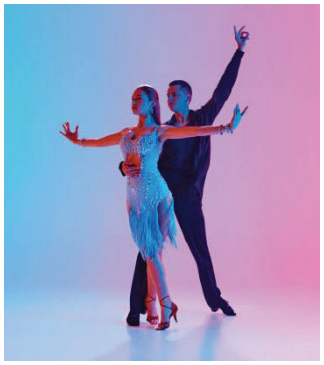
MASTER® BUILDERS SOLUTIONS



How Can Admixtures Support Cement Changes

Tony Schlagbaum

March 11, 2026

ASCC Survey

- February 2024 Survey - specific to slab construction
- 173 respondents primarily from the U.S.
- Cement Producers, Owners, Architects/Engineers, Concrete Producers, Gen. Contractors, Testing Labs, Admix Suppliers, Concrete Contractors

Question 6: If you used Type IL cement concrete, did you experience any problems? If so, did they occur at a greater, the same, or at a lower frequency than with Type I cement concrete?

n=173

Profession	The Same Frequency, %	Lower Frequency, %	Higher Frequency, %
Owner	20	0	80
Architect/Eng.	47	0	53
Testing Lab	40	0	60
GC	40	0	60
Concrete Contractor	26	2	72
Concrete Producer	60	2	38
Admix Supplier	11	0	89
Cement Producer	86	0	14
Other	30	0	70

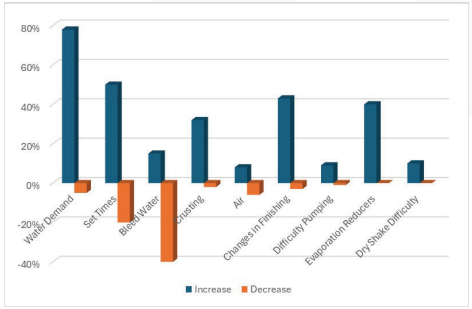
ASCC Survey - Primary Challenges

- Compared to OPC did you experience any of the following when using PLC, an increase or a decrease in a) water demand, b) set times, c) bleed water, d) crusting, e) air content, f) finishing, g) pumping, h) evaporations retarders, i) dry shakes

Focus on:

- Placement - Bleed/Finishing/Workability
- Strength
- Set Times/Workability Retention

Separate question on strength identified early and late age differences



Low Carbon Concrete Example

MN Buy Clean

Please note: materials/products for which GWP limits are not set per this table still require EPDs but are not bound by GWP limits at this time.

Material Category[1]			Maximum Allowable GWP Limit (kgCO2e per unit)
Ready-Mix Concrete[2] (kgCO2e/m3) based on concrete compressive strength	Normal-Weight concrete (NW)	≤2500 psi	241
		3000 psi	264
		4000 psi	312
		5000 psi	372
		6000 psi	394
		8000 psi	460
	Lightweight concrete (LW)	3000 psi	487
		4000 psi	537
		5000 psi	591
	Add 30% to these GWP limits where high early strength[3] concrete mixes are required for technical reasons.		
Concrete Masonry Units (CMU)			TBD[4]
Precast / Prestressed Concrete			TBD[4]

For concrete strengths between the stated values, use linear interpolation to determine GWP limits, rounded to the nearest whole number.

1. Only permanently installed materials must be considered.
2. **(a)** GWP values shown are categorized by 28-day concrete compressive strengths (psi) and based on NRMCA's North Central Regional Baseline published in NRMCA's National and Regional LCA Benchmark Report v3.2 (2022).

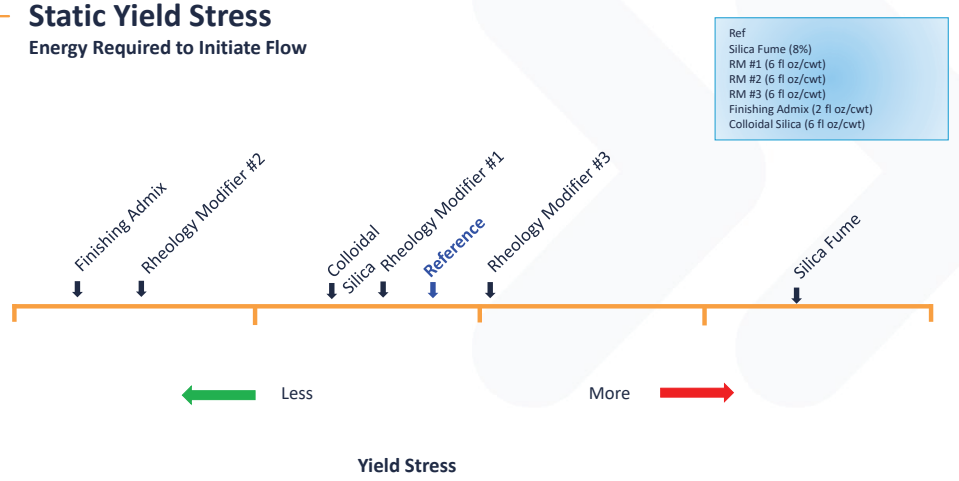
   (b) Limits shown **do not apply to concrete pavement mix designs.** GWP limits specific to concrete pavement applications will be developed at a later date, taking into account other factors, aside from concrete compressive strength, including but not limited to permeability, workability, smoothness, and functional application which may warrant creation of additional concrete subclassifications unique to pavement.

   (c) Portable/mobile batch plants need not meet the GWP limits shown, but are encouraged to submit material EPD data following the recommendations included in the current PCR "NSF PCR for Concrete v2.3 – 2024 Extension" (NSF 1112-19 with 2024 deviation). Portable batch plant requirements may be revised to align with future PCR or industry updates.
3. "High early strength" is concrete that, through the use of additional cement, high-early-strength cement, or admixtures, has accelerated early-age strength development. High early strength concrete produced using additional cement should be avoided where possible, due to its higher embodied carbon. An affected project delivery team must submit documentation from the Structural Engineer of Record (SEOR) on whether high early strength concrete is necessary for technical reasons, and obtain written approval from the Department of Administration or Department of Transportation prior to procurement. This 30% allowance reflects input from building sustainability experts, general contractors, engineers, and ready-mix or cement producers.
4. Lack of data at this time. It is anticipated that limits will be set for these materials once data availability and accuracy improve. Please note: Items (mixtures, materials, products) for which GWP limits are not set per this table still require EPDs but are not bound by GWP limits at this time.

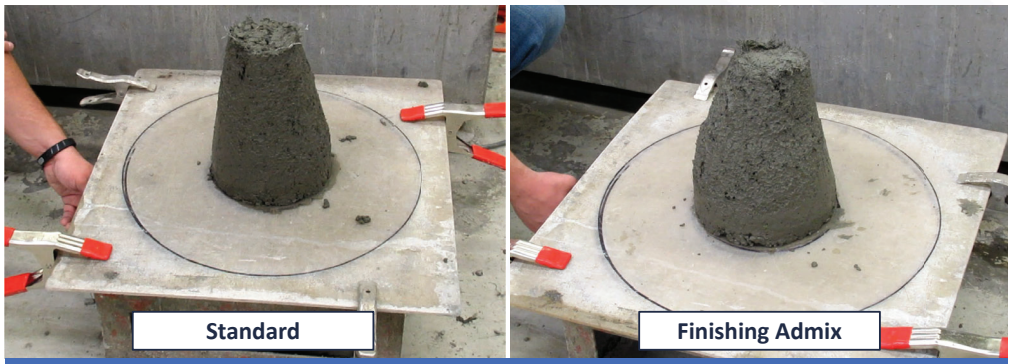
Concrete Placement

Static Yield Stress

Energy Required to Initiate Flow



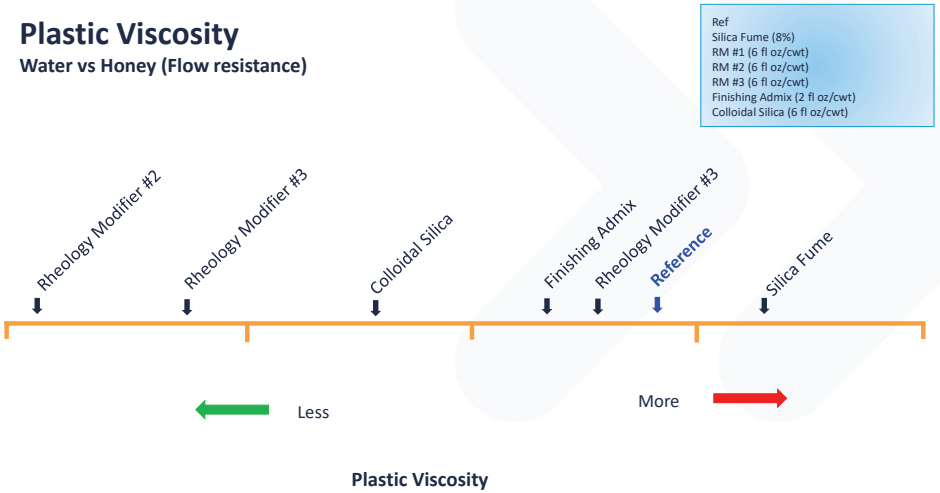
Easier to Place and Finish



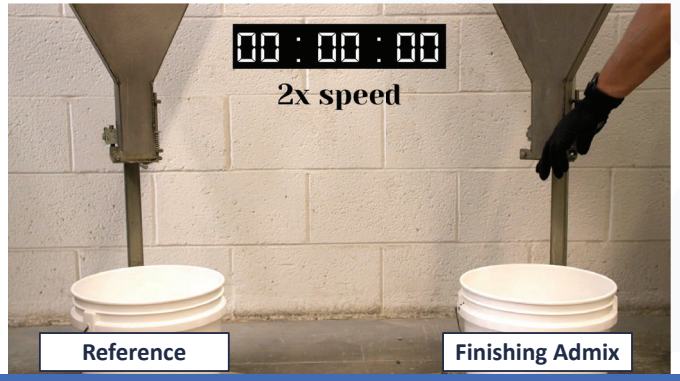
Less energy and effort needed to handle concrete.

Plastic Viscosity

Water vs Honey (Flow resistance)

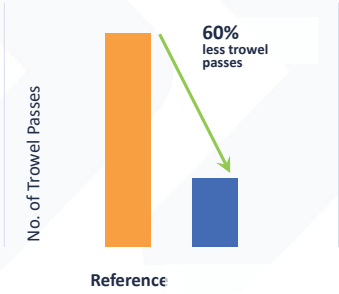


Faster Flow & Discharge



Reduced viscosity, stickiness and harshness.

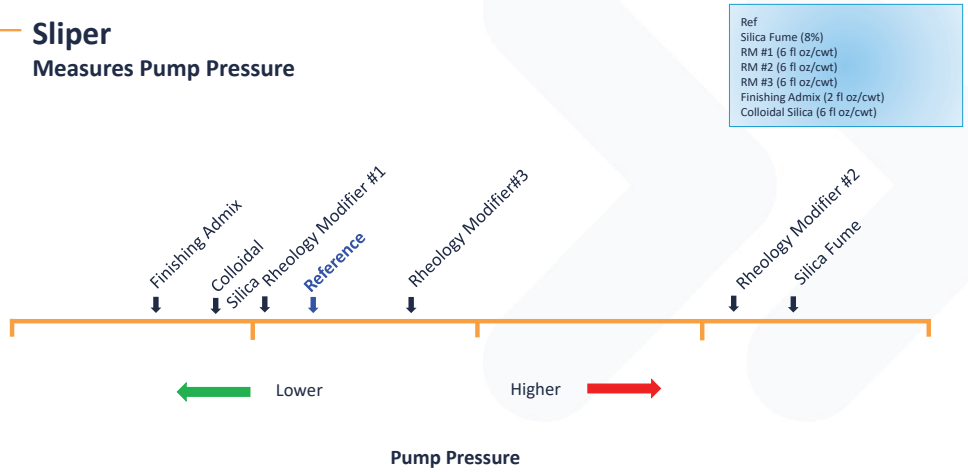
Faster and Easier Finishing



Labor/Effort Reduction

Sliper

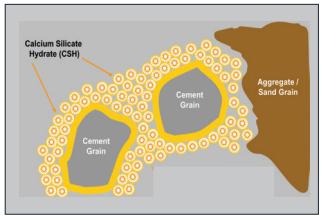
Measures Pump Pressure



Strength Development

Strength Enhancers:

Launched in N. America in 2018



Benefits:

- Increase 28-day normally by 5-15%
- Early age strengths can be substantially more
- Accelerate construction schedule
- Reduce cementitious content
  - Meet sustainability GWP challenges

Year of use	Approx. GWP reduction vs. baseline
Year 1	~10%
Year 2	~15%
Year 3	~25%
Year 4	~35%

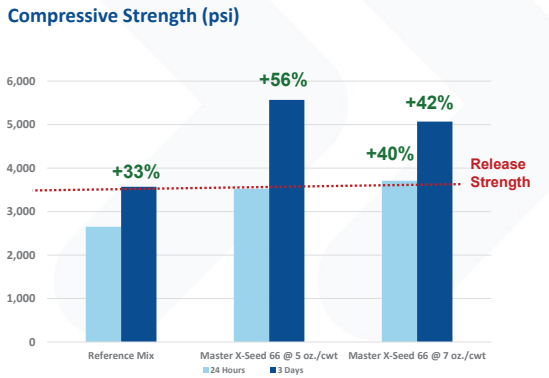
Producer Comments : (Results rounded to the nearest 5%):

- We were using Type IL cement with fly ash
  - That pairing, with CSH Seeds, enabled the reductions above while cutting total cementitious by roughly 20–30%.
  - Better results likely with slag

Strength Enhancers

CSH Seeding in Post Tension

- Post tension earlier
- Insurance against job delays
- Lower Vibration Energy – Easier on Equipment
  - Incorporates finishing admix

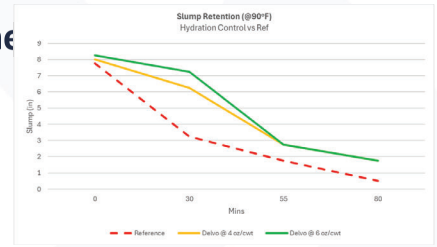


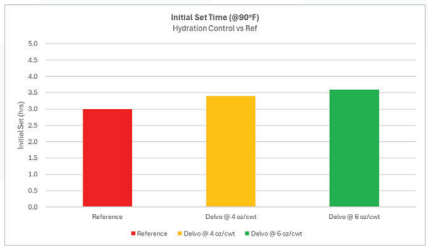
Workability Retention and Set Times

Slump Retention and Set Time

Hydration Control Admixtures

- Rapid slump loss observed at 90ºF
- Hydration control admixtures provide additional workability retention with limited set time effect

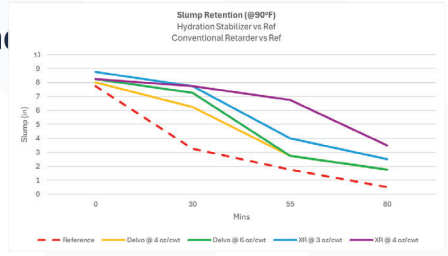


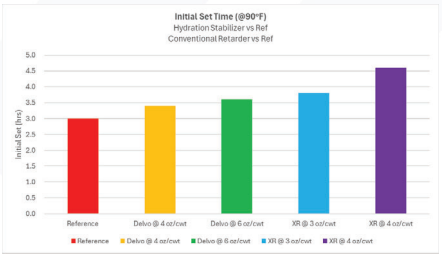


Slump Retention and Set Time

Conventional Retarders

- Rapid slump loss observed at 90°F
- Hydration control admixtures provide add'l workability retention with limited set time effect
- Conventional retarders improve workability retention but with additional set retardation

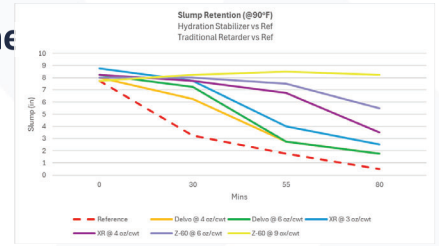


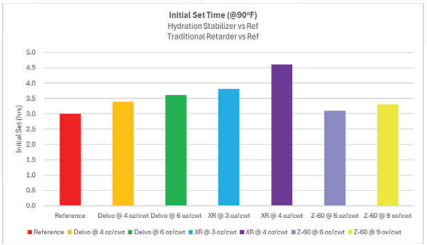


Slump Retention and Set Time

Workability Retaining Admixture

- Rapid slump loss observed at 90°F
- Hydration control admixtures provide some workability retention with limited set time effect
- Conventional retarders improve workability retention but with additional set retardation
- The slump retaining admixtures can provide very good workability retention with minimal set time effect





ACI 305 – Hot Weather Concreting

Typical Effects of Weather Conditions on Concrete During and After Finishing:

Evaporation will increase by 300%

Rules of Thumb

- If air temperature & humidity stays the same with wind speed increase from 5-20 mph (8-32 km/h)
- If humidity & wind stays the same with air temperature change from 60 - 90 ºF (16-32 ºC)
- If air temperature & wind remain the same with humidity decrease from 90 - 70%
- Combination of all the above - evaporation will increase by 900%

Concrete Now App

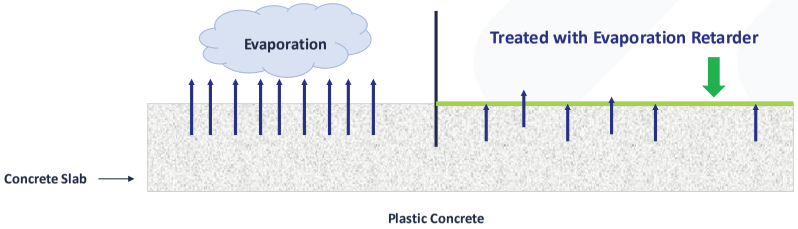
Evaporation Retarder

- Application: immediately after screeding or between finishing operations (as needed)

- ❖ Not a finishing aid – mist, do not pond and finish
- ❖ Not a curing compound

Benefits:

- ✓ Eliminates need for added water - compensate for rapid evaporation
- ✓ Provides additional time for finishing process
- ✓ Air-entrained concrete possible in rapid-drying conditions
- ✓ Reduces plastic shrinkage cracking in slabs and pavements



Concrete Curing is Critical !!!

The Benefits of Properly Cured Concrete are Significant

- **Maximized Hydration Process:** Proper curing leads to improved strength and abrasion resistance. Adequate moisture retention during curing ensures optimal cement hydration, resulting in a denser and stronger concrete matrix.
- **Enhanced Durability and Service Life:** By maintaining adequate moisture levels, curing minimizes the risk of surface deterioration and surface degradation over time. This results in concrete that withstands environmental stresses.
- **Decreased Permeability:** Curing is crucial for enhancing concretes resistance to water penetration and chemical ingress.
- **Surface Defect Prevention:** By preventing rapid moisture loss and temperature differentials, proper curing significantly reduces the potential for surface defects such as scaling and mortar flaking.

Follow ACI 308 Guidelines

- Curing Compounds
- Sprinkling/Fog Spraying
- Wet Burlap
- Ponding
- Plastic Sheeting/Reinforced Paper

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Thank You!

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