NRMCA RES Committee

Gaylord Rockies Hotel

Denver, CO

October 10, 2024

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NRMCA RES Committee

- Chair: Justin Lazenby, Thomas Concrete
- V. Chair: Bobby Dowdy, MMC Materials
- Execom Liaison: Scott Brewer, Dolese Bros

- Staff:
  - Colin Lobo
  - Karthik Obla

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NRMCA Antitrust Policy

The National Ready Mixed Concrete Association assigns the highest priority to full compliance with both the letter and the spirit of the antitrust laws. Agreements among competitors that unreasonably limit competition are unlawful under federal and state antitrust laws, and violators are subject to criminal fines and incarceration, civil fines and private treble-damage actions. Even the successful defense of antitrust litigation or an investigation can be very costly and disruptive. It is thus vital that all meetings and activities of the Association be conducted in a manner consistent with the Association's antitrust policy.

Examples of illegal competitor agreements are those that attempt to fix or stabilize prices, to allocate territories or customers, to limit production or sales, or to limit product quality and service competition. Accordingly, it is inherently risky and potentially illegal for competitors to discuss under Association auspices, or elsewhere, the subjects of prices, pricing policies, other terms and conditions of sale, individual company costs (including planned employee compensation), the commercial suitability of individual suppliers or customers, or other factors that might adversely affect competition.

It is important to bear in mind that those in attendance at Association meetings and activities may include competitors, as well as potential competitors. Any discussion of sensitive antitrust subjects with one's competitors should be avoided at all times before, during, and after any Association meeting or other activity. This is particularly important because a future adversary may assert that such discussions were circumstantial evidence of an illegal agreement, when viewed in light of subsequent marketplace developments, even though there was, in fact, no agreement at all.

If at any time during the course of a meeting or other activity, Association staff believes that a sensitive topic under the antitrust laws is being discussed, or is about to be discussed, they will so advise and halt further discussion for the protection of all participants. Member attendees at any meeting or activity should likewise not hesitate to voice any concerns or questions that they may have in this regard.

Adopted by the NRMCA Membership, April 3, 2006; reaffirmed by legal counsel January, 19, 2024

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RES Committee

- Call to order
- Introductions
- Approval of minutes – March 18, 2024
- Remarks by Chair
- Additions to the Agenda

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Staff Report

- NRMCA Update
- Update on ConcreteWorks

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Engineering Division Focus Areas

- Advocacy
  - Performance specifications
  - Sustainability
  - Reliable Acceptance Testing
- Workforce
  - Education / certification
  - Publications and information
- Technical Resource
  - Consultation
  - Literature and Information
  - Promotion and Design Assistance
- Quality
  - Resources to improve quality
  - Plant certification
  - Awards and recognition
  - Quality Benchmarks
- Research
  - Performance & Sustainability
  - Member support
  - Innovation

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CW Tech Sessions

- Setting Standards for Innovative Cementitious Materials
  - Sutter; Oct 12, 2:00 – 3:00 pm
- Panel: Pre-construction Planning for Sustainable Concrete using PLC
  - Peterson, Betts, Clark; Oct 12, 3:30 – 4:30 pm
- Specifications for Performance and Sustainability
  - Nmai, Oct 13, 2:00 – 3:00 pm
- Low Carbon Concrete Codes and the NRMCA Carbon Calculator
  - Lobo, Wray; Oct 12, 3:30 – 4:30 pm

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Sustainability Initiatives

- EPD Grant Program (EPA)
- Other Federal Initiatives

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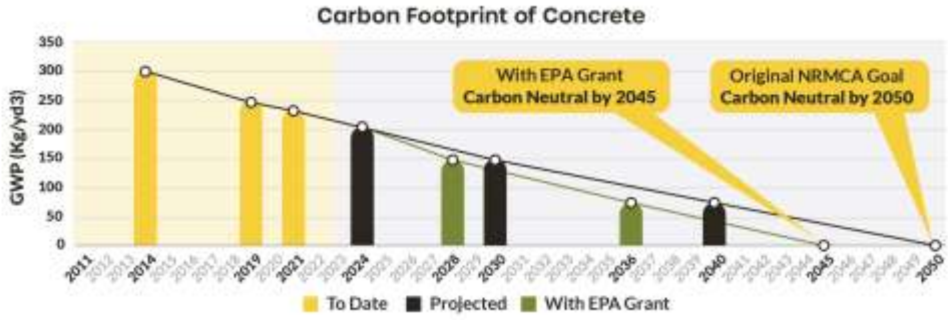
Inflation Reduction Act (IRA) of 2022

Procure Low-Carbon Materials	\$2.15 billion to GSA \$2 billion to the FHWA
Develop EPDs	\$250 million to EPA
Label Materials with Lower GWP	\$100 million to EPA, FHWA, and GSA

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

Objective 1: Increase Number of Ready Mixed Concrete EPDs

Goal: Increase plants with EPDs to 4500

Plant	Amount
Companies that did not have EPDs[1]	$5,000 for first plant
Companies that already have EPDs[2]	$2,000 per plant

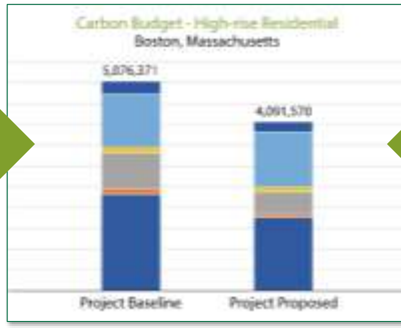
1. Companies who have never published an EPD at any plant.
2. For second plant and beyond.
   a. Publish EPDs at a plant that did not have EPDs
   b. Publish new EPDs lower than NRMCA Benchmarks at a plant with EPDs

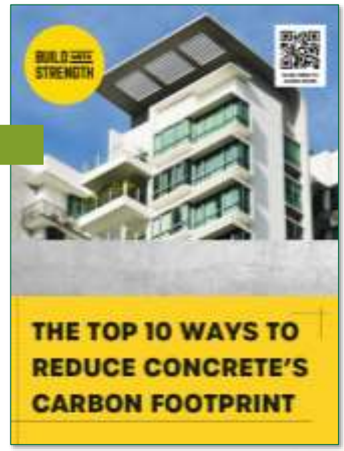
Objective 2: Ensure Technical Proficiency of Concrete Industry Personnel

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**

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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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EPA Label Program

- Label Program - Low Embodied Carbon Const. Matls (EPA)
- Data Quality Improvement
  - US EPA Criteria for Product Category Rules (PCRs)
- Setting Thresholds for "Substantially Lower GWP"
  - Industry averages
  - Based on collected EPDs

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EPA Label Program

- GWP from product-specific Type III EPDs
- Concrete EPDs rely on upstream facility specific cement EPDs
- Targets based verified source of same product category
  - Lowest 20th percentile
  - Lowest 40th percentile
  - Less than Industry average

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FHWA Low-Carbon Transportation Materials Grants Program

Announced March 12 / Closed June 10 / Awarded October

Assist public agencies

- Document embodied carbon for construction materials
- Develop/update specifications for low(er) carbon materials
- Identify, verify, and use low(er) carbon materials

Eligible entities:

- State departments of transportation (DOTs) ($1.2B)
- Local agencies, tribes, other Federal agencies, etc. ($800M)

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FHWA GWP Benchmarks (from NRMCA)

- 6 Conventional Concrete Mixtures &
- 3 Lightweight Concrete Mixtures
- Developed 20^{th} and 40^{th} percentiles

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

[all values in kg CO2e / m3]	A1 (Eastern)	A2 (Eastern)	A3 (Eastern)	A1-A3 Total (Proposed Method)	Current A1-A3 GSA Thresholds
20%	207	12	7	**226**	257
40%	226	17	9	**252**	291
50%	229	20	10	**259**	x
Average	230	22	11	**263**	318

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DOE Grants

- Low-Carbon Cement & Concrete Center of Excellence
- US National Labs - $9M
- Accelerate development and adoption of novel low-carbon cement and concrete technologies
  - Test Method Development
  - Modeling
  - Data collection and monitoring
  - Carbon Accounting

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NIST Consortium

- Working Groups
  - Performance Specifications
  - Quantifying Carbonates
  - Carbon Accounting
  - Novel Materials, Products, Processes

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ACI Update

- ACI 318 – response to public comments
  - Remove Exposure Class F3 and limits on SCMs
  - Exposure C2 – include air-borne chlorides
  - Permits 2 4x8 for strength tests instead of 3
  - Appendix N - Sustainability
- ACI 301
  - Working on several changes
  - 318 revisions

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ACI Update

- 323 – Code Requirements for Low-Carbon Concrete
  Concrete Mixture GWP
    - GWP Documentation
    - GWP Weighted Average
    - GWP Benchmark
  - Buildings
  - Pavements
  - Bridges
  - Other structures

Does not apply to
- precast concrete,
- auger cast concrete,
- shotcrete, or
- concrete strength < 2500 psi or > 8000 psi

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ACI Update

- 323 – Code Requirements for Low-Carbon Concrete (final)

$$GWP_{benchmark\ avg} = \frac{\sum_{i=1}^{n} GWP_{benchmark\ i} \times Vol_i}{\sum_{i=1}^{n} Vol_i} \qquad GWP_{project\ avg} = \frac{\sum_{i=1}^{n} GWP_{project\ i} \times Vol_i}{\sum_{i=1}^{n} Vol_i}$$

  - Buildings floor area ≥ 50,000 sq ft
  - Pavements ≥ 7,500 yd^3
  - Bridges deck area ≥ 25,000 sq ft
  - Other structures ≥ 7,500 yd^3

$GWP_{project\ avg} \leq 0.85\ GWP_{benchmark\ avg}$

NRMCA Benchmarks

  - Smaller projects – report GWP and strategies to reduce GWP

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ACI Update

- 321 – Durability Code – general chapters (draft)
  1. General
  2. Notations, Terminology
  3. References
  4. Materials
  5. Durability Planning - responsibilities
  6. Exposure Categories and Requirements
  7. Durability Design
  8. Construction
  9. Quality Management
  10. Maintenance

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ACI Update

- 321 – Durability Code – Exposure Categories

Exposure Category[b]	Exposure Description	Exposure Classes
F	Freezing and thawing	F0 to F2
S	Chemical sulfate attack	S0 to S3
P	Physical sulfate attack	P0 or P1
CC	Steel corrosion due to carbonation	CC0 to CC3
CD	Steel corrosion due to deicing chemicals	CD0 to CD2
CM	Steel corrosion due to marine environment or saline[a] solutions	CM0 to CM5
E	Erosion and abrasion	E0 to E4

ACI Update

- ACI 329 Guide performance spec
  - Ch 1 (Intro) - completed
  - Ch 2 (Spec Sec 1) – second ballot
  - Ch 3 (Spec Sec 2) – being written
  - Ch 4 (Spec Sec 3) – later
  - Ch 5 (test methods and other) – completed
- 132 - Responsibilities
  - Revising Responsibility document 132R

ACI Update

- 201 – Durability
- 211 – Proportioning mixtures
  - Combined Aggregate Gradings – Guide Published
  - Troubleshooting Concrete Mixture Issues as Influenced by Constitutive Materials, Job Site Conditions or Testing Practices - Guide

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ACI Update

- 214 – Strength Test Evaluation
  - Evaluation of Strength Test Results of Concrete-Guide – Balloting 2 chapters
  - Low pair differences does not mean good testing (bad curing, test machine bias)
- 232 – Fly ash
- 240 – Pozzolans
  - Many tech notes on new pozzolans being planned

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ASTM

- C150 – portland cement
  - Removed Type II (MH) and Type IV cement
  - Report HOH by C1702 (3d) by request
  - Permitting manufactured forms of calcium carbonate (for limestone)
  - Change in compositional requirements for limestone (40% Ca; 70% Ca and Mg)
  - Calculating limestone – based on measured Ca and Mg
- C595 – blended cement
  - Removed MH and LH – report HOH by C1702 (3d) on request;
  - New Table 2 with lower strength minimums for higher SCM content
  - Reporting alkali content of constituents and finished cement
  - Permitting manufactured calcium carbonate and composition of carbonates
  - Revisions to Type IT cement
  - Defining a new "Type IC" composite cement – min clinker content
  - Sulfate resistance – C452 (shorter) to replace C1012 for Type IL cement

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ASTM C94 – in progress

- Current version – C94-24c
  - Permitted water on ticket – at request of purchaser
  - Mixture proportions on request – linked to Mix ID
- In progress
  - Include ref specification for fibers
  - Retest air and slump before rejection
  - Revise cement to "cementitious materials"
  - Revision to appendix – strength overdesign
  - Revisions to ordering info –properties other than strength, delete Option C
  - Discharge limits on delivery ticket – change from mandatory to if requested
  - Define individual and cumulative batchers for aggregates and tolerances

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ASTM C94

- Consideration of water tolerance
  - Mixing water ±3%
  - How should trim water be addressed?
  - Notification on limit to purchaser?
  - Impact on yield

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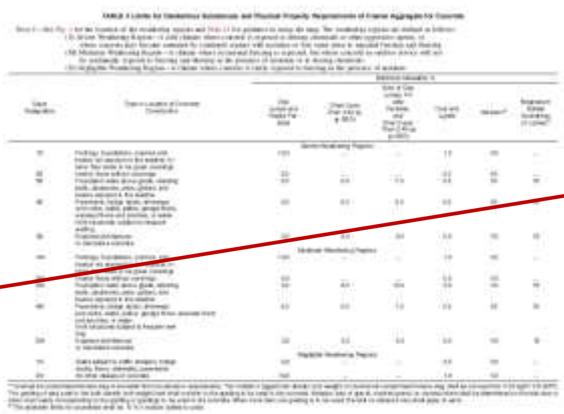
ASTM

- ASTM C33-24
  - Simplified limits for coarse agg – Replaced Table 4; removed weathering map



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ASTM

- ASTM C33-24
- Simplified limits for coarse agg
  - Abrasion < 50%
  - Soundness
    - <12% (sodium);
    - <18% (magnesium)
  - Permit use with service record

TABLE 4 Limits for Deleterious Substances in Coarse Aggregate for Concrete

Class	Type of Concrete Construction	Maximum Allowable, % by mass			
		Clay Lumps & Friable Particles	Chert[A]	Clay Lumps and Friable Particles + Chert[A]	Coal & Lignite
A	Interior concrete or below grade applications; Other types not designated here	10.0	–	–	1.0
B	Concrete surfaces subject to abrasion[B]	5.0	–	–	0.5
C	Exterior concrete exposed to freezing weather – Vertical surfaces[C]	5.0	5.0	7.0	0.5
D	Exterior concrete exposed to freezing weather – Horizontal surfaces[D]	3.5	5.0	6.0	0.5
E	Where surface appearance of concrete is of importance[E]	2.5	3.0	4.0	0.5

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ASTM

- C9.24 SCM
  - Natural pozzolans specification (C1945 - same as in C618)
  - LOI - report only in C618
  - New “performance” specification for SCM;
  - New specification for colloidal silica
  - Industry wide fly ash EPD
  - Harvested ash – company specific EPD, 3M tons sold

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ASTM

- C09.50 AAR Risk Management
  - C1567 – use of C595 blended cements, C1697 blended SCMs, and C1866 ground glass pozzolans
  - C1293 – Modify Fig. 1 flowchart
  - Many other items
  - Consideration of C1778 concepts in new ASR spec
- New C09.51 Sulfate Resistance
  - Develop guide and harmonize mitigation

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ASTM

- C09.66
- ASTM C1876

12.1 Remove the test specimen from the container of pore solution, then under a faucet, rinse with running tap water for 45 ±5 s while rotating the specimen and using palms of hands to remove pore solution from the specimen surface, blot off

  - Allow for conditioning/curing in lime water as an alternative

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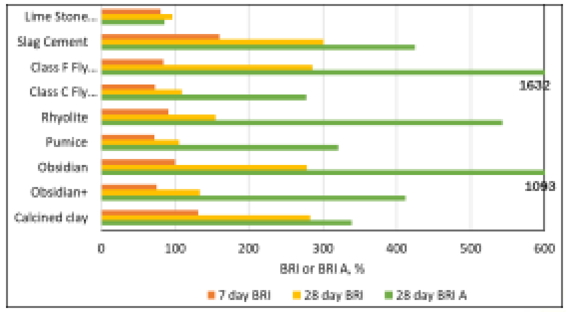
ASTM

- ❑ New test Method for Reactivity of Cementitious Materials using Bulk Resistivity


A LIMITED PERFORMANCE EVALUATION OF NATURAL POZZOLANS USING THE BULK RESISTIVITY TEST

Final Report
Prepared by
Karthik Obla, Ph.D., P.E.



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ASTM

- ❑ June 9: Workshop on Next Generation Cements and SCMs: Towards Specification
  - Innovative low carbon material manufacturers
  - Obla presented "Innovation in the Concrete Industry" – challenges, opportunities
- ❑ Obla C09.66 – Honorary member C01 and CO9

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AASHTO

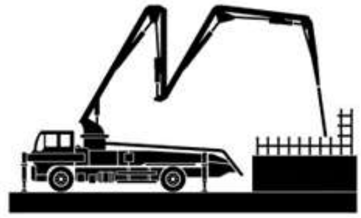
- Approved as AASHTO Guide

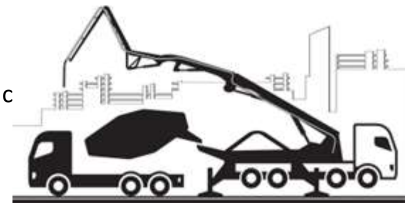
AASHTO

- Performance Engineered Mixtures (R 101)
  - Simplify to remove some suggested requirements
  - Appendix – guidance – as a separate document (CP Tech Center)
- ASR
  - Incorporate recommended changes from NCHRP
  - New method on alkali threshold for combined aggregates
    - Actual alkali loading in concrete < threshold
- Ready Mixed Concrete Spec – M 157
  - Several revisions for consistency with ASTM C94
  - Task Group on sampling location

Concrete Public Service Announcement

- FHWA <u>continues</u> to recommend that point of placement acceptance is the best practice.
- In the case of pumped concrete that would be <u>After</u> pumping.
- About 1% of the entrained air goes into solution at typical pumping pressures.
- Dr Ley has demonstrated is that in a good air system that 1% will rebound.
- Dr Ley has also confirmed that drop height has a significant impac on the air system
- A good air system can survive a drop height of as much as 10-15 feet.
- A poor air system does not survive those same drops.
- Poor entrained air system air can be eliminated during placement without any drop height.





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Concrete Public Service Announcement

- FHWA <u>continues</u> to recommend sampling pumped concrete <u>After</u> pumping for strength, air, and permeability.
- Concrete accepted after pumping should have the total air lower specification limit reduced by 1-1.5% to account for the air that has not yet rebound from solution after being pressurized.
- Agencies that check air both at truck and pump and require adjustment after checking for air loss after pumping > 1.5% don't need any specification adjustment, continue with the current practice.
- Testing at the truck alone should only be with SAM
- The Type B total air will not measure the quality of all air systems and all air entraining add mixtures are not created equal.

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NCHRP

NCHRP 1083 Alkali-Silica Reactivity Potential and Mitigation TEST METHODS AND STATE OF PRACTICE

- Recommend using ASTM C1293 (<0.040% at 1y) for aggregate evaluation as well as AASHTO T380 (<0.030% at 56 days)
- Removed ASTM C1293 2-year req. for CM selection
- Requiring ASTM C1567 <0.1% at 28 days (not for Zone 3 in C1778) or AASHTO T 380 < 0.025% at 84 days
- FHWA T-Fast underpredicted the reactivity
- Alkali wrapping procedure did not increase C1293 exp.

NCHRP 1105 Use of Marginal and Unconventional-Source Coal Ashes in Concrete

- Evaluated 22 different ashes, 14 of them not meeting spec
- Recommendations for AASHTO M295 revisions
  - Harmonize with C618
  - Water requirement to report only
  - R3 bound water (3.5 g/100 g paste) and C1827 FIT as report only

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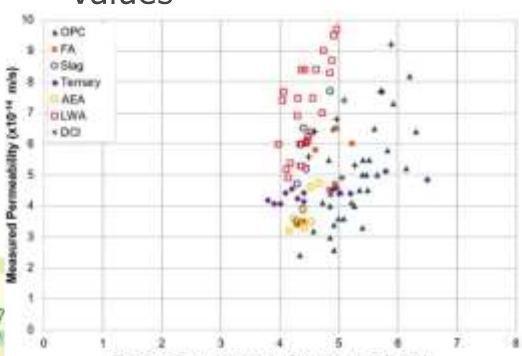
NCHRP 1086 Rating Concrete Water Permeability Based on Resistivity Measurements

- Proposed Practice for Determining the Permeability of Hardened Concrete Using Water
- Correlation between water permeability vs resistivity
- Proposed Practice for Rating Concrete Permeability Using Resistivity Values



Concrete Permeability Rating	Resistivity (kΩ-cm)	Water Permeability ($\times10^{-14}$ m/s)
High	< 5	> 5.2
Moderate	5–10	4.6–5.2
Low	10–20	4.3–4.6
Very Low	20–200	4.0–4.3
Negligible	> 200	< 4.0

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P2P Advocacy

- Update NRMCA Guide

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SECTION 033000 - CAST-IN-PLACE CONCRETE

ACI 318-25

ACI 301-??

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P2P Advocacy

- Develop an AI-based Specification review tool
  - Input - Prescriptive specification
  - Output - AI model will recommend improvements and performance-based alternatives
  - Funded as part of the EPA grant proposal

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P2P Advocacy

- To attain 2030, 2050 GWP targets need:
  - Performance-based low-carbon concrete (LCC) specifications for projects
  - Technical Proficiency of Industry Personnel
  - Incentivize LCC mix development
- Communication:
  - Transforming Industry: Strategies for Decarbonization Workshop – Hosted by DOE, panel breakouts, May 14-15, Arlington, VA
  - WH OSTP meeting, July 19, Concrete Innovation Summit

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Slabs – Performance Criteria

- Current specifications for floor slabs are prescriptive (ACI 302)
- Issues - shrinkage cracking, curling, joint spacing, bleeding, setting time, workability and finishability, slab moisture emissions
- Performance-based criteria can support concrete with lower GWP
  - High SCM mixtures, new low carbon materials
- Need new workability tests, bleeding criteria, models to account for field conditions
- Partner with ASCC, researcher
  - EPA grant proposal – not funded

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NRMCA Research Laboratory

- Foundation has funded 2 proposals
- $90,000 over 2 years. Includes $30,000 for Tourney

Using Resistivity Test Results for Service Life Prediction (Chloride Induced Corrosion)

Problem

- D_a and m (D_a decay coefficient) is used in Life 365 model to predict service life
- Resistivity correlates with D_a but impacted by pore solution resistivity (PSR)

Approach

- Measure resistivity and calculate formation factor by 3 techniques including novel insitu device for PSR measurement
- Measured at several early ages (<90 days)
- Develop best early-age criteria to estimate D_a and m

Resistivity Test Results for Service Life Prediction

Collaboration with PSU and Tourney

Research Value

- ❑ Designers can specify early age criteria for target service life
- ❑ Producers can design mixtures to meet criteria

Mixture No.	Mixture Type	NIST PSR, Ω-m	Expected Permeability
1	0.40SL50LA	0.26	Very Low
2	0.40SL50HA	0.11	Very Low
3	0.40FA30HA	0.05	Low
4	0.60SL50LA	0.43	Low
5	0.60SL50HA	0.19	Low
6	0.50FA15LA	0.13	Moderate
7	0.50FA15HA	0.07	Moderate
8	0.50CEMLA	0.18	High

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New Approach to Strength Acceptance Criteria for Low Carbon Concrete Mixtures

Problem

Low carbon mixtures may gain 50% strength >28 days not 20%. Producers document strength gain thru 90 days and use equivalent 28-day f'_c. Approach not widespread.

- ❑ How to calculate equivalent 28-day f'_c from mixture submittal? Ratio or fixed addition (Ken Day)?
- ❑ How to calculate f'_{cr} at later ages when S from past 28-day data are available?

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Curing Concrete in Structure (Section 26.5.3)

- Concrete shall be maintained at least 50°F for 7 days in moist condition (3 d for high early strength).
  - ACI 301 has same limits
- This has worked. Is this adequate for LCC mixtures?

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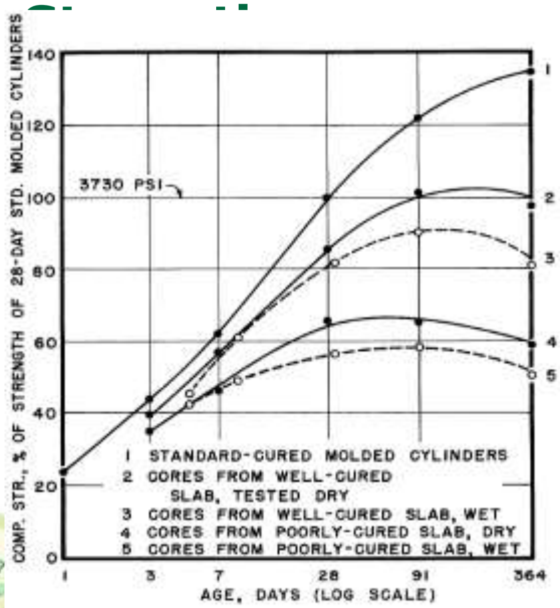
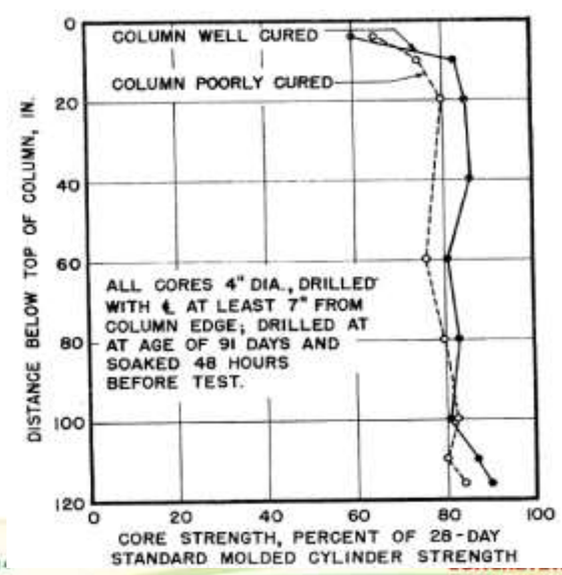
Standard Cured Cylinder vs In-place





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To evaluate protection and curing of the structure

- Field cured cylinders can be made along with standard-cured cylinders
- Requirements are:
  - ≥ 85% of companion lab cured
    Or
  - ≥ (f'_c+ 500) psi

Experimental Plan

- Different period of moist curing, accelerated curing
- Member field data analysis
- Document GWP reductions
- Resistivity

Research Value

- Mixtures with lower GWP can be designed

	Total CM, lb/yd³	SCM and %	w/cm
1	625	0	0.40
2	625	20% Class F fly ash	0.40
3	625	50% Class F fly ash	0.40
4	625	30% slag cement	0.40
5	625	60% slag cement	0.40
6	540	0	0.52
7	540	20% Class F fly ash	0.52
8	540	50% Class F fly ash	0.52
9	540	30% slag cement	0.52
10	540	60% slag cement	0.52

Participation in Research Consortiums

- Penn State U – Use of Steel Slag in Concrete and Cement – US DOT
- ASCC, Don Davies – Innovative materials demo – DOE Voucher
- Consortium led by Clemson – Utilization of ASCM in Highway Applications – NCHRP 18-21
- University consortium led by U. Alabama - Novel cement formulations in combination with alternative SCMs – DOE
- Center for Excellence; Workforce development – DOE

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Innovation

- 2023 study evaluated 5 NPs
  - Calcined clay, Obsidian, Obsidian, Pumice, Rhyolite
- Accelerate innovation in the industry
  - Limited complimentary lab evaluation (not endorsement)
  - Present at RES, 1-page report, NRMCA website
  - Provide platform to showcase (expo, Innovation sessions, Concrete Works)

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Ground Glass Pozzolan

- 20% GGP and 20% Class F fly ash control
- 0.50, 550 pcy, 5 in. slump, non-air
- Slightly higher water demand (more HRWR)
- Entrained air (Detrainer)
- Similar compressive strength, and higher bulk resistivity

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Nano catalyst

- 28 oz/cwt. and 3 oz/cwt. Type A control
- 0.50, 550 pcy, 20% fly ash, 6 in. slump, non-air
- 13% higher water reduction
- 3% higher entrained air
- Higher compressive strength, slightly higher resistivity

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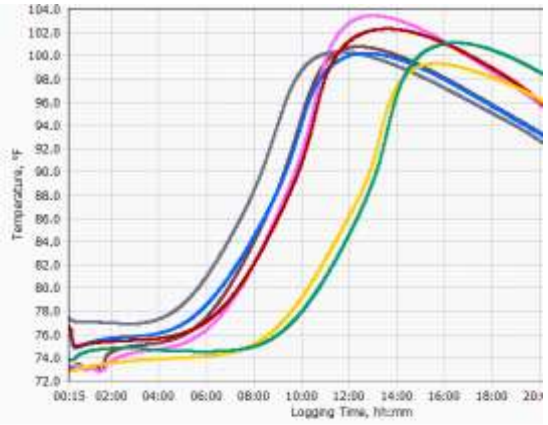
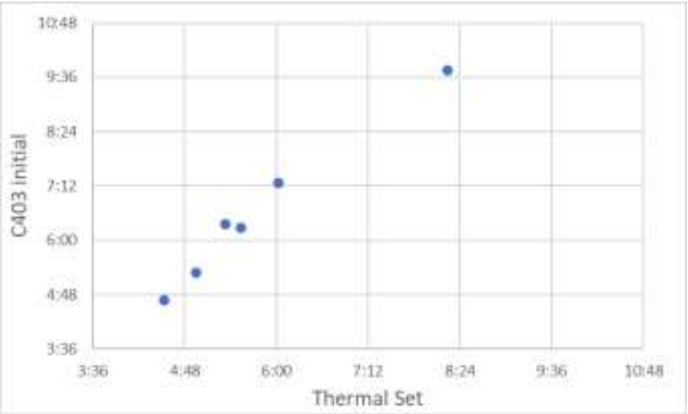
New Capabilities – Evaluated several NPs



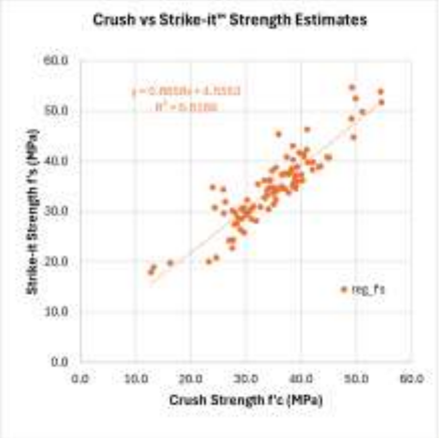


66

New Capabilities - Strike-it tool

SoundQA

Acoustic Impulse Response



67

New Capabilities – Mini CPT (AASHTO T 380)

Using it to evaluate GGPs along with 2-year C1293

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CONCRETEWORKS

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High strength high air mixtures

- 7000 psi f'_c with 6% air is challenging
- 650 pcy, 40% slag, 0.40 w/cm, HRWR 7.1 oz/cwt, 5 in. slump

Air Content	28 day strength	C666, %
2.8%	8370 psi	Failed at 72 cy
4.9%	7100 psi	95% at 140 cy
7.4%	6800 psi	96% at 140 cy

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CONCRETEWORKS

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Contract work

- 200 projects in progress including 4 innovative materials – low carbon material sources, new lightweight aggregate
- Low carbon concrete mixture assistance program

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CONCRETEWORKS

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Testing Task Group

- Task group formed at the RES meeting - Sep. 23
- Implement solutions to ensure acceptance testing is performed according to standards

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CONCRETEWORKS

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Testing TG - Members

Mike Whisonant	Martin Marietta
Terry Harris	GCPAT
Karthik Obla	NRMCA
Colin Lobo	NRMCA
Alberto Romanach	Cemex
Bobby Dowdy	MMC Materials
Eric Misenheimer	Chandler Concrete
Justin Lazenby	Thomas Concrete
John Cook	Thomas Concrete
Mark Giancola	Suzio York Hill
Lars Anderson	Cemstone
Ben Olin	Dickinson Readymix
Chris Wolf	Shelby Materials
Bryan Fulcher	Maschmeyer
John Vaughan	Heidelberg Materials
Lee Thrasher	CTS Cement
Adam Neuwald	Concrete Supply Co.
James M. Shilstone, Jr.	Command Alkon
Rachel Angelias	Redmix, a CRH co.
Mike Davy	Argos
Greg Wong	Kniferiver
Michael Hernandez	ASCC
Jason Wimberly	Lithko
Todd Ohlheiser	CRMCA
Scott Grumski	Forney
Jim Casilio	PACA

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Testing TG - Activities

- Since the last RES meeting we have had online meetings
  - May 1, June 17
- Previously, we had considered 22 ideas and identified 7 ideas for implementation

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Idea 1 - CTAC

- Helps have conversations on testing
- With data to support our position
- New development – Focus on Initial curing
- CPG KC has municipality inspectors who help enforce
- Is more website assistance needed for training and quarterly reporting?
- Should we work with our state assns.?

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Idea 2 – State Code

- State Code – NC Code, Chapter 17, Special Inspections (handout)
  - Special inspection - check compliance of initial curing, recorded and reported
  - Disseminated to other state associations
  - Should we work with our state assns.?

6. Prior to concrete placement, fabricate specimens for strength tests, perform slump, density and air content tests, and determine the temperature of the concrete.	X	—	ASTM C172 ASTM C31 ACI 318: 26.5, 26.12	~~1908.10~~
6a. Verify that the concrete specimens for strength tests are maintained in the required initial curing environment, and that the maximum and minimum temperatures during the initial curing period are being reported.	—	X	ACI 318: 26.12.3.1(a) ASTM C31: 10.1.2, 12.1.5	—
6b. Prior to shotcrete placement, perform slump and air content tests, and determine the temperature of the shotcrete. After the placement of the shotcrete, obtain strength test specimens.	X	—	ASTM C172 ASTM C143 ASTM C231	1908.10

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Idea 3 - CCRL

- Notify labs that don't maintain info on initial curing as per C31 - max/min. test records, curing method
- We need more people to communicate this to CCRL

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Idea 4 – Boilerplate language

- PACA has developed a warranty statement and form letter for Terms and Conditions
  - Should we consider displaying on NRMCA website as an example or
  - introduce to state association execs

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Idea 5 – NRMCA Position Statement

Released Sep. 24

MIT also has a brief on carbon impact of testing

Can be used for communication to stakeholders

Trying to get endorsement from SEA, ASCE

Any other way we can use this?


RELIABLE CONCRETE ACCEPTANCE TESTING FOR IMPROVED SUSTAINABILITY AND PERFORMANCE

NRMCA Position Statement

Idea 6 – DOT

- DOTs – Specification clauses for initial curing varies (see below)

WA DOT

The Contractor shall provide and maintain a sufficient number of cure boxes in accordance with FOP for AASHTO R 100 for curing concrete cylinders. The cure boxes shall be readily accessible and no more than 500 feet from the point of acceptance testing, unless

NH DOT

"On projects with less than a total of 100 cy of concrete, the curing box shall be relatively airtight with provisions for storing cylinders in damp sand or sawdust at temperatures between 60º F and 80º F. On projects with more than 100 cy of concrete, the curing box shall comply with the following specifications: The internal dimensions shall be approximately 30" long by 18" wide by 19" deep. The top shall be hinged at the back and a lock shall be provided at the front. The interior shall be rustproof. A moisture-proof seal shall be provided between the lid and the box. A drain pipe shall be provided through the side of the box. A grating shall be provided to hold the concrete cylinders above the water surface. A minimum/maximum thermometer shall be installed to measure the internal temperature of the box. The thermometer shall be readable from outside of the box and shall be accurate to within 2 °F. The thermometer shall have minimum graduations of 2 °F. A thermostat shall maintain the water at a temperature of 72 ± 5 °F when the ambient temperature is as low as -10 °F."

- Is there value in NRMCA providing language for testing contracts?
  - Curing boxes, water curing, continuous monitoring, reporting, inspections

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CONCRETEWORKS

Idea 7 – ACI

- ACI Field Level I Certification manual – Add a module on the consequences of non-standard testing; ACI staff have our position statement
- Should local ACI technician training include CTAC findings of non-compliance?

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Other Outreach

- Talk at GRMCA by Karthik and other industry members


2024
DAY OF CONCRETE
GRMCA

OCOTBER 2, 2024 GDOT OFFICE OF MATERIALS & TESTING
8 AM - 1:30 PM *This Event Qualifies for 4 Professional Development Hours*

ision: The GRMCA exists in order to help the Georgia ready mix industry be safe, compliant and prospe

8:00 AM	**Breakfast & Registration**
8:50 AM	**Introduction** Paul Ramsburg, Sika
9:00 AM	**Why We Design for Strength and The Importance of Compressive Strength Cylinders** Karthik Obla, Ph.D., P.E., FACI, National Ready Mix Concrete Association
10:00 AM	**ACI Test Methods, Certifications & The Importance of Accuracy** Wayne Wilson, P.E., Heidelberg Materials Executive Director, Georgia Chapter ACI
10:50 AM	**Break**
11:00 AM	**Concrete Testing Adherence Collaboration Program** Lee Thrasher, Komponent
12:00 PM	**In-Place Evaluation and What Happens When a Cylinder Fails** Shawn McCormick & Brian Wolfe SGS Tec Services

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DIL Engineering Task Group - Update

Cost of Returned Concrete

DIL Project Team:
- Steve Schaef, Master Builders Solutions
- Danielle Belchior, VCNA
- Greg Hendrix, CalPortland

Update from:
- Chris Eagon, Master Builders Solutions

BUILD with STRENGTH | www.nrmca.org | National Ready Mixed Concrete Association | #nrmca | PAVE AHEAD

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Issues with returned concrete?

Returned Concrete
- 2%-10% of Production (avg 6%)

Industry	Plant	Truck
» 385,000,000 yd^3 annually	» 53,000 yd^3 annually	» 5,300 yd^3 annually

- Growing problem - % returned is constant but increasing concrete volume produced
- Has a direct impact on companies' revenue/profits
- Push for carbon neutrality - Increased interest for producers to understand impact on full process
- Lack of comprehensive tools available to quantify cost and footprint for handling returned concrete

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Engineering Task Group Objectives

The primary objective of the task group was to:

- Evaluate the processes a concrete producer has available to address returned concrete
- Accurately quantify profit/loss for a given handling process
- Create a user-friendly Tool for producers to identify 'best' management of returned concrete

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Tool Options

Returned Concrete

Produce Blocks & Sell (3)
- Capacity of forms
- Driver wage and time
- Time for discharge and truck washing
- Cost of hooks
- Time to unform, stack, and load
- Profit for sell

Granulize via Admix & Sell / Reuse (4)
- Cost of admix
- Driver wage
- Time for mixing and dumping
- Time for truck washing
- Time for stockpiling
- Profit for sell / reuse

Dumping offsite (2)
- Driver wage
- Time for travel
- Fee for disposal
- Time for truck washing

Breaking & Stock Piling (5)
- Driver wage and time for discharge
- Time for truck washing
- Load operator wage
- Time to break & stockpile

Mechanical Crush & Sell/ Reuse (6)
- Equipment cost
- Operator wage
- Time for crushing
- Profit for sell /reuse

Haul Offsite (7)
- Load operator wage
- Time for loading
- Hauling & disposal fee

Additional future features:
- Inclusion of treating and reselling returned concrete
  - ASTM 1798 standard
- Carbon tracking/calculator

Potential for future DIL Project

BUILD with STRENGTH
PAVE AHEAD

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Final Tool Completed (v20)

Tool presented at 2022 NRMCA Concrete Works (DIL Project)

Metric & Imperial versions

DIL Team Feedback:

- Each RMC location is different, so recommend analyzing each one independently.
- Set a standard for time tracking - same start/stop times.
- Keep track of units and what the calculator is asking for.
- The more data you collect the better the tool and outputs

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Tool Distribution

Tool provided to NRMCA producers – awaiting feedback

prairie materials
Heidelberg Materials
KNIFE RIVER
CEMSTONE
TITAN CONCRETE Materials for Life
CALPORTLAND

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Next Steps

Requesting RES support to increase usage of Tool

- We will house the tool on the NRMCA website
  - https://www.nrmca.org/association-resources/research-and-engineering/
- Requesting feedback from producers on implementing/using tool and value
- Develop process for updates (future DIL assignment?) – new team ownership
  - Inclusion of treating and reselling returned concrete (ASTM C 1798)
  - Carbon tracking/calculator
- Create promotional campaign – Supporting Usage of Tool
  - Email to NRMCA Members with link to Tool
  - Hold web session(s) for training on Tool and inputs
  - Additional training session at 2025 Concrete Works

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2024 Quality Award winners

- 82% of 51 applications got awards
- Enews, news release, posted on the NRMCA website
- Recognition at Awards Lunch

Issues

- 1.5 & 1.7 – quantifiable objectives and measurement
- 4.6 – scale check – not consistent with C94
- 5.1 – cement QC – many are sending mill test report
- 6.3 – performance tests other than strength – not clear
- 7.4 – Quality audit – Do we need to develop a checklist?

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2024 Quality Award winners

- Anderson Concrete Corporation
- Bayou Concrete LLC, Florida
- Bayou Concrete, LLC, Mississippi-Alabama
- Buckeye Ready-Mix, LLC
- BURNCO Colorado
- CalPortland Company, Arizona Division
- CalPortland Company, Central Coast Division
- CalPortland Company, Central Valley Division
- CalPortland Company, Nevada Division
- Glacier Northwest, CalPortland Company, Oregon/SW Washington Division
- CalPortland Company, San Diego Division
- CalPortland Company, Southern California Ready Mix Division
- CalPortland Company, Washington Division
- CEMEX Florida Region
- CEMEX, Ready Mix Division San Francisco Bay Area
- Cemstone Concrete Materials
- Cemstone Products Company
- Cemstone Ready Mix
- Chandler Concrete Co., LLC
- Concrete Supply Co., LLC
- Irving Materials Inc., Indiana Division
- Irving Materials Inc., Kentucky Division
- Irving Materials Inc., Ohio Division
- Irving Materials Inc., Tennessee Division
- Lyman-Richey Corporation, A CRH Company
- Martin Marietta - Southwest Division
- Maschmeyer Concrete
- MMC Materials, Inc., Central Area
- MMC Materials, Inc. Delta Area
- MMC Materials, Inc. Hattiesburg Area
- MMC Materials Inc., Memphis/North MS Area
- Preferred Materials, Inc a CRH company
- Quality Concrete
- S&W Ready Mix
- Thomas Concrete, Inc. Atlanta Division
- Thomas Concrete, Inc. Charlotte Division
- Thomas Concrete, Inc. Coastal Division
- Thomas Concrete, Inc. Raleigh Division
- Thomas Concrete, Inc. Upstate Division
- Titan Florida LLC
- Titan Virginia Ready Mix LLC
- VCNA Prairie Materials

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Task Groups

- Publications
- Plant Certification
- Research
- Standards

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Publications

- TIPs
- CIPs
- QC Guide
- Other resources for members and other users

Evaluation of Cementitious Materials

- Broad suggested evaluation
  - Mill Test report
  - Uniformity of source
  - Additional Testing (external)
  - Internal Testing
    - Cement
    - Mortar
    - Concrete
- Review Suggestions
  - Focus on PLC - broaden scope
    - All cement and SCM?
  - Concise – remove procedures?
  - Identify CM properties to issues with concrete?
  - Develop an evaluation summary with pointers to detail

Publications - TIPs

1. Quantifying Concrete Quality
2. Establishing the Required Average Strength, f'_{cr}, of Concrete Mixtures
3. Aggregate Sampling for Laboratory Tests
4. Aggregate Sample Reduction for Laboratory Tests
5. Capping Cylindrical Concrete Specimens with Sulfur Mortars and Unbonded Caps
6. Aggregate Moisture and Making Adjustments to Concrete Mixtures
7. Creating and Using Three Point Curves for Laboratory Trial Batches
8. Concrete Yield
9. Density of Structural Lightweight Concrete
10. Mixing Water Quality for Concrete
11. Testing Concrete Cores
12. Slump Loss of Concrete
13. Chloride Limits in Concrete
14. Time of Setting of Concrete Mixtures
15. Estimating Concrete Strength using Maturity
16. Evaluating Strength Test Results
17. Drying Shrinkage of Concrete
18. Managing Concrete Temperature for Specified Requirements
19. Reuse of Returned Concrete
20. Understanding Variability of Test Methods—Precision Statements
21. Lower Embodied Carbon in Concrete
22. Designing and Producing High Strength and High Modulus Concrete
23. Establishing Required Average for Specified Properties
24. Permeability of Concrete

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Publications – TIPs – in progress

- Revise TIP 7 – Trial Batches (waiting on ACI 211)
- Making trial batches in the laboratory (C192) – Luce / Lobo
- Managing Air Content – Harris / Obla
- Admixture compatibility (C1753), ??
- Mixtures for Sulfate Resistance – Obla draft, ballot in Fall

- Other topics? – ASR – summarize ASTM C1778? examples

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Publications - CIPs

1. Dusting Concrete Surfaces
2. Scaling Concrete Surfaces
3. Crazing Concrete Surfaces
4. Cracking Concrete Surfaces
5. Plastic Shrinkage Cracking
6. Joints in Concrete Slabs on Grade
7. Cracks in Residential Basement Walls
8. Discrepancies in Yield
9. Low Concrete Cylinder Strength
10. Strength of In-Place Concrete
11. Curing In-Place Concrete
12. Hot Weather Concreting
13. Blisters on Concrete Slabs
14. Finishing Concrete Flatwork
15. Chemical Admixtures for Concrete
16. Flexural Strength of Concrete
17. Flowable Fill
18. Radon Resistant Buildings
19. Curling of Concrete Slabs
20. Delamination of Troweled Concrete Surfaces
21. Loss of Air Content in Pumped Concrete
22. Grout
23. Discoloration
24. Synthetic Fibers for Concrete
25. Corrosion of Steel in Concrete
26. Jobsite Addition of Water
27. Cold Weather Concreting
28. Concrete Slab Moisture
29. Vapor Retarders Under Slabs on Grade
30. Supplementary Cementitious Materials
31. Ordering Ready Mixed Concrete
32. Concrete Pre-Construction Conference
33. High Strength Concrete
34. Making Concrete Cylinders in the Field
35. Testing Compressive Strength of Concrete
36. Structural Lightweight Concrete
37. Self Consolidating Concrete (SCC)
38. Pervious Concrete
39. Maturity Methods to Estimate Concrete Strength
40. Aggregate Popouts
41. Acceptance Testing of Concrete
42. Thermal Cracking of Concrete
43. Alkali Aggregate Reactions (AAR)
44. Durability Requirements for Concrete
45. Portland Limestone Cement
46. Environmental Product Declarations

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Publications – CIPs

New topics

- Other???

Needs revision

- Thermal Cracking of concrete (2009)
- Durability Requirements (ACI 318-25)

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Website Q&A – Uploaded Fall 24

Acceptance Testing

1. What are the requirements in industry standards for obtaining samples for acceptance testing of concrete?
2. For strength specimens what is standard curing and why should this be done?
3. What is field curing and when is it used?
4. When should you investigate low strength test results?
5. How do you investigate low strength test results?
6. What are the acceptance criteria for core tests?
7. What does the ACI standards say about distribution of test result?
8. What are the ACI 318 and 301 requirements for third party acceptance testing?

Specifying

1. Can you add water to a truck at the jobsite?
2. Can recycled water and non-potable water be used to make concrete?
3. Is it appropriate to specify a minimum cement content?
4. When should a maximum w/cm be specified?
5. Should maximum limits on SCM content be specified?
6. How should I specify to prevent problems related to ASR?

Sustainability

1. What is low carbon concrete?
2. How to specify low-carbon concrete?

CONCRETEWORKS

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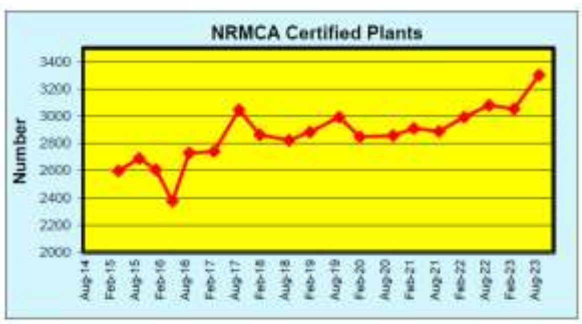
Plant Certification

Status of NRMCA Plant & Truck Certification Program Mar-24

State	Plants	State	Plants		
AK	13	NC	255	Currently Certified Plants	3,301
AL	138	ND	52		
AR	10	NE	79	Currently Certified Trucks	
AZ	23	NH	0	Apr-12	16,294
CA	248	NJ	1	Sep-12	16,247
CO	29	NM	32	Apr-13	17,367
CT	31	NV	48	Sep-13	17,363
DC	5	NY	56	Apr-14	18,386
DE	6	OH	17	Sep-14	18,377
FL	32	OK	34	Apr-15	19,513
GA	17	OR	32	Sep-15	19,062
HI	12	PA	15	Jan-16	20,256
IA	4	PR	11	May-16	18,990
ID	39	RI	5	Sep-16	20,214
IL	51	SC	128	Mar-17	18,991
IN	60	SD	2	Sep-17	20,751
KS	29	TN	102	Sep-18	20,447
KY	26	TX	392	Feb-19	19,592
LA	28	UT	91	Sep-19	20,457
MA	23	VA	122	Feb-20	20,742
MD	30	VI	3	Mar-21	22,624
ME	0	VT	2	Sep-21	20,257
MI	190	WA	120	Mar-22	20,022
MN	1	WI	37	Sep-22	21,639
MO	13	WV	3	Mar-23	20,422
MS	73	WY	4	Sep-23	[illegible]
MT	8	Non US	264	Mar-24	20,847



CONCRETEWORKS

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Plant Cert

- Processing is within set goals – regular is a bit behind – tech issues
- Inspector/assistant approval – online process
- Distribution by email (pdf)
  - Truck Cards (Mar 24)
  - Certificates for plants (in transition) – PE sign and seal
- Other issues
  - Contract trucks – inspected by approved PE (Option B)
  - Precast plants – issue certificate with statement (no ticket)
  - Site plants without delivery vehicles – Issue with statement (no certified trucks)

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Research TG

- Scope
  - Maintain concrete materials research needs topics and concept proposals form
  - Review concept proposals twice/year and recommend to Foundation advisory group
  - Assist researcher as needed
- Research priority topics updated - in the agenda package

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Standards TG

- Scope
  - Proactive changes to standards (ACI, ASTM)
  - Review proposed changes / decide to support
- Activity
  - Proposed revisions to
    - MasterSpec Sec 033000
    - Review revised Guidance doc accompanying spec
  - What other issues should be addressed?

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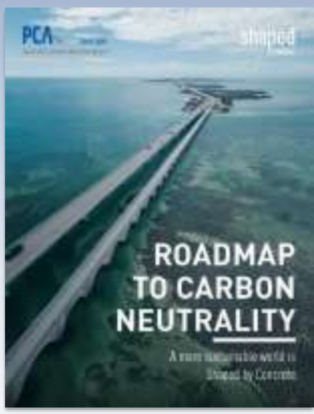
PCA Activities

Subtitle

105

Roadmap to Carbon Neutrality



Third Anniversary- Oct 24
- Alternative Fuels
- CCUS
- Blended Cements

ROADMAP TO CARBON NEUTRALITY
Portland Cement Association

PCA

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PS&T Activities- Blended Cements Subcommittee

Blended Cement as a Share of Total Cement - US

ROADMAP TO CARBON NEUTRALITY
Portland Cement Association

PCA

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PS&T Activities- ASTM C150/C595 TG and JAAHTG

Proposals for ASTM C595/AASHTO M 240 that are being balloted at the main committee:

- **A modification of alkali reporting requirements (to support changes published in ASTM C1293 and ASTM C1778)**
- **A revision to refer to 'coal ash' rather than 'fly ash'**

ROADMAP TO CARBON NEUTRALITY
Portland Cement Association

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PS&T Activities- ASTM C150/C595 TG and JAAHTG

Proposals balloted at ASTM C01.10 and anticipated for AASHTO TS 3a balloting in 2025:

- **Modifications to the LOI limits for Type IP cements and natural pozzolan constituents**
- **Revisions to Type IT cement requirements**
- **Defining a new "Type IC" composite cement**

ROADMAP TO CARBON NEUTRALITY
Portland Cement Association

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Roadmap to Carbon Neutrality

ROADMAP TO CARBON NEUTRALITY
Portland Cement Association

PCA

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Celebrating 100 Years of Concrete Knowledge

- 100 Years Old!!!
- 17th edition is Available in Hard Copy
- Retail Price: $149
- 4th printing October 2024
- Date/printing history on page ii
- eBook no longer available

ROADMAP TO CARBON NEUTRALITY
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PCA

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Concrete Advancement Foundation

- Project 24-03: Using Resistivity Test Results for Service Life Prediction
  - NRMCA - $60,000 over 24 months
- Project 24-05: A New Approach to Strength Acceptance Criteria for Low Carbon Concrete Mixtures
  - NRMCA - $30,000 over 10 months
- Project 24-07: Examining the Abrasion and Carbonation Resistance of Portland Limestone Cement (PLC) Systems for Industrial Floors,
  - Temple U. - $53,478 over 15 months (PCA Foundation support)

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Concrete Advancement Foundation

MIT

- Mix optimization – characterizing reactivity of materials
  - Supports evaluation of novel materials
- Support Testing Task Group
  - Quantify carbon impact of overdesign
- Supporting several policy initiatives on sustainability

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Tech Education

- Short Course
  - OK - Feb 5 – 9, 2024
  - MD – Sep 9 – 13, 2024
  - Regional 2025 – Feb – location TBD

Location	Date	Attendees	NRMCA Level 2			NRMCA Level 3			Certifications	
			Attempted	Passed	Passed %	Attempted	Passed	Passed %	Level 2	Level 3
Oklahoma City, OK	Feb 5-9, 2024	49	48	25	52%	46	25	54%	25	22
Columbia, MD	Sep 9-13, 2024	53	53	28	53%	50	23	46%	28	21
					64%			48%		

- Durability
  - Milwaukee – May 8 – 10, 2024
  - OK – Nov 20 – 22, 2024

Location and Date	Date	Attendees	Level 4 Exam			Certifications
			Attempted	Passed	Passed %	Level 4
Online	Dec 11-18, 2023	35	31	24	77%	18
Milwaukee, WI	May 8-10, 2024	20	19	12	63%	5
		542			75%	276

- Specs (26 offerings, 1030 att)
  - 2025
- Quality (18 offerings, 670 att)
  - Kansas City, Sept 2024

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2025 Richard D. Gaynor Award

- Nomination for 2024
- Other nominations?
- Vote to approve nominee

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- Other Business

- Next Meeting
  - NRMCA Annual Convention: Mar 4 - 7, 2025
  - JW Marriott Tucson Starr Pass Resort & Spa
    - Tucson, AZ
  - RES meeting TBD

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Adjourn

- Motion to adjourn

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