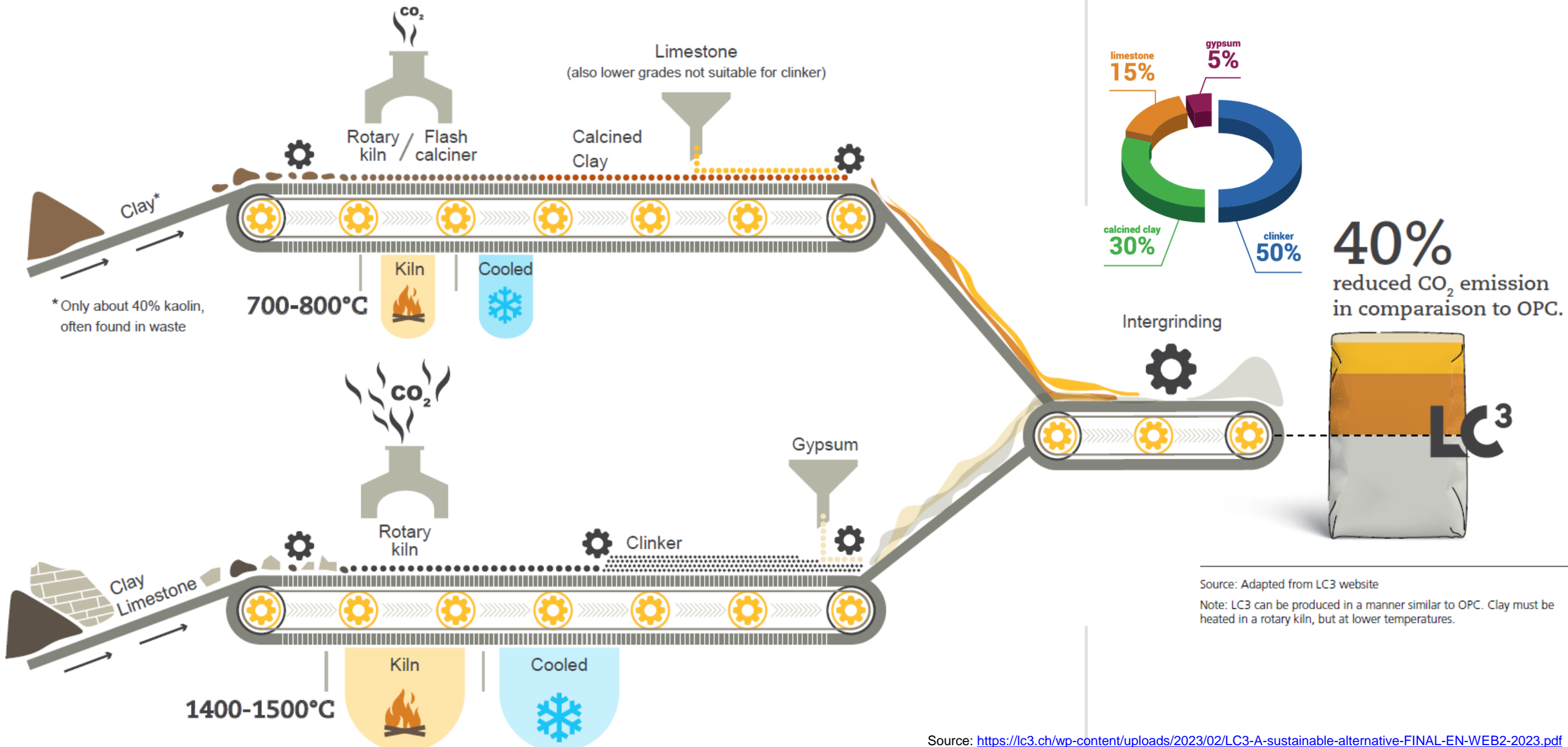
- 50% less clinker
- 40% less CO<sub>2</sub>
- Similar strength
- Better chloride resistance
- Resistant to alkali silica reaction

Source: <https://lc3.ch/wp-content/uploads/2023/02/LC3-A-sustainable-alternative-FINAL-EN-WEB2-2023.pdf>

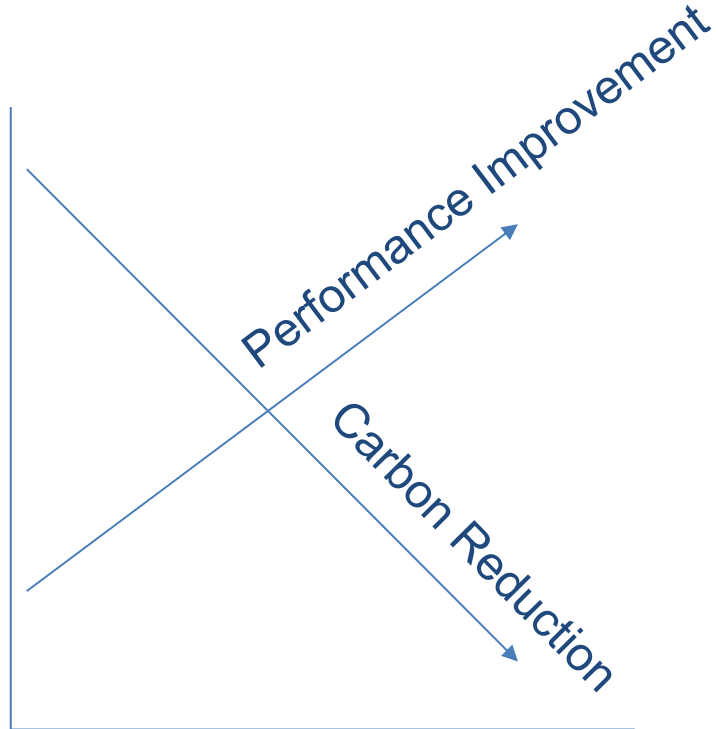
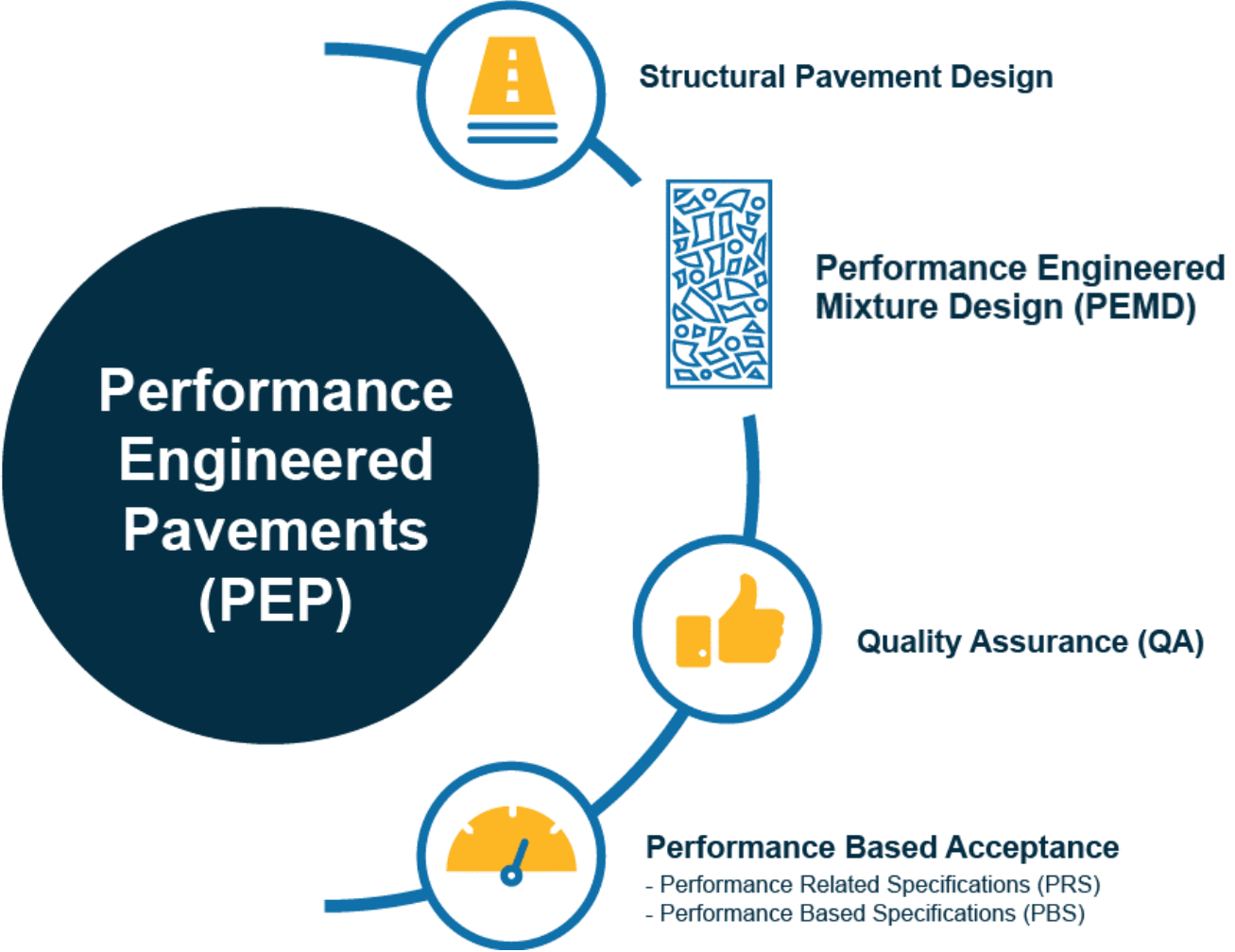
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# Alternative Cements: LC3



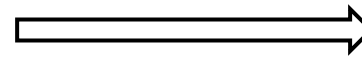
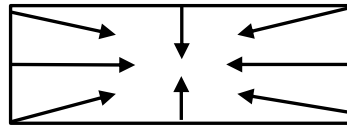
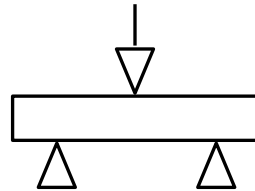
# Performance Engineered Infrastructure



Source: Federal Highway Administration (FHWA-HIF-20-005)

# Material Properties Affecting Pavement Performance & Sustainability

- Enhance strength
- Increase tensile capacity
- Lower shrinkage
- Reduce curl and warping



Better Performance  
And  
Improved Sustainability

# Transparency & Reporting

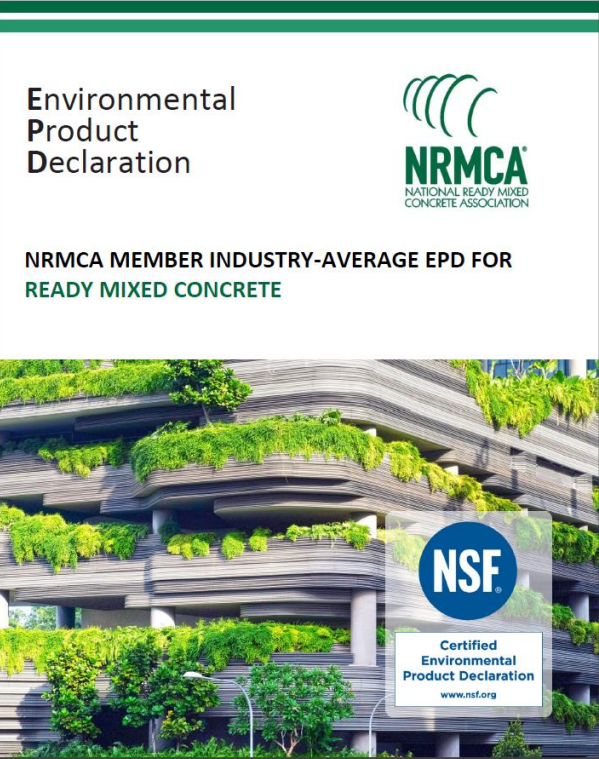
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# Industry Wide Environmental Product Declaration

- Ready Mixed Concrete Industry Wide EPD (v3.2) Jan 2022 – Jun 2025
- Based on NRMCA Member Data (rep. of 100+ Companies & ~2,000 Plants)
- Concrete GWP Values from IW EPD (calculated at ↑strength & ↓SCM ranges):



Industry Average EPD (Published January 3rd, 2022)										
28-day f'c, psi	Minimum	Maximum	0% FA/SL	20% FA	30% FA	40% FA	30% SL	40% SL	50% SL	50% FA/SL
<b>Conventional Concrete GWP (per yd<sup>3</sup>)</b>										
0 - 2,500	136.6	213.7	213.7	184.7	169.1	152.6	168.0	152.8	137.5	136.6
2,501 - 3,000	150.7	238.1	238.1	205.2	187.4	168.8	186.1	168.9	151.7	150.7
3,001 - 4,000	182.5	293.3	293.3	251.7	229.1	205.5	227.5	205.6	183.7	182.5
4,001 - 5,000	220.3	358.5	358.5	306.6	278.6	249.0	276.5	249.2	221.8	220.3
5,001 - 6,000	231.5	377.4	377.4	322.6	293.0	261.7	290.8	262.0	233.1	231.5
6,001 - 8,000	266.9	438.9	438.9	374.4	339.5	302.6	336.9	302.9	268.9	266.9
<b>Lightweight Aggregate Concrete GWP (per yd<sup>3</sup>)</b>										
0 - 3,000	303.0	426.4	426.4	367.2	335.2	360.0	305.7	340.8	303.0	321.6
3,001 - 4,000	343.6	491.2	491.2	424.0	385.0	414.7	348.2	390.3	343.6	362.5
4,001 - 5,000	373.6	547.6	547.6	468.5	422.4	455.3	380.1	427.5	373.6	394.4

Supplementary Cementitious Material (SCM) Ranges:  
 0-19% Fly Ash and/or Slag, 20-29% Fly Ash, 30-39% Fly Ash, 40-49% Fly Ash, 30-49% Slag, 40-39% Slag, ≥ 50% Slag, ≥ 20% Fly Ash and ≥ 30% Slag

**• NRMCA members decreased their carbon footprint by 21% in 7 years**

[https://www.nrmca.org/wp-content/uploads/2022/03/NRMCA\\_EPVDV3-2\\_20220301.pdf](https://www.nrmca.org/wp-content/uploads/2022/03/NRMCA_EPVDV3-2_20220301.pdf)

# Regional LCA Benchmark Report

Region	28-Day Compressive Strength, psi								
	2,500	3,000	4,000	5,000	6,000	8,000	3,000LW	4,000LW	5,000LW
	Global Warming Potential (per yd <sup>3</sup> )								
National	183.5	200.6	235.6	279.0	294.6	341.3	376.4	412.9	449.8
Eastern	183.3	201.5	240.2	289.0	305.3	360.5	395.4	437.9	480.1
Great Lakes Midwest	177.6	194.8	231.4	277.6	293.1	345.3	381.6	421.6	461.3
North Central	184.2	201.9	238.8	284.7	301.5	351.8	372.1	410.7	451.7
Pacific Northwest	180.0	199.8	242.0	295.2	311.9	372.7	396.2	439.7	483.4
Pacific Southwest	196.5	213.5	247.3	288.9	306.4	349.0	382.2	417.5	453.9
Rocky Mountains	177.5	194.6	229.8	273.4	289.6	336.7	369.8	406.5	443.5
South Central	172.4	187.7	218.6	257.2	272.2	312.8	357.7	390.2	424.5
South Eastern	188.9	204.6	236.5	275.5	292.1	332.2	365.6	398.7	429.4

- Published by NRMCA July 2022 (v3.2)
- Region Specific Mixtures For:
  - 6 Conventional Concrete Mixtures &
  - 3 Lightweight Concrete Mixtures

Table B1-NRMCA U.S. National Benchmark Mix Designs (per cubic yard)										
Compressive Strength	psi	2500	3000	4000	5000	6000	8000	3000 LW	4000 LW	5000 LW
Portland Cement	lbs	354	394	475	576	610	719	394	475	556
Fly Ash	lbs	62	69	83	101	107	126	69	83	97
Slag Cement	lbs	17	19	23	28	30	35	19	23	27
Mixing Water	lbs	305	305	305	315	341	341	308	308	308
Crushed Coarse Aggregate	lbs	1,126	1,115	1,083	1,029	1,061	1,018	0	0	0
Natural Coarse Aggregate	lbs	553	547	531	505	521	499	0	0	0
Crushed Fine Aggregate	lbs	169	167	162	154	159	152	161	149	136
Natural Fine Aggregate	lbs	1,282	1,270	1,233	1,171	1,208	1,159	1,225	1,130	1,035
Man. Lightweight Aggregate	lbs	0	0	0	0	0	0	980	990	1,000
Air %	%	6%	6%	6%	6%	6%	0	6%	6%	2%
Air Entraining Admixture	oz	1	1	1	1	1	1	1	1	0
Plasticizer & Superplasticizer	oz	3	3	3	7	3	3	3	7	7
Set Accelerator	oz	25	20	15	10	25	20	15	10	10
Total Weight	lbs	3,867	3,886	3,895	3,878	4,037	4,049	2,178	2,168	2,159



# FHWA Low Carbon Transportation Materials Grants (IRA SEC. 60506)

- FHWA will refer to industry data to demonstrate compliance with the EPA's Interim Determination (asphalt, concrete, glass, steel) for compliance with LCTM grant funding.
- September 30, 2023: Provide FHWA with intent to publish industry averages. ✓
- November 30, 2023: Publish methodology and assumptions. ✓
- September 1, 2024: Provide methodology for subject matter expert review. ✓
- November 2024: Provide industry averages on a public facing website. ✓
- <https://www.nrmca.org/association-resources/sustainability/environmental-product-declarations>



# Concrete Benchmarks Published to Assess Compliance with EPA Interim Determination

Table 6: Benchmark for 3,000 psi mixture in Pennsylvania

[all values in kg CO <sub>2</sub> e / m <sup>3</sup> ]	A1 (Eastern)	A2 (Eastern)	A3 (Eastern)	A1-A3 Total (Proposed Method)	Current A1-A3 GSA Thresholds
20%	207	12	7	<b>226</b>	257
40%	226	17	9	<b>252</b>	291
50%	229	20	10	<b>259</b>	X
Average	230	22	11	<b>263</b>	318



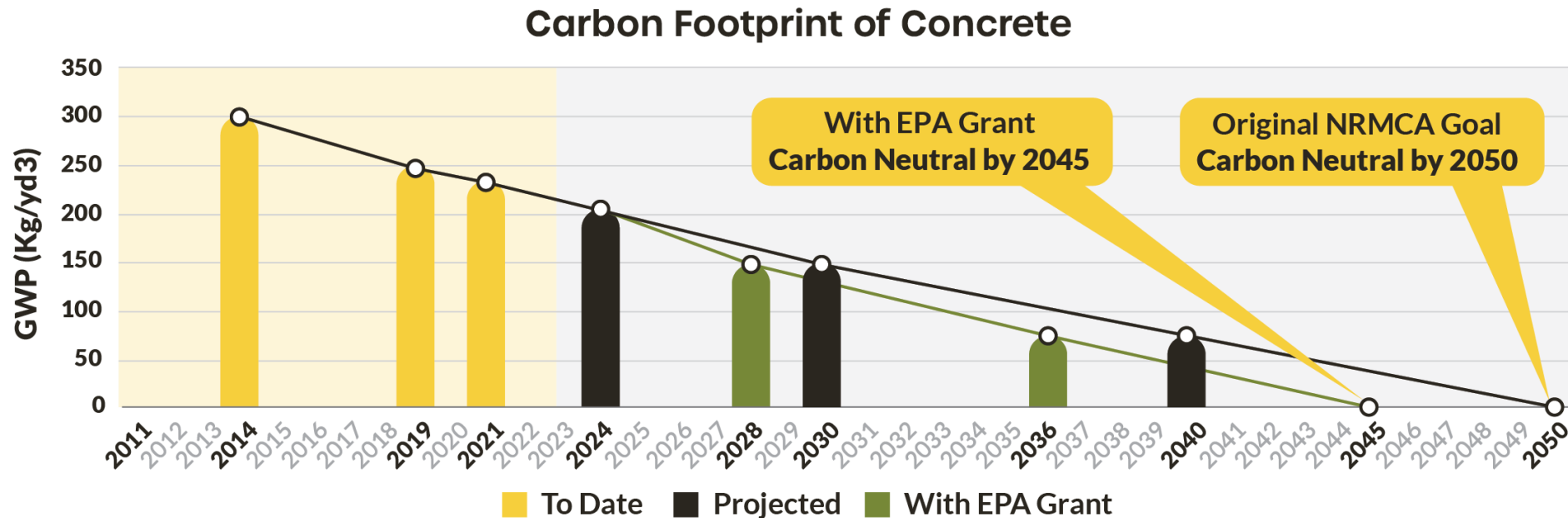
## Future (The Next 5-Years...)



# Accelerating Concrete's Drive To Carbon Neutrality

## NRMCA Selected for \$9.63 Million EPA Grant

**GOAL:** Reduce the carbon footprint of concrete by 50% by 2028 and achieve carbon neutrality by 2045.



[www.nrmca.org/EPAGrant](http://www.nrmca.org/EPAGrant)

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# Objective 1: Increase Number of Ready Mixed Concrete EPDs

**Goal: Increase plants with EPDs to 4,500**

<b>Plant</b>	<b>Amount</b>
<b>Companies that did not have EPDs<sup>1</sup></b>	\$5,000 for first plant
<b>Companies that already have EPDs<sup>2</sup></b>	\$2,000 per plant

1. Companies who have never published an EPD at any plant.
2. For second plant and beyond.
  - a. Publish EPDs at a plant that did not have EPDs
  - b. Publish new EPDs lower than NRMCA Benchmarks at a plant with EPDs

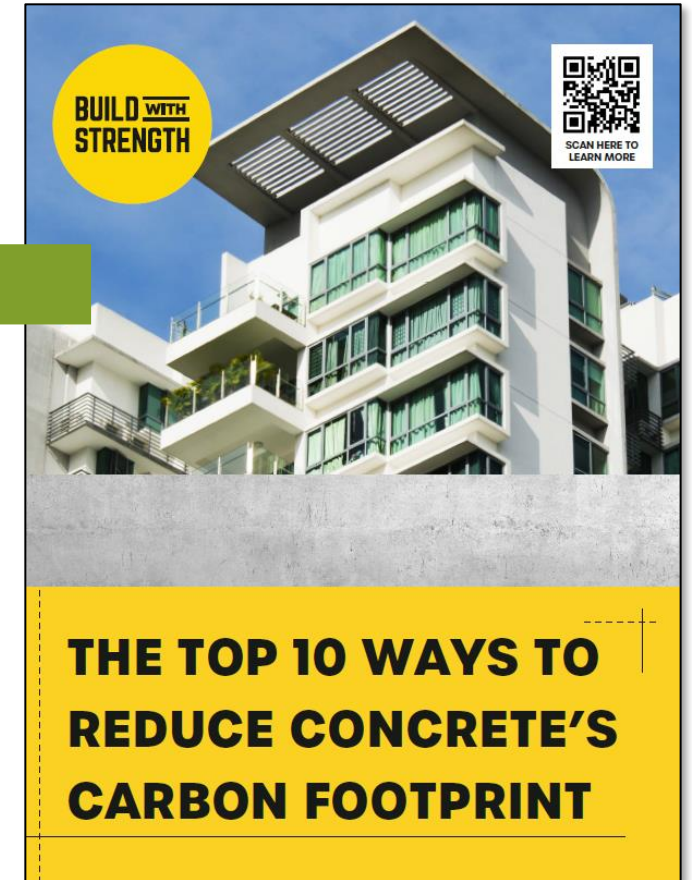
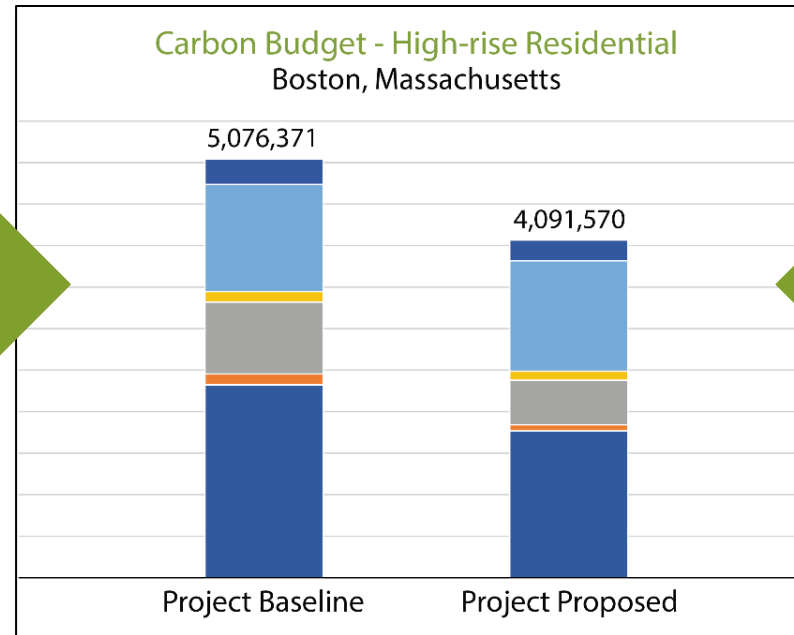
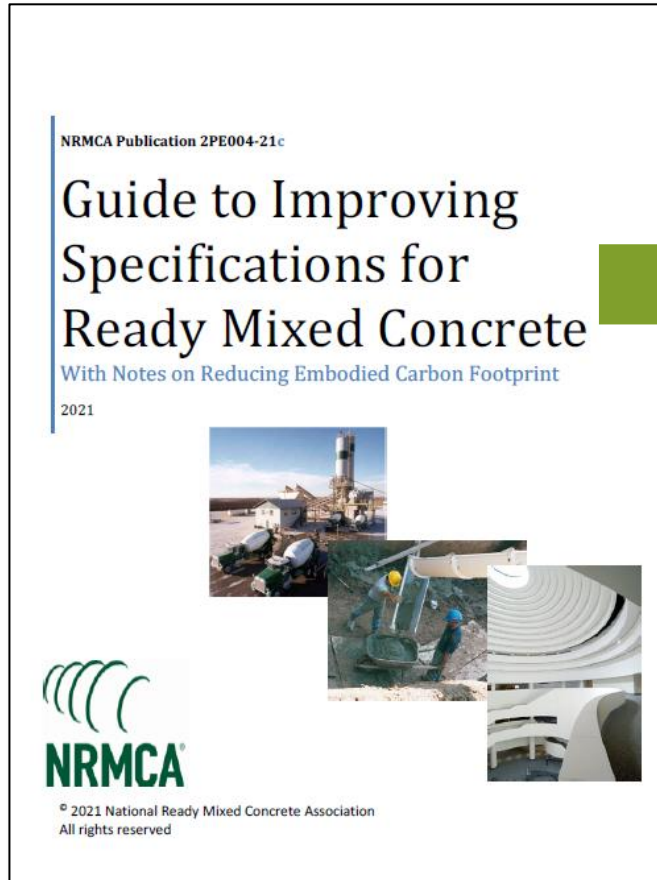
# Objective 2: Ensure Technical Proficiency of Concrete Industry Personnel

## Goal: Certify 500 Individuals

- Develop and maintain education and certification program for producers
- Enhance Concrete Design Center to consult on EPDs



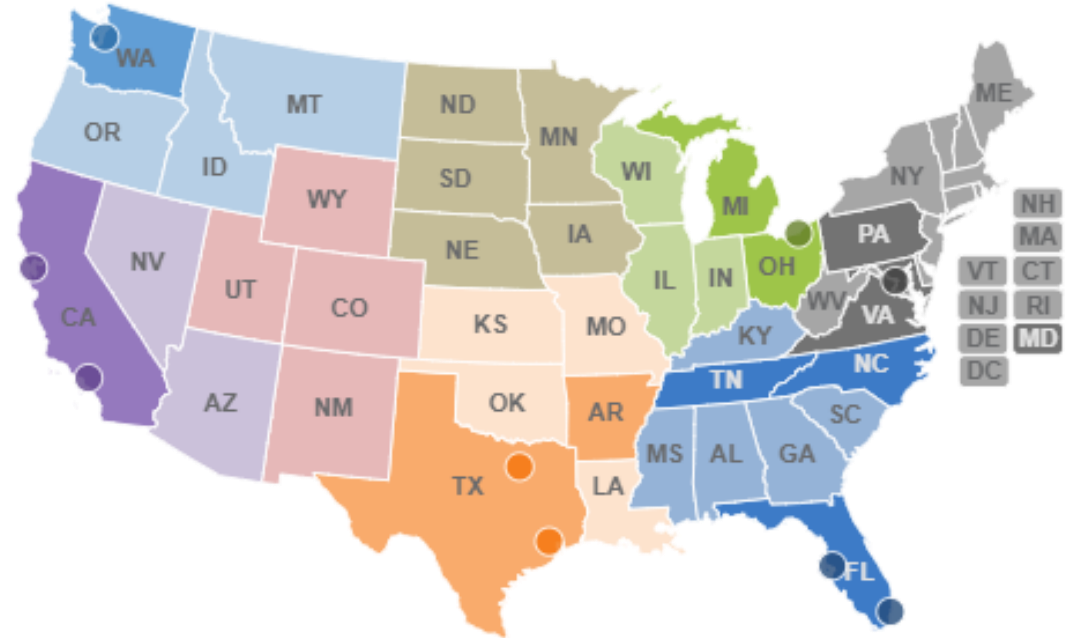
# Objective 3: Enhance Low-Carbon Concrete Design Tools



- Enhance Carbon Calculator
  - Specification guidance
  - Low-carbon concrete strategies
  - AI specification review tool

## Objective 4: Improve Benchmarks for Concrete

- Publish benchmarks in 30 regions in 2025
- Publish benchmarks in 50 regions in 2029





# Objective 5: Improve PCRs and EPDs for Constituent Materials

- Develop PCR, benchmarks and EPDs for **admixtures**
- Update PCR and develop benchmarks and EPDs for **lightweight aggregates**
- Develop benchmarks for **RCC pavements**



# Funding and Timeline

- NRMCA was notified of selection – June 18, 2024
- Public announcement of grant selection – July 16, 2024
- Grant will likely start funding in 2025
- NRMCA will begin administering pass-through grants – mid-2025
  - Develop ADA compliant, searchable EPD website
  - Develop online application and payment system
  - Develop online/helpline
- Funding is for 5 years



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