



# MTD's Efforts to Ensure SCM Supply in Texas

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# TxDOT's Research Efforts (2000 to Present)



- 0-4085 – Mitigating ASR in New Concrete
  - 0-4888 – Sulfate Attack Mitigation
  - 0-5207 – Air Entrainment and Fly Ash
  - 0-6648 - Characterizing Class C Fly Ash
  - 0-6717 – Alternate SCM's
  - 5-6717 – Alternate SCM's Implementation
  - 0-6656 – ASR Aggregate Testing
  - 0-6906 – Chemical Solutions for Durability
  - 0-6966 – Assessment of SCM's
  - 0-6958 – High Performance Concrete
- Use Fly Ash for Durability
- How to Use Bad Ash
- How to Use Something Other Than Fly Ash
- What do We Really Need?



- Broaden the type of coal ashes
  - Blended Coal Ashes
  - Ground Bottom Coal Ashes
  - Harvested Coal Ashes
- Off-Spec Ashes
  - Evaluating fineness spec limits to allow coarser fly ashes
  - Chemical properties



## DMS-4610

### Coal Ash

*Effective Date: Draft*



#### 1. DESCRIPTION

This Specification establishes the requirements, test methods, and the Coal Ash Quality Monitoring Program (CAQMP) for non-blended and blended sources of fly ash, modified fly ash (MFA), harvested coal ash, and ground bottom ash (GBA) used in concrete products. Non-blended fly ash is the finely divided residue or ash that remains after burning finely pulverized coal at high temperatures. Blended fly ash is fly ash blended by interblending or intergrinding with other supplementary cementing materials including other coal ash, slag cement, natural pozzolans, etc. MFA is a non-blended or blended fly ash produced by intergrinding with or without additional additives. Harvested coal ash is ash extracted from a landfill and processed to meet this specification. GBA is the coarse residue or ash that remains after burning finely pulverized coal at high temperature and is ground to finer material.

# Evaluating Fineness limits of Coal Ashes



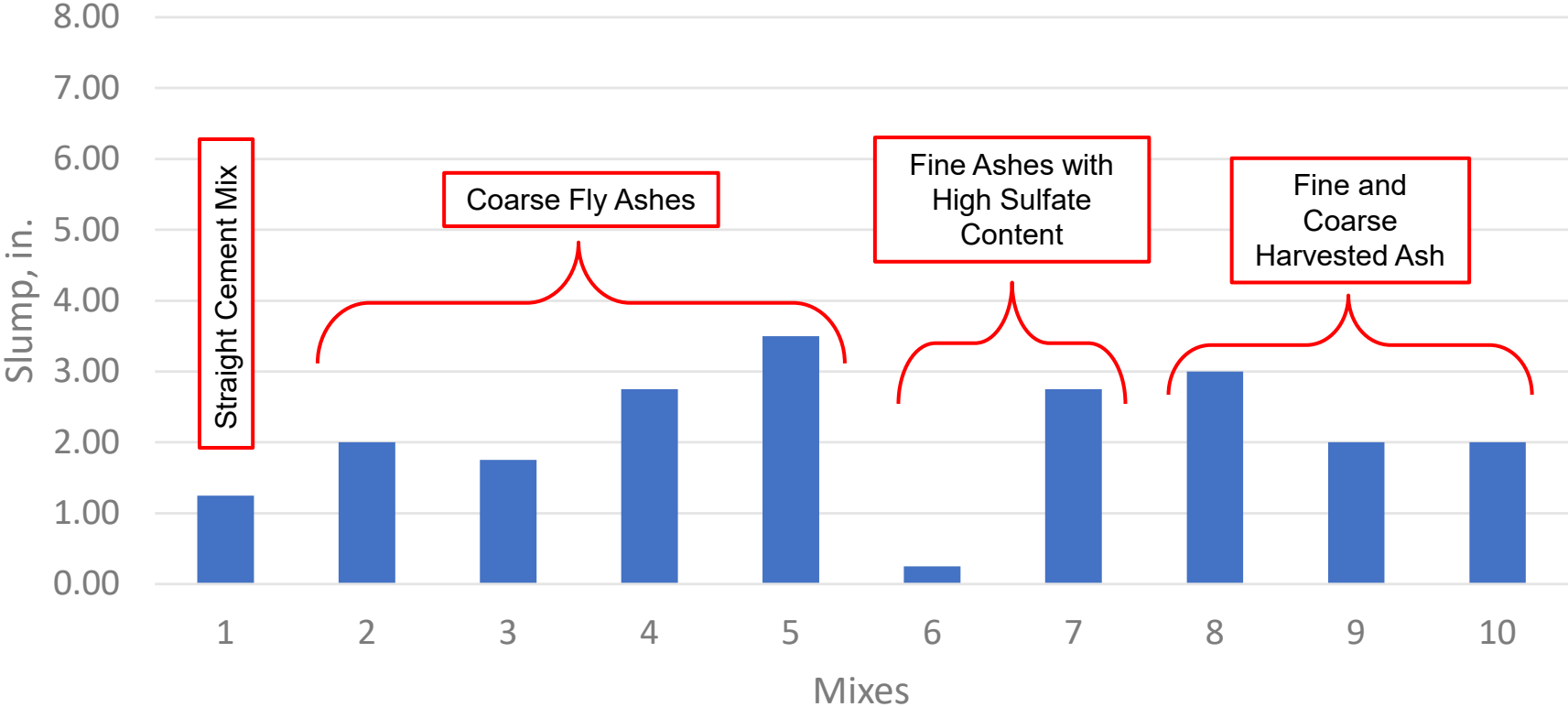
Coal Ash Samples	% Retained on 45 $\mu$ m sieve	% Retained on 150 $\mu$ m sieve
FA1	39.74%	6.29%
FA2	43.20%	7.21%
FA3	37.16%	3.93%
FA5	51.96%	14.13%
HCA2	17.78%	0.42%
HCA4	51.62%	26.58%
HCA6	53.60%	23.60%

**What is the impact of fly ash fineness on fresh and hardened concrete properties?**

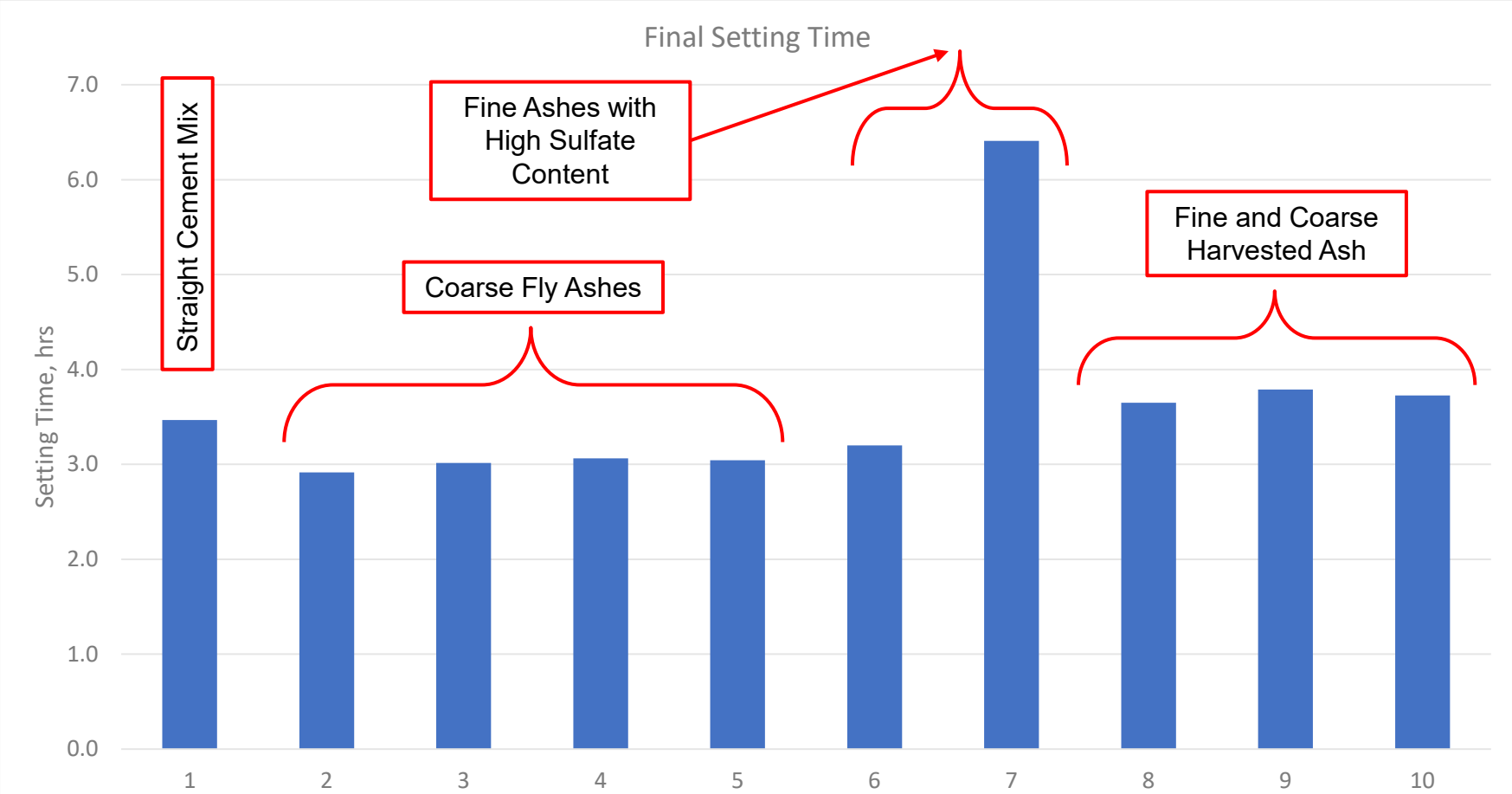
# Coal Ashes – Fresh Properties: Slump



### Slump for Fly Ashes



# Coal Ashes – Fresh Properties: Setting Time

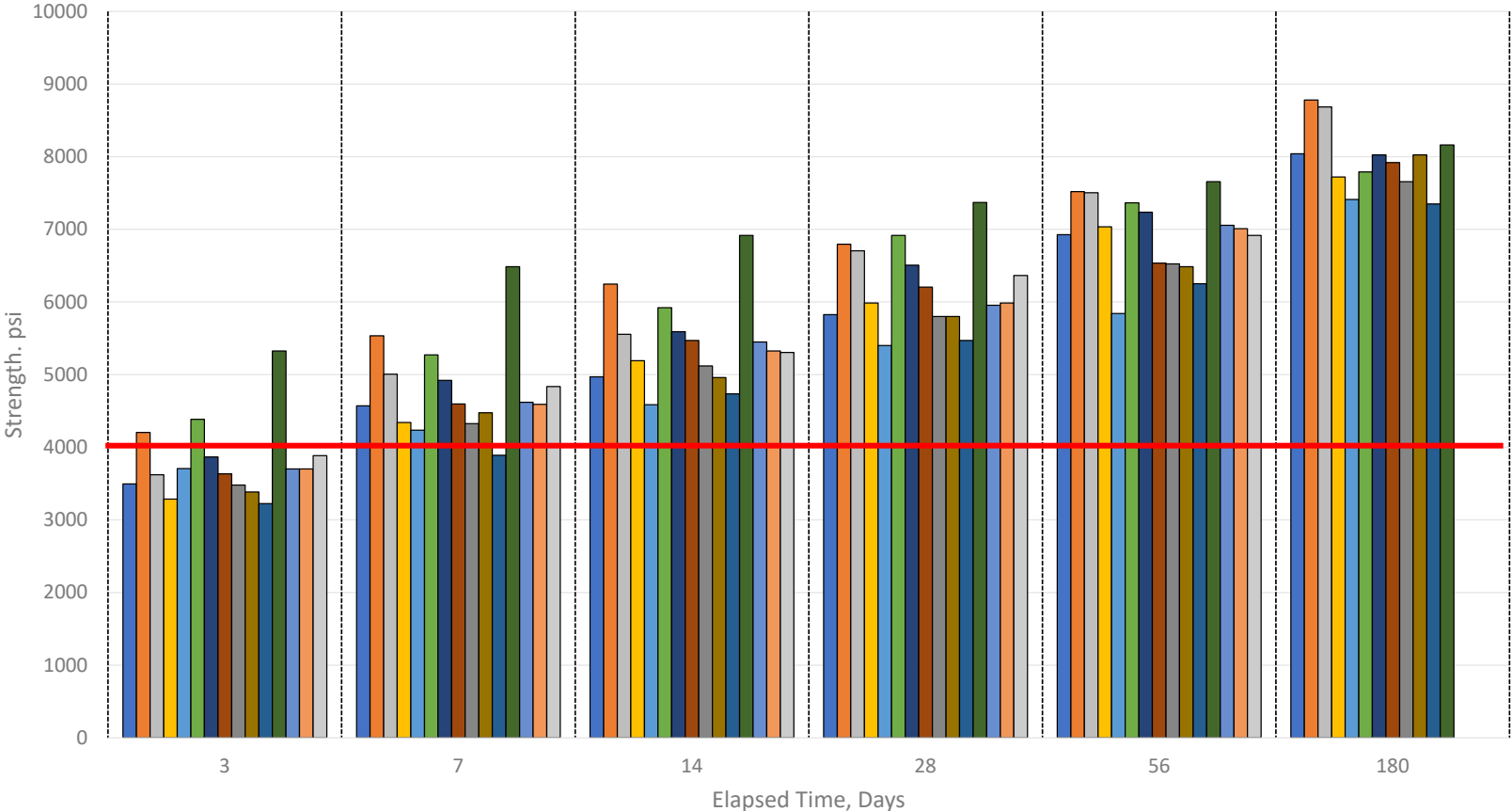




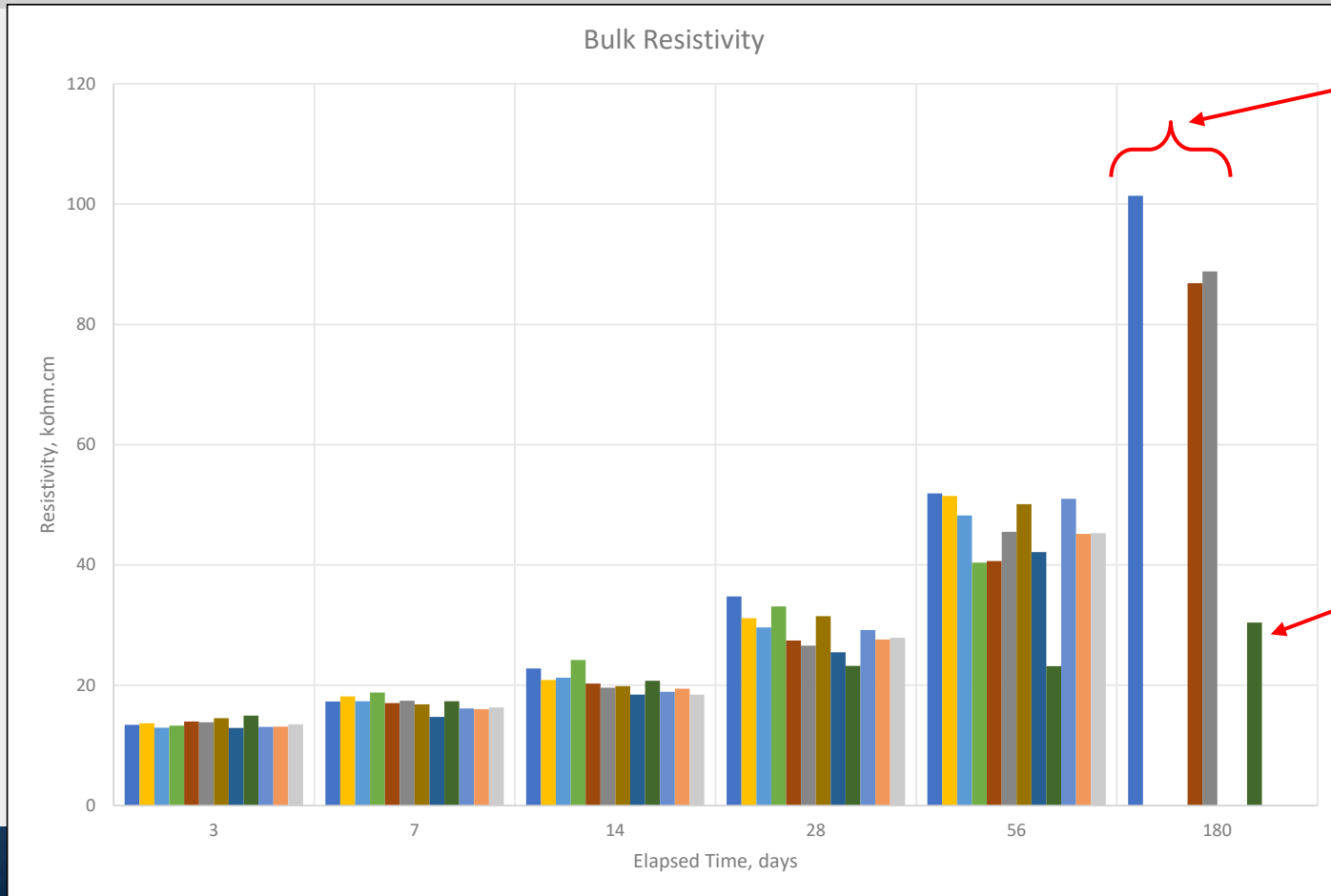
# Coal Ash - Hardened Properties: Strength



Compression Strength Results @ 20% Replacement



# Coal Ash – Hardened Properties - Permeability



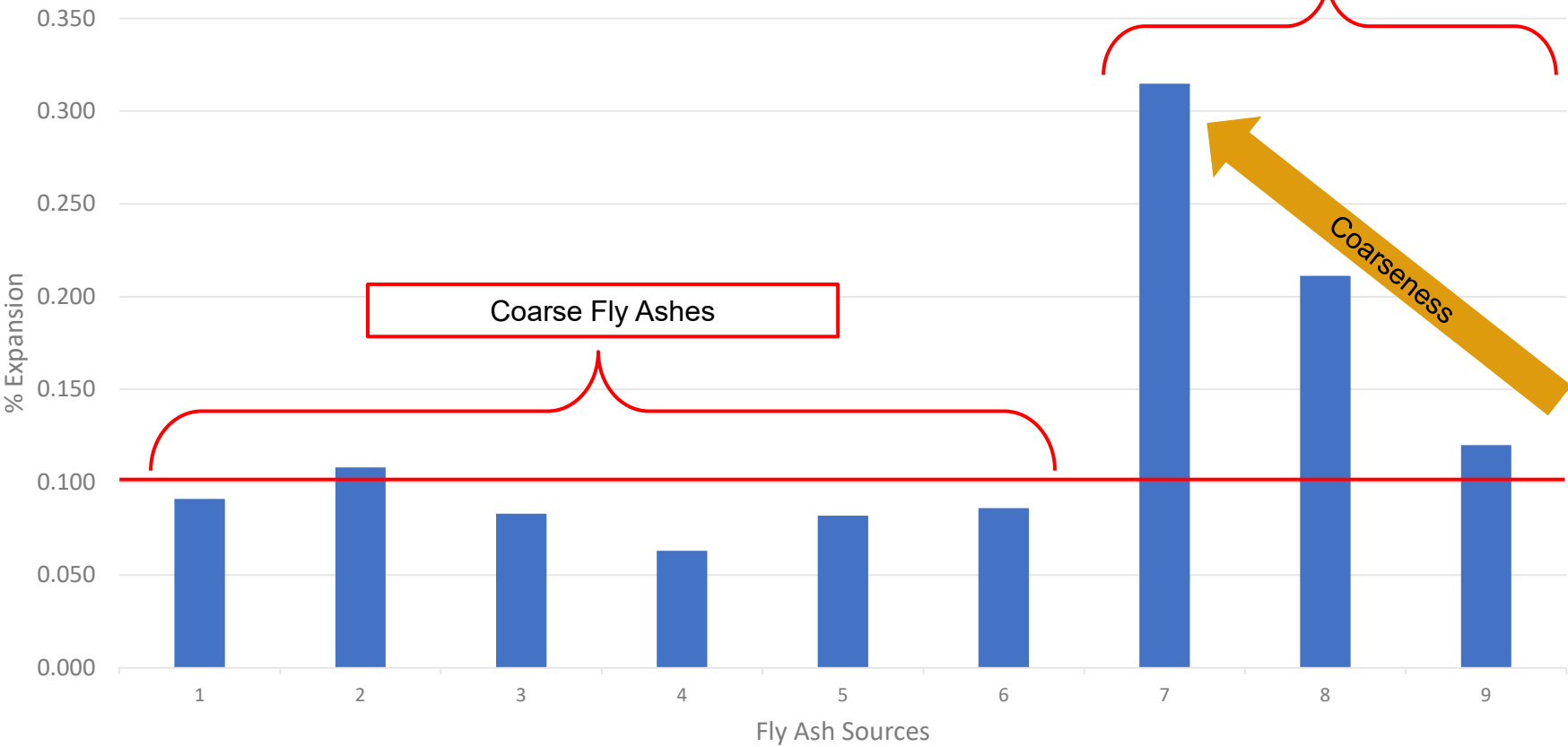
Coarse Fly Ash Mixes

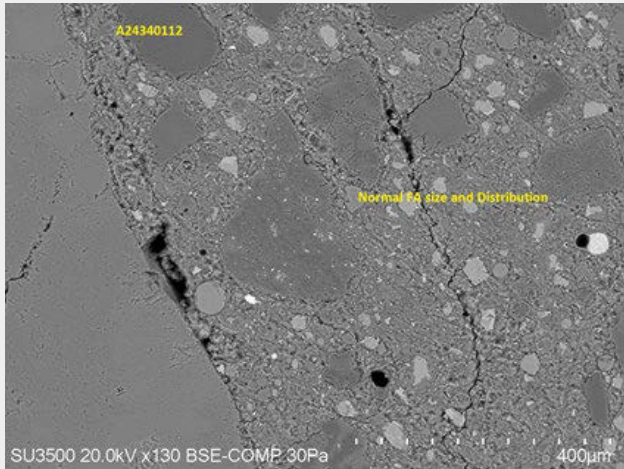
Straight Cement Mix

# Coal Ash – ASR Mitigation

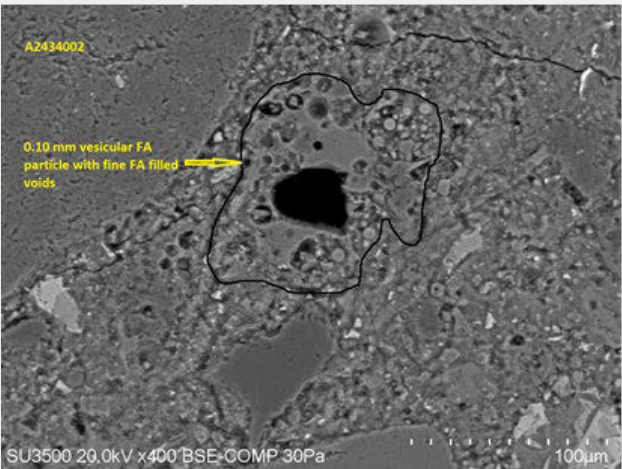


ASTM C1567, 20% Fly Ashes

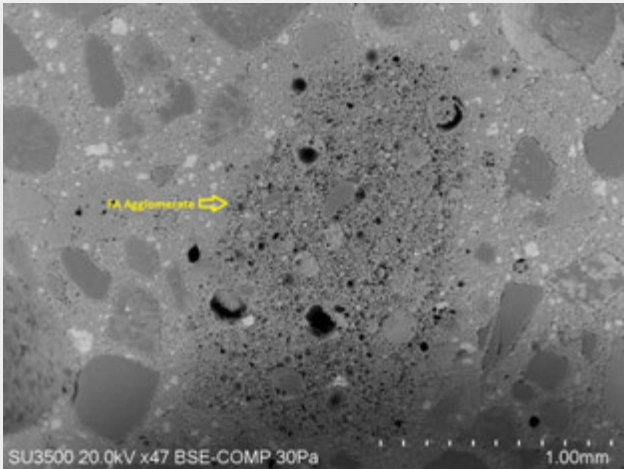




Normal spacing without agglomerates



Irregularly shaped vesicular particle



Large agglomerate



## DMS-4635¶

## Natural Pozzolan¶

*Effective Date: DRAFT¶*



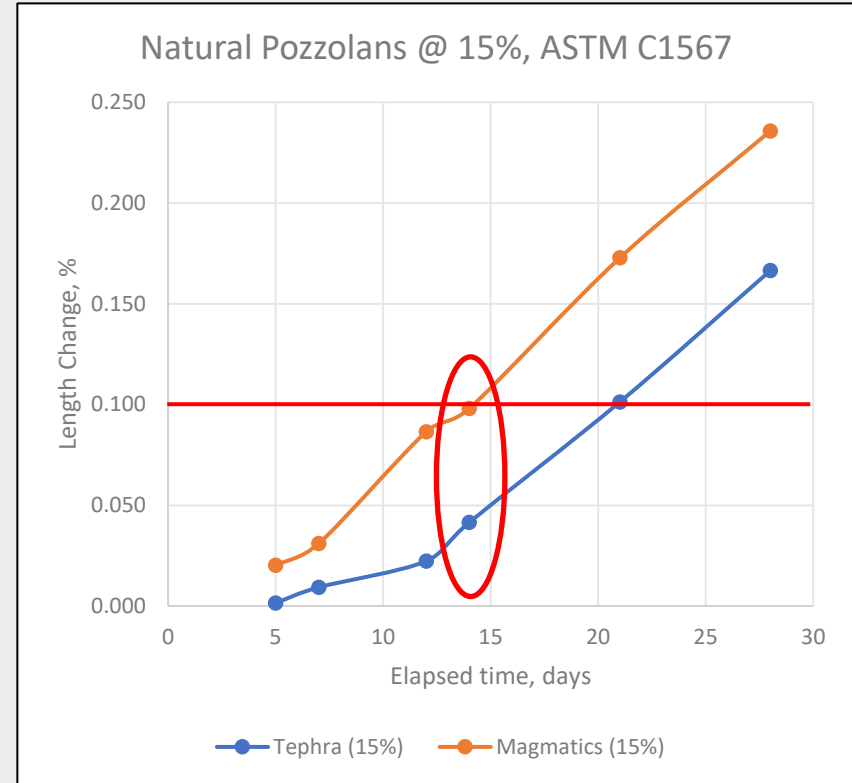
### 1. → DESCRIPTION¶

This Specification establishes requirements and test methods for Natural Pozzolans. Pozzolans are finely divided siliceous or siliceous and aluminous material that will not react chemically with water but will react with calcium hydroxide and water at ordinary temperature to form compounds possessing cementitious properties. Raw or calcined natural pozzolans may be diatomaceous earths; opaline cherts and shales; tuffs and volcanic ashes or pumicites, calcined or uncalcined; and various materials requiring calcination to induce satisfactory properties, such as some clays and shales. ¶

## Natural Pozzolans Cont.



- Natural Pozzolans have not been readily available in Texas
- Like other SCM's, Natural Pozzolans generally improve concrete fresh and hardened properties
- Can be more efficient in mitigating ASR





- Slag Cement has not been readily available in Texas
- Two slag cement grinding facilities in Houston
  - One scheduled to come on-line by early spring
  - The other on-line by late summer
- Some limited research on slag cements effectiveness to mitigate ASR in Texas
  - Not an issue for pavement and most non-structural concrete
  - May need higher replacements for structural concrete



- Propose changes to Coal Ash spec to allow slightly coarser fly ashes
- Continue to approve Natural Pozzolans
- Work with slag cement facilities to get accelerate approval once plants are on-line
- Plan to evaluate slag cements for ASR mitigation effectiveness



# Questions?

