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CIVIL AND ENVIRONMENTAL ENGINEERING

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Concrete Construction Recap: Placement, Sampling, and Early Findings

Cells 5, 7, and 9: Construction on September 16, 2025

(CalPortland High-Performance Ternary Blend (IT(L10)(P10)HS) (HPT), Fortera reactive calcium carbonate (ReAct), KMI natural pozzolan (Zeolite)

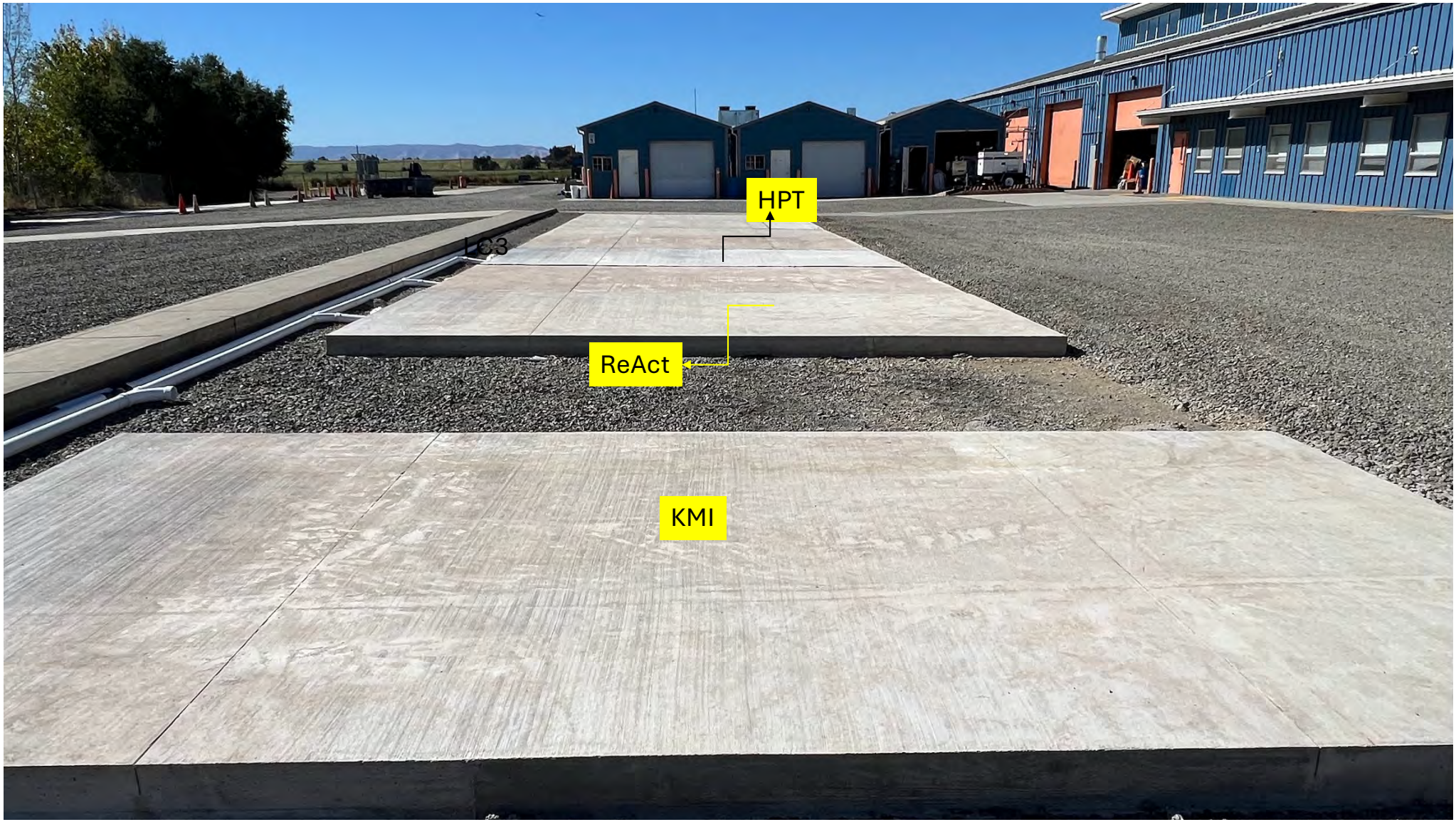
October 2025

Mix Proportions (Batch Size: 6.75 cy)

Item	Units	CEL 5 TR 1-HPT	CEL 5 TR 2-HPT	CEL 7-ReAct	CEL 9-KMI
Batching date-time Ambient temperature	- °F	9/16-6:38 AM 58	9/16-8:52 AM 75	9/16-10:57 AM 79	9/16-1:20 PM 90
Test material		Blended cement: Type IT(L10)(P10)HS		Reactive Calcium Carbonate	Zeolite natural pozzolan
Cement	lb/batch (lb/cy)	3982.5 (590)	3,982.5 (590)	1,595 (236)	3180 (472)
Slag (50%)	lb/batch (lb/cy)	-	-	1,994 (295)	-
Other SCM	lb/batch	-	-	399 (10% ReAct)	795 (20% KMI)
Batched Water	gal/batch (gal/cy)	209.9 (31.1)	212.8 (31.5)	209.8 (31.1)	221.4 (32.8)
Added extra water	gal/batch (gal/cy)	32 (4.74)	14 (2.1)	25 (3.7)	20 (3)
Total water	gal/batch (gal/cy)	241.9 (35.84)	226.8 (33.6)	234.8 (34.8)	241.4 (35.7)
Coarse Aggregate	lb/batch	10,600	10,600	10,580	10,580
Int. Aggregate	lb/batch	1,920	1,920	1,920	1,940
Fine Aggregate	lb/batch	8,780	8,800	9,180	8,660
Type A WR, Type B RA, and Type D RA&WR	oz/cwt	4.6	4.8	3	4.8
Initial PCE Type A WR and Type F HRWR	oz/cwt	3	4	3	0
Extra PCE Type A WR and Type F HRWR	oz/cwt	4.5	1.5	6	3
Total PCE Type A WR and Type F HRWR	oz/cwt	7.5	5.5	9	3
Type S SRA	oz/cwt (gal/cy)	32.5 (1.5)	32.5 (1.5)	-	21.7 (1)
Type B RA and Type D RA&WR	oz/cwt	-	-	1	2

RA: retarding admixture
WR: water reducer
HRWR: high-range water reducer

RA&WR: retarder and water reducer
SRA: shrinkage-reducing admixture
PCE: Polycarboxylate Ether-based admixture


HPT
ReAct
KMI

CEL 7 (ReAct)

- Batching started at 10:57 AM
- The truck arrived at the site at 11:40 AM
- The ambient temperature at the site was 81°F
- To achieve the desired slump:
  - 25 gal of water and 6 oz/cwt of HRWR were added to the truck
- Initial slump: 5.25in.
- Discharge started at 11:52 AM

Constructability – CEL 7 (ReAct)

Constructability – CEL 7 (ReAct)

Constructability – CEL 7 (ReAct)

Constructability – CEL 7 (ReAct)

Finishability – CEL 7 (ReAct)

- Finishing started at 12:01 PM
- Ambient temp was 82°F
- A small amount of water is being sprayed during placement due to significant slump loss at the end of the placement

Finishability – CEL 7 (ReAct)

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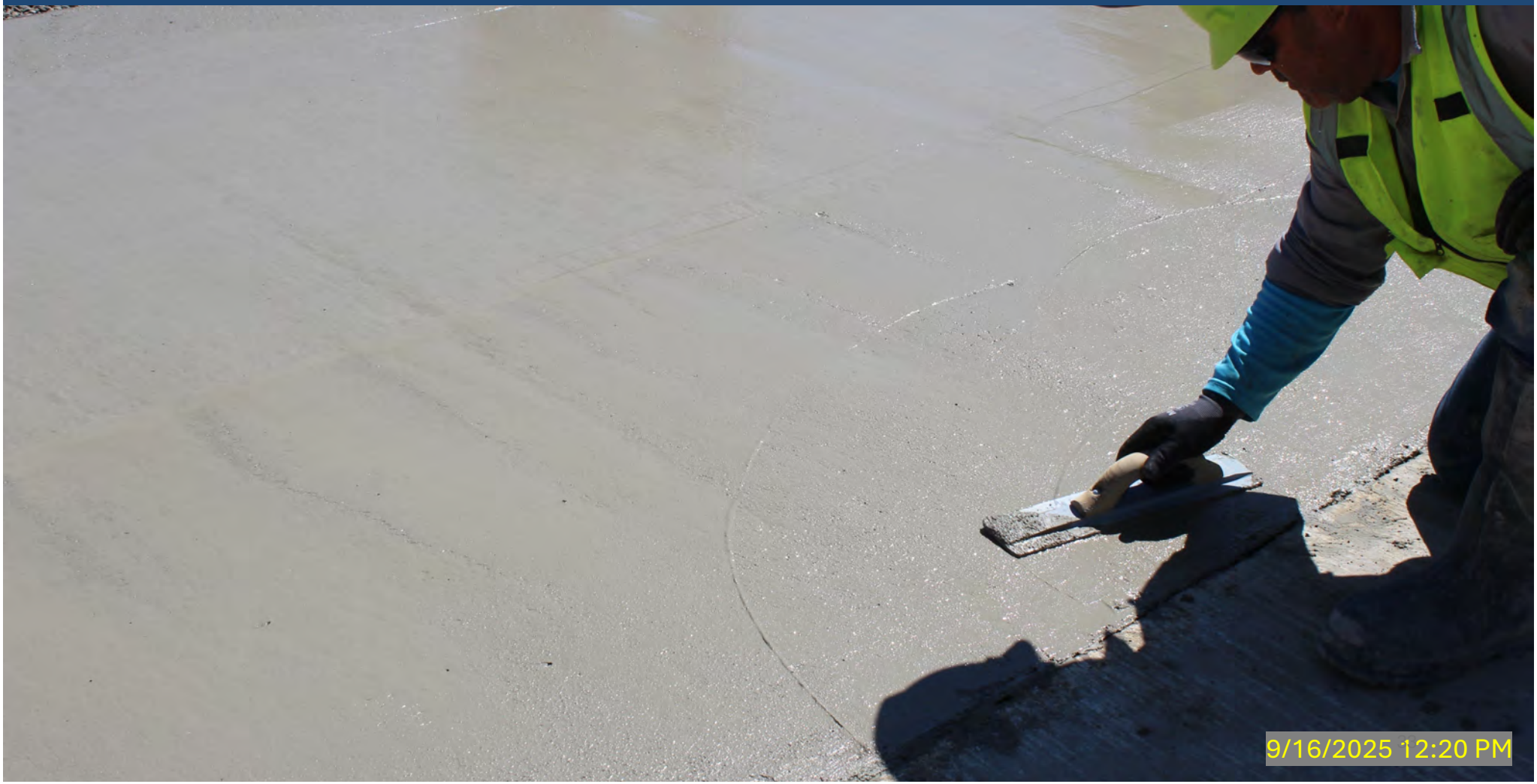
Finishability – CEL 7 (ReAct)



Finishability – CEL 7 (ReAct)

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Finishability – CEL 7 (ReAct)

- Slabs covered with wet burlap cover and then sealed with a plastic sheet at 3:30 PM

Plastic Concrete Test Results

- Slump: ASTM C143, Air Content: ASTM C231, Unit weight: ASTM C138
- Bleed rate: ASTM C232

Property	Unit	CEL 5 TR 1	CEL 5 TR 2	CEL 7	CEL 9
Temperature during slump test	°F	84.2	82.2	87.8	89.6
Initial slump (before discharge)	inch	1.75	None	5.25	8
Final slump (run on sample taken from middle of truck discharge)	inch	6.5	6.25	1	5.5
Air Content	%	Not measured	2	2	1.4
Unit Weight	lb/ft^3	Not measured	149.1	150.3	148.7
Bleed rate	$lb/ft^2/hr$	Not measured	0	0	0

Plastic Concrete Test Results

Property	Unit	CEL 5 TR 2	CEL 7	CEL 9
Initial Set Time of the sample	h:m (min) since batching time at the plant	4:22 (262)	2:50 (170)	3:17 (197)
Final Set Time of the sample	h:m (min)	5:26 (326)	4:12 (252)	4:21 (261)
Initial Set Maturity	°F-min	13,424	9271	11,798
Final Set Maturity	°F-min	17,273	14,202	17,053
Initial Set Time of the slab	h:m (min)	3:59 (239)	2:47 (167)	3:11 (191)
Final Set Time of the slab	h:m (min)	4:57 (297)	4:01 (241)	4:30 (270)
Start of Saw Cutting Window: =1.3 x final set time at target maturity + 30 min	h:m (since final set time)	7:05	5:52	6:30
Saw Cutting Time	h:m	7:00 AM*	7:20 AM*	7:40 AM*

*following day

Why Trial Batching Matters: Moisture & w/c Ratio Verification are Needed

- Allows finalizing the mixing procedure, including water and admixtures
- Verify sand moisture content with the burn method; not relying solely on the sensor
- Observation (supersack discharge method):
  - Higher w/c (furnace-measured) → higher slump and better workability
- Verifying w/c ensures enough water for uniform mixing throughout the load

Cell / Truck	Measured w/c (furnace test)	Calculated w/c (batch records)
Cell 5 (slump=6.5in.)	0.52	0.50
Cell 7 (slump= 3 in.)	0.53	0.51
Cell 9-Truck 1 (dry mi: Slump= 2 in.)	0.50	0.50
Cell 9 -Truck 2 (slump = 5in.)	0.57	0.51

= Lower measured w/c than calculated (low water / poor workability)
= Higher measured w/c than calculated (more water / better workability)

w/c Verification Results: What They Reveal About Mixing & Workability

Cell / Truck	Measured w/c (furnace test)	Calculated w/c (batch records)	Comments/ Observations
Cell 5 Truck 1 (End-Sample 1)	0.54	0.54	• Lower w/c than calculated → poor mixing / drum residue
Cell 5 Truck 1 (End-Sample 2)	0.53	0.54	
Cell 5 TR 2 (Start)	0.55	0.50	• Higher measured w/c → uniform mixing + water availability
Cell 5 TR 2 (Middle)	0.58	0.50	
Cell 7 (Start)	0.47	0.50	Slump loss tied to lower available water across the batch
Cell 7 (Middle)	0.50	0.50	
Cell 7 (End-Sample 1)	0.55	0.50	
Cell 7 (End-Sample 2)	0.50	0.50	
Cell 9 (Start)	0.55	0.53	• Higher measured w/c → uniform mixing + water availability
Cell 9 (Middle)	0.59	0.53	
Cell 9 (End-Sample 1)	0.55	0.53	
Cell 9 (End-Sample 2)	0.58	0.53	

■ = Lower measured w/c than calculated (low water / poor workability)
■ = Higher measured w/c than calculated (more water / better workability)

w/c Ratio Verification Insights-Trial batch day (Sep 15)

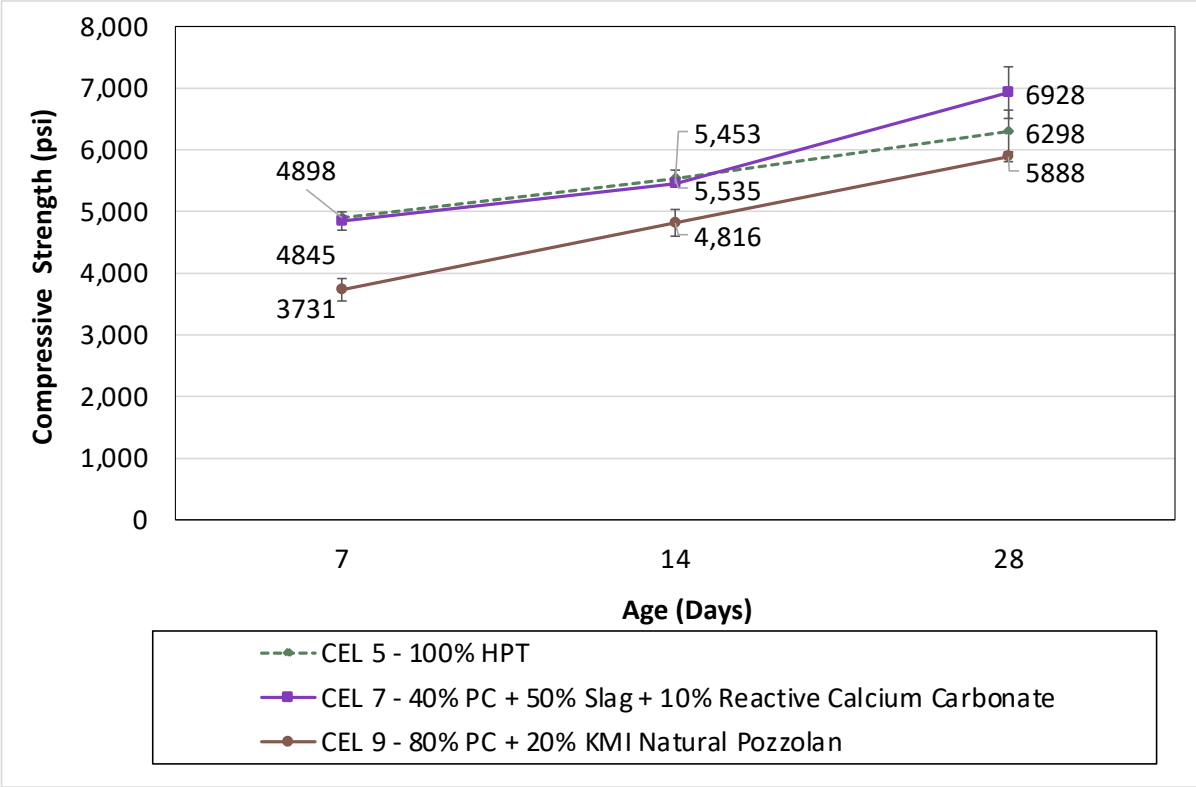
Cell / Truck	w/c based on mass loss in furnace at 600 ℃	Calculated w/c based on recorded water and admix
HPT-Truck 1 (slump=6.5in.)	0.52	0.50
ReAct Fortera (good-slump= 2.75in.)	0.53	0.51
KMI-Truck 1 (dry mix-Slump= 2 in.)	0.50	0.50
KMI-Truck 2 (good batch=slump = 5in.)	0.57	0.51

- A similar trend is observed in the results of the trial batch day:
  - Mixes with higher measured w/c ratios (determined by the furnace method) produced more workable mixes with higher slump.

- Verifying w/c ratios is important to ensure adequate upfront water and uniform mixing throughout the batch.

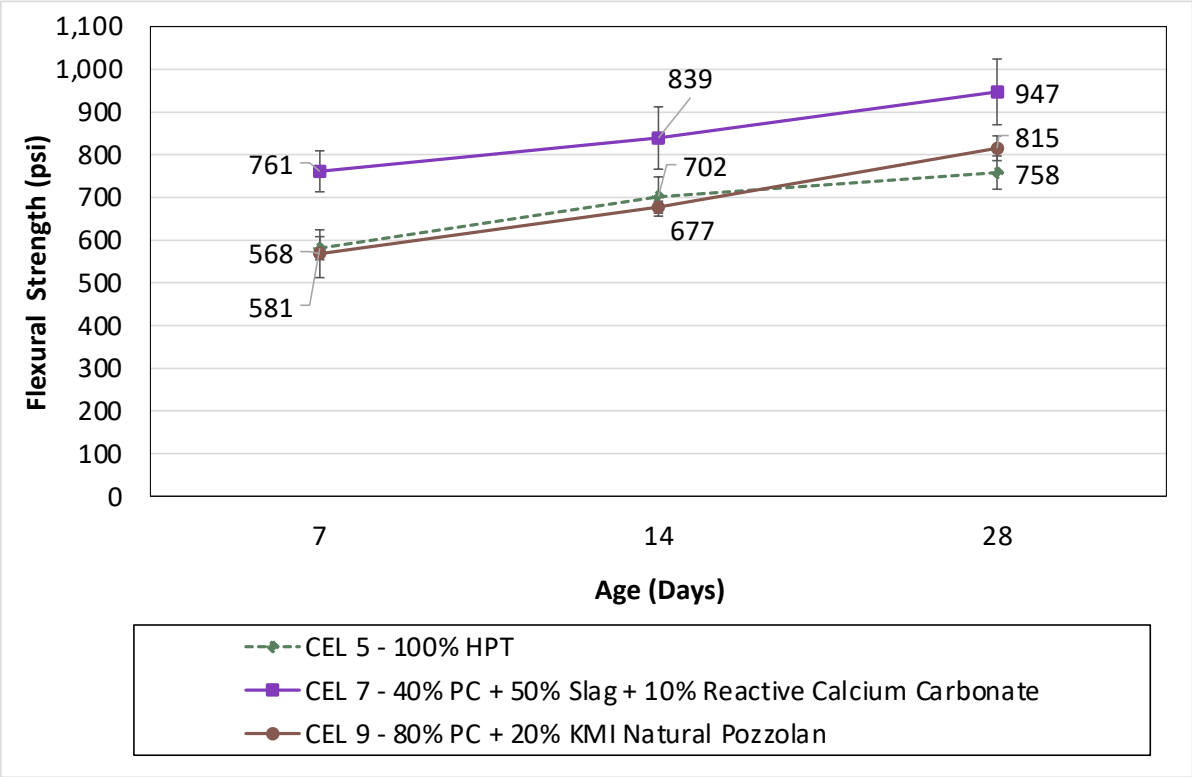
Compressive Strength Test Results

- Compressive strength increased across all mixes from 7 to 28 days, more rapid strength development for KMI.
- By 28 days, all three mixes had a strength of nearly 6,000 psi or greater.



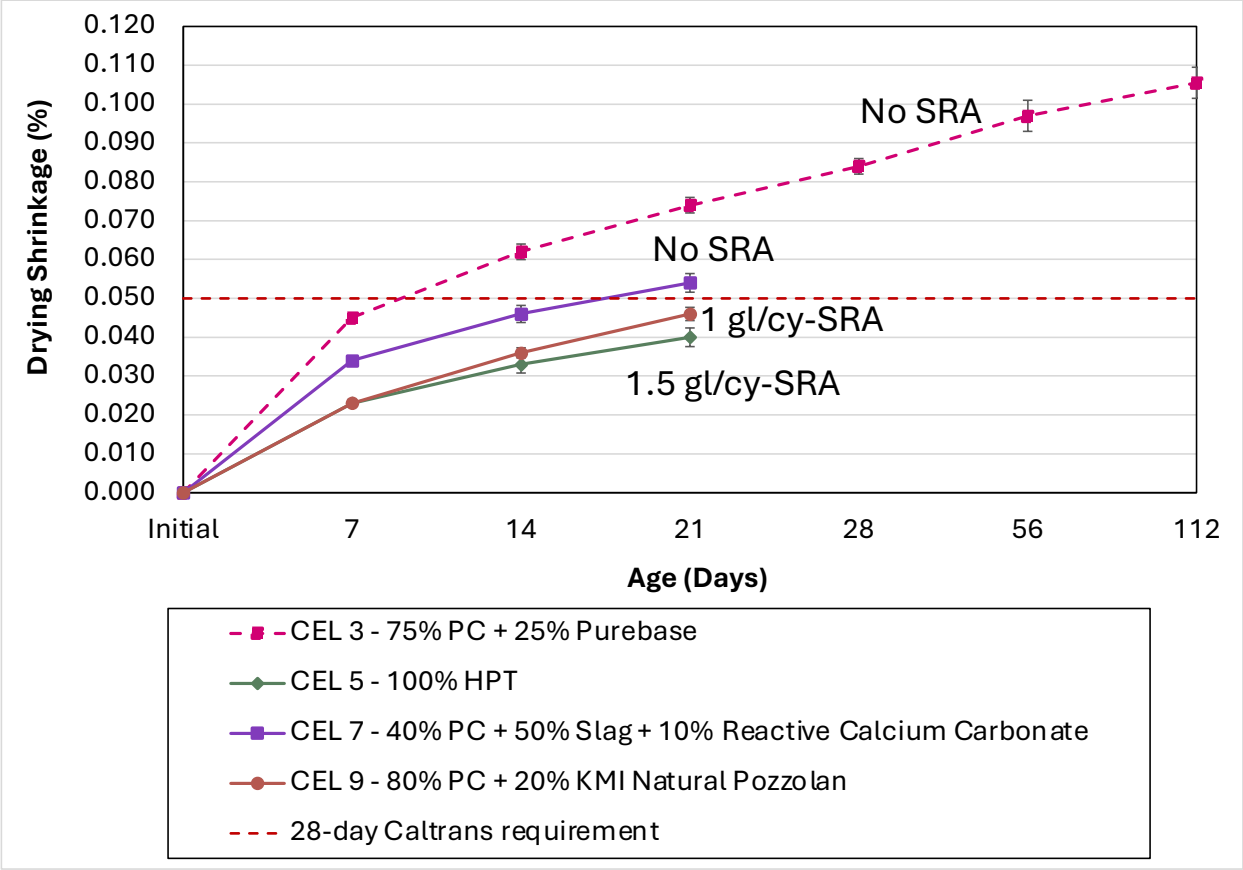
Flexural Strength Test Results

- All three mixes easily meet the 42-day 650 psi Caltrans requirement and produced exceptionally high flexural strength by 28 days



Drying Shrinkage Test Results

- KMI mix had 1 gal of SRA per CY, and HPT mix had 1.5 gal of SRA per CY and met Caltrans's 28-day 0.05% requirement
- C-FA (25% coal fly ash) and Purebase had no SRA and showed high drying shrinkage. These mixes need SRA to meet the requirement
- ReAct/slag mix had a slightly higher drying shrinkage than KMI and HPT, but still much lower than C-FA and Purebase. A dose of SRA is required to meet the spec



What's Next?

- **Share Construction Recap Materials**
  - Post the recap presentation on the Lab2Slab website and email the link to all attendees.
- **Continue Data Analysis**
  - Review and analyze instrumentation data along with other field and laboratory results.
- **Plan the Next Meeting**
  - Schedule a mid-year or annual meeting to discuss findings and next steps.
- **Publish Annual Updates**
  - Post summarized field and lab data on the Lab2Slab website for member access.
- **Present findings** — CalCIMA and ACI Spring Convention.
- **Prepare next test cells** — Planning and design for the upcoming construction are underway.

Thank you!!

- Reports will be posted at:
- 🔗 https://mdsc.ucdavis.edu/lab2slab/
- https://ucprc.ucdavis.edu/publications