Durable Concrete: The Future and Use of Supplementary Cementitious Materials

Virginia Concrete Conference, March 2, 2017
Thomas H. Adams – American Coal Ash Association
A.J. Marisca – BASF
Henry Prenger – LaFarge Holcim (presentation given by Larry J. Lundy)
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Durable Concrete: The Future and Use of Supplementary Cementitious Materials

This symposium will answer the following questions:

1. What are Supplementary Cementitious Materials?

2. Why are they used in hydraulic cement concrete mixes?

3. What is the future for Supplementary Cementitious Materials at VDOT?
1. What are Supplementary Cementitious Materials?

Supplementary Cementitious Materials are often referred to as SCMs or mineral admixtures. From a VDOT perspective these include:

- Fly Ash (Class F)
- Metakaolin
- Slag Cement
- Silica Fume
2. Why are they used in hydraulic cement concrete mixes?

Easy answer - To improve durability.

If we accept this decision, then we are done with this presentation.

Underlying question:

Should we ever consider using straight portland cement concrete mixes?
2. Why are they used in hydraulic cement concrete mixes?

Two fix two basic problems
2. Why are they used in hydraulic cement concrete mixes?

First:

- Concrete is like a sponge
  - SCMs densify concrete
  - Reduces permeability to minimize the intrusion of detrimental chemicals like road salt and sulfates.
Sulfate Attack
Steel Rebar Corrosion
Steel Rebar Corrosion
2. Why are they used in hydraulic cement concrete mixes?

Secondly,

Supplementary Cementitious Materials mitigate a chemical reaction call ASR – alkali silica reaction

Without using supplementary cementitious materials, what can we see on VDOT structures?
2. Why are SCMs used in hydraulic cement concrete mixes?

ASR occurs when three conditions occur simultaneously in concrete:

1. Total alkali contents in cement above about 0.4 percent.
2. Presence of reactive free silica from the aggregate.
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2. Why are SCMs used in hydraulic cement concrete mixes?

To mitigate without SCMs:

- Keep concrete dry, and/or
- Use only low alkali cement content and/or non-reactive aggregate
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3. What is the future for Supplementary Cementitious Materials at VDOT?
Use of Supplementary Cementitious Materials at VDOT

What are Supplementary Cementitious Materials and why do we use them?

- **Fly Ash**  
  Thomas H. Adams, American Coal Ash Assn.
  - Metakaolin  
    A.J. Marisca, BASF
  - Slag Cement  
    Henry Prenger, LaFarge/Holcim (Larry J. Lundy)
  - Silica Fume  
    Larry J. Lundy, P.E., VDOT

- Conclude with:
  - The Future for Supplementary Cementitious Materials at VDOT
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