



ACI 212 Chemical Admixtures –
New Innovations in Chemical Admixtures

New Generation of High-Range Water Reducers

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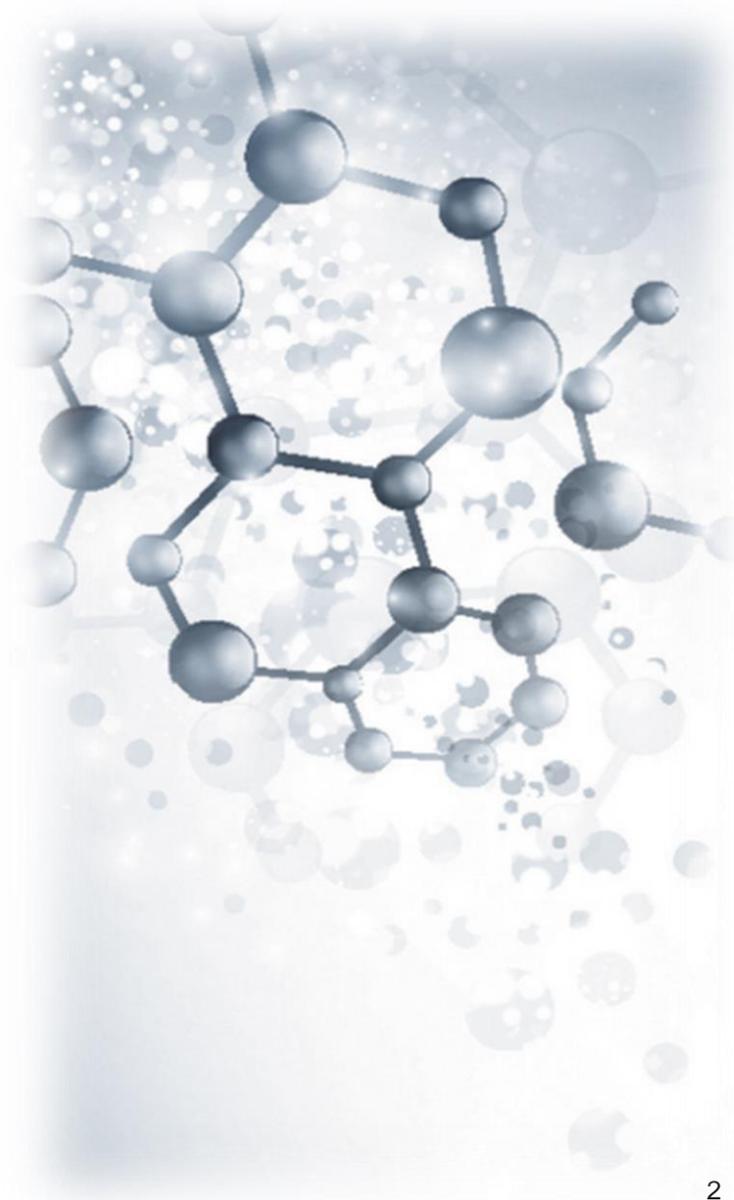
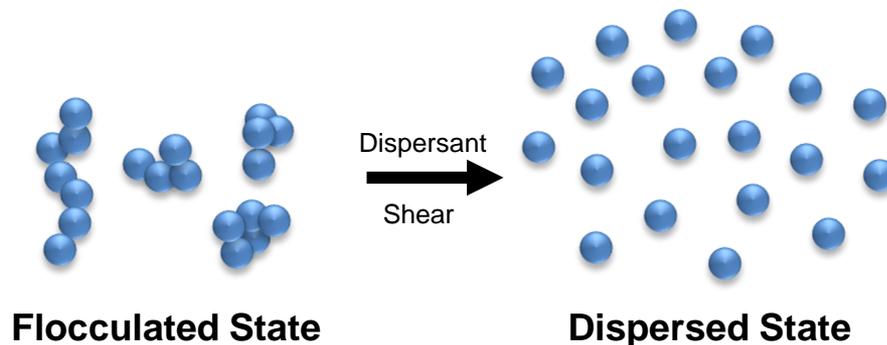
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New Generation HRWR's

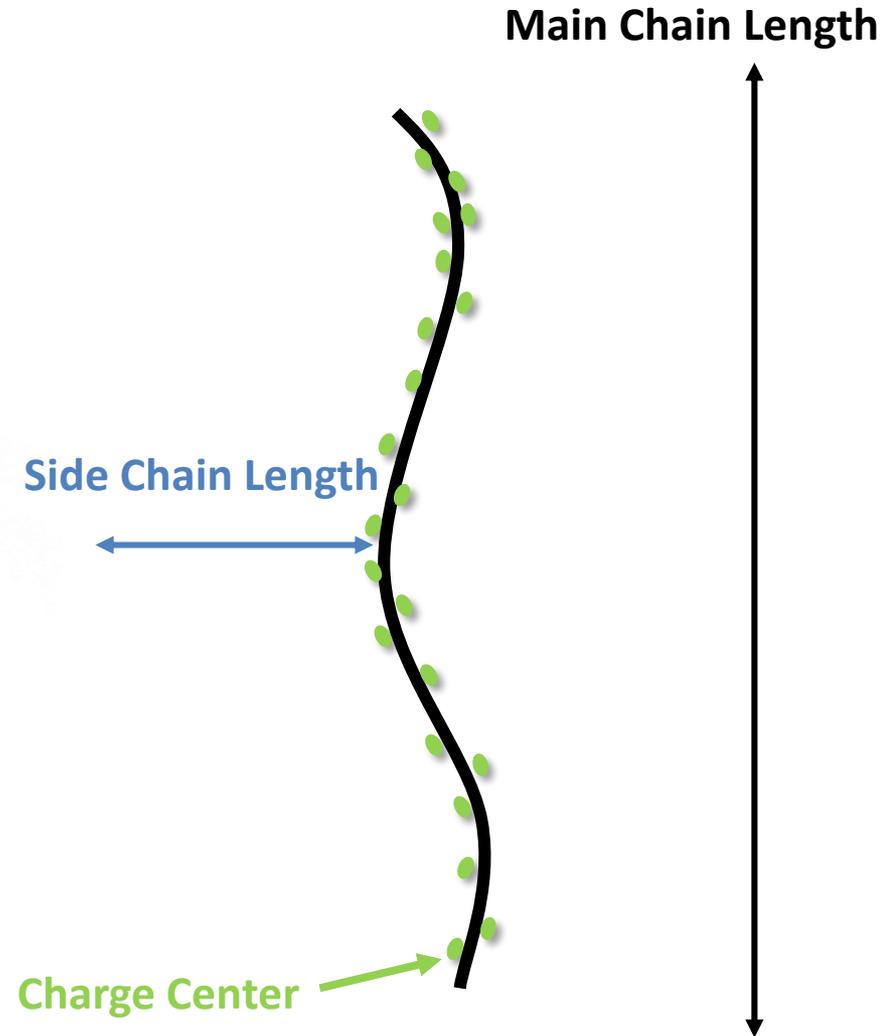
- New performance space still possible decades after initial PCE discovery
- Value to producers beyond performance in concrete

Dispersant (Dispersing Agent): Material added to a solid in liquid suspension to separate flocculated particles, under shearing forces, into individually suspended particles and to reduce their natural tendency to re-associate.



PCE Basics

- Key structural features of a PCE dispersant
 - Main chain
 - Side chain
 - Charge centers
- Purposeful modifications to key structural features enable new areas of performance
 - Faster cement dispersion
 - Less sensitivity to changes in cement chemistry



Experiment- Materials

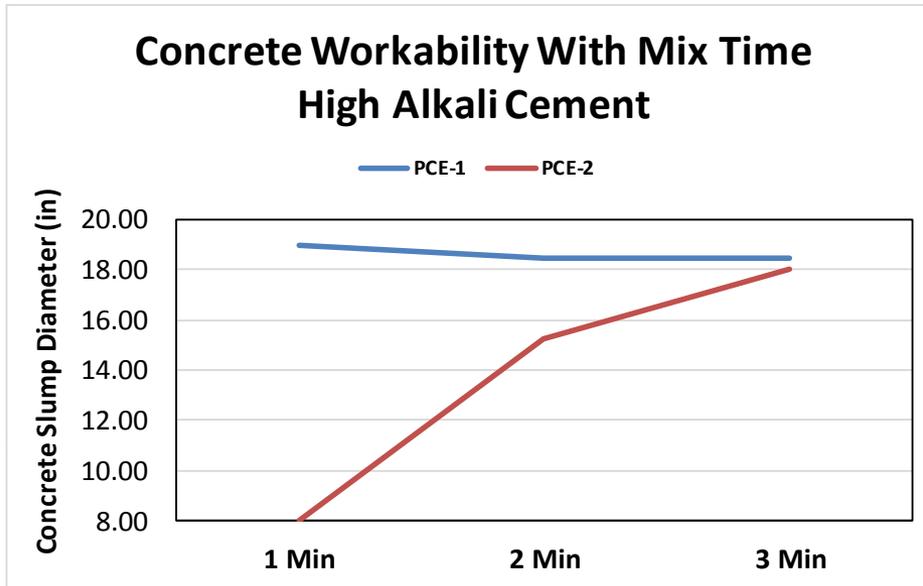
- Concrete Materials
 - High Alkali Cement
 - ~23,000 ppm soluble SO_4^{-2}
 - Low Alkali Cement
 - ~3,800 ppm soluble SO_4^{-2}
 - Class F Fly Ash
 - Fine Aggregate (natural sand)
 - Coarse Aggregate (crushed limestone)
- Cement Dispersants
 - PCE1 (faster dispersion)
 - PCE2 (general purpose)

Experiment- Mix Design

	Design 1	Design 2
Cement (lbs/yd ³)	850	675
F-Ash (lbs/yd ³)	0	130
Fine Agg (lbs/yd ³)	1275	1275
Coarse Agg (lbs/yd ³)	1740	1740
Water (lbs/yd ³)	275	275
Air (%)	2	2

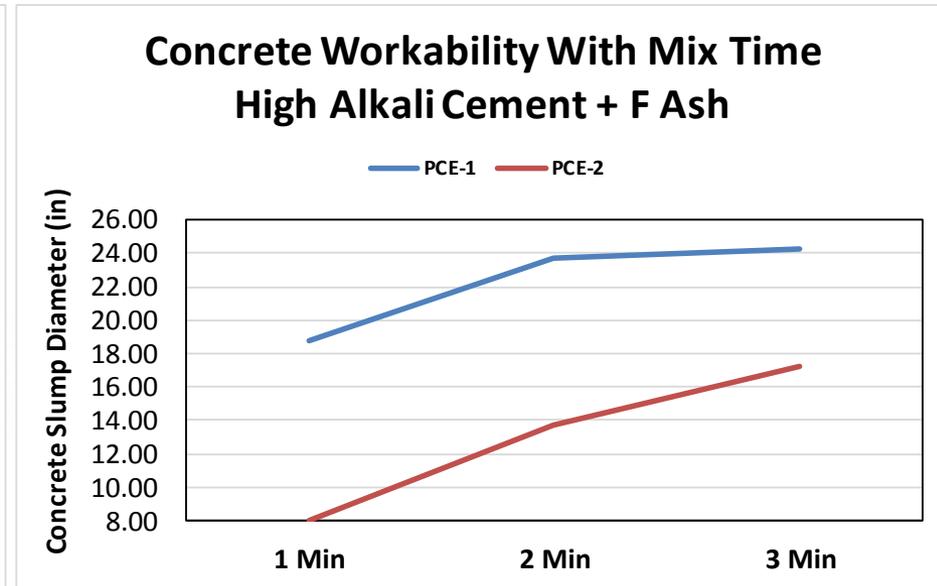


Results- High Alkali Cement



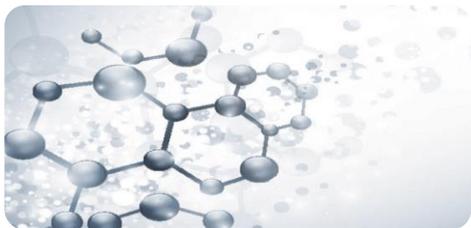
PCE1 Dosage
0.225% of cmts

PCE2 Dosage
0.300% of cmts



PCE1 Dosage
0.180% of cmts

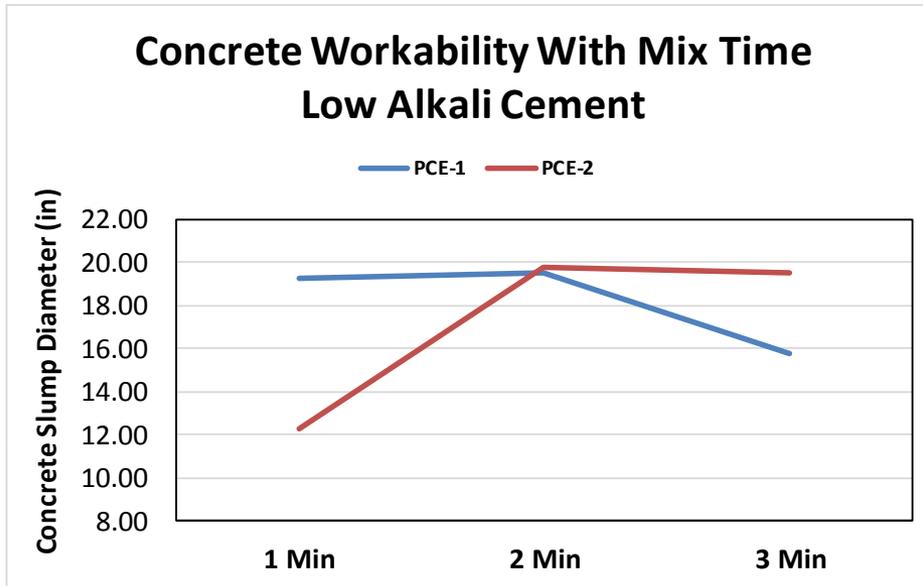
PCE2 Dosage
0.210% of cmts



PCE1

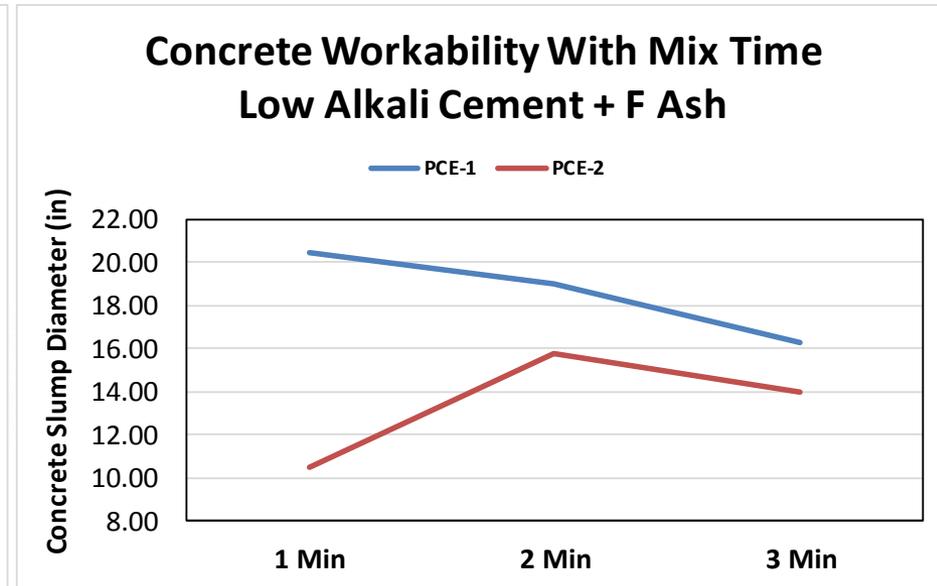
- Fastest Workability generation
- Lower dosage requirement
- Less sensitive to changes in mix

Results- Low Alkali Cement



PCE1 Dosage
0.125% of cmts

PCE2 Dosage
0.130% of cmts



PCE1 Dosage
0.110% of cmts

PCE2 Dosage
0.150% of cmts

Performance advantages observed across multiple cement chemistries

Advancements in PCE's provide benefits beyond the concrete



Improved Concrete Performance

- Faster workability generation
- Promotes concrete consistency



Improved Robustness

- Reduced sensitivity to changes in cement
- Ability to produce more high performance concrete



Operational Efficiencies

- Enables faster batching processes
- Increased overall concrete production potential



Capturing the Value- Example

	Standard PCE	PCE 1
Average batch size (yd3 or m3)	10	10
Average hours per work day	12	12
% of mixtures using HRWR	20%	20%
	Minutes	Minutes
1 - Position truck under mixer	1	1
2 - Mix concrete	3.25	1.5
3 - Discharge concrete	0.75	0.5
4 - Truck exits chute	0.75	0.75
Total time	5.75	3.75
Batches per hour	10.4	16.0
yd3 or m3 per hour	104.3	160.0
Production increase		
% increase		53%
Additional batches per hour		1.11
Additional yd3 or m3 per hour		11.13
Additional batches per day		13.4
Additional yd3 or m3 per day		133.6



- Establish Baseline



- Capture *ACTUAL* field performance
- Assess your “as-is” situation



- See the impact
- Quantify the value to your operations

New Generation HRWR technology enables a 53% increase in production!

Capturing the Value- Case Study, Inventory Precast

	Evaluation 1		Evaluation 2	
	Standard PCE	PCE 1	Standard PCE	PCE 1
Average batch size (yd3 or m3)	4	4	4	4
Average hours per work day	10	10	10	10
% of mixtures using HRWR	75%	75%	75%	75%
	Minutes	Minutes	Minutes	Minutes
1 - Position truck under mixer	0	0	0	0
2 - Mix concrete	3	2	2.6	2.26
3 - Discharge concrete	0	0	0	0
4 - Truck exits chute	0	0	0	0
Total time	3	2	2.6	2.26
Batches per hour	20.0	30.0	23.1	26.5
yd3 or m3 per hour	80.0	120.0	92.3	106.2
Production increase				
% increase		50%		15%
Additional batches per hour		7.50		2.60
Additional yd3 or m3 per hour		30.00		10.42
Additional batches per day		75.0		26.0
Additional yd3 or m3 per day		300.0		104.2



- Baseline Established



- Mixing time savings in both evaluations
- No change to discharge time



- 15-50% increase in production
- 26-75 more batches/day

New Generation HRWR technology enables producer to increase production volume by 26 and 75 additional batches per day!



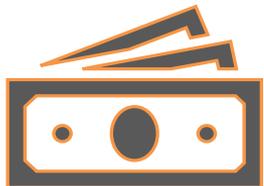
Advances in PCE's still yield impactful results



Faster Workability generation and decreased sensitivity to changes in cement



Value to producer beyond concrete properties & performance



Operational efficiencies yield increased profit potential

Thank you

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