CIRCA

Use of Flyash from a Concrete Supplier Perspective

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Types of Flyash

- In Alberta we have two types of flyash available they are Class F and CI
- Class F and CI flyashes with (low CaO) are beneficial in improving sulphate resistance of concrete

Disadvantages of Flyash in Concrete

- Variable quality of flyash (most are classified in Alberta)
- Requires closer quality control (air monitoring)
- An additional variable in the mix
- Variability upsets other admixture dosage
- Proper curing is required
- Longer curing time may be required
- Possible more deicer scaling if not properly cured

Advantages of Fly Ash in Concrete

- Improved Workability
- Reduces heat of Hydration
- Economy with delayed early strength
- Reduced Alkali-aggregate reactions
- Possible improved Sulphate resistance
- Reduced permeability
- Kyoto (reduced GhGs)

Improved Workability

- Requires less water for same workability as non flyash concrete up to 10% water reduction.
- Concretes using flyash generally exhibit less bleeding and segregation than plain concretes (volumes of fines increased)
- Finishability is improved (spherical shape provides more slump at same water content)
- Pumpability is improved (greater cohesiveness minimizes segregation, pump line friction decreases)

Reduces heat of Hydration

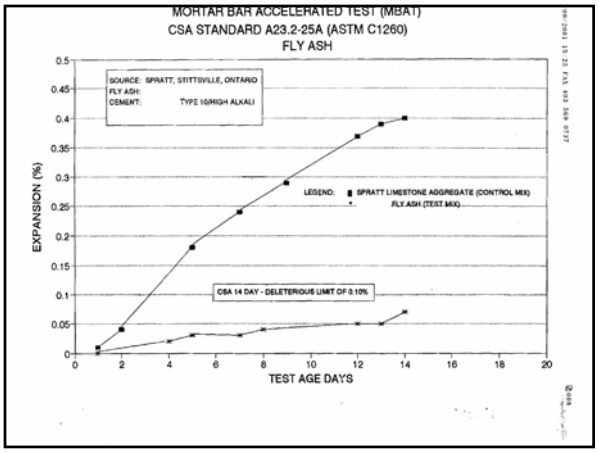
- Flyash concrete has a lower heat of hydration
- Some Flyashes have a heat of hydration of only 40% that of cement
- Beneficial in concrete used for massive structures.

Economy

- Flyash is typically 1/3 to 1/2 the cost of cement, kg. for kg.
- Amounts of flyash in concrete by mass of cementing materials flyash will range from 15 to 30% or higher in Alberta.
- Caution must be used when using HVF
- It takes 3.2 billion flys to produce one ton of flyash (V. Dobson)

Reduced Alkali-aggregate reactions (ASR)

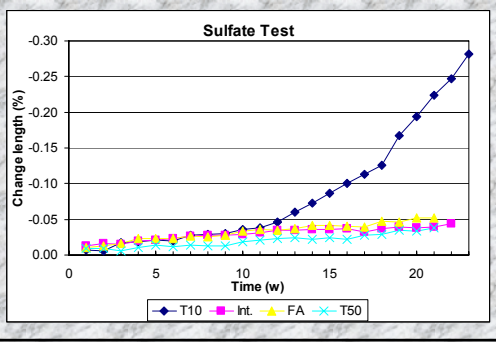
- Most aggregates in Alberta are reactive in varying degrees.
- CSA A23.1.2.B.5.2.4. recommends the usage of flyash of in the levels of 20 and 25% for mitigation of ASR
- No effect in controlling Alkali-carbonate reaction.



Improved Sulphate Resistance

- Class F and CI fly ash (low CaO) is beneficial in improving sulphate resistance of concrete
- Mechanism Intruding sulfates from the soil/sea attack the C_3A and C_4AF/water/gypsum reaction products causing disruptive expansion.

Test Results - Sulfate Resistance (ASTM C 1012)



Reduced permeability

- Additional calcium silicate hydrate lowers permeability
- Efflorescence is usually reduced
- Less water therefore lower w/cm ratio for a given slump

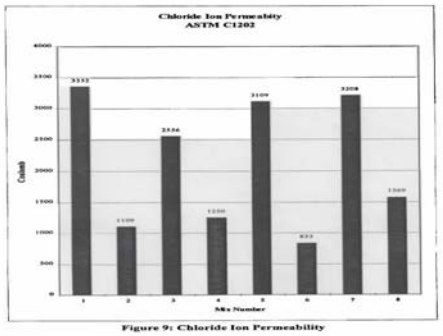


Figure 9: Chloride Ion Permeability

Mix #2 335 cement/ 65 flyash
Mix #4 335 cement/ 65 flyash
Mix #6 305 cement/ 75 flyash
Mix #8 300 cement/ 40 flyash

Summary from a Concrete Suppliers Perspective

- Improved Workability
- Reduced Alkali-aggregate reactions
- Possible improved Sulphate resistance
- Reduced permeability
- Economy with delayed early strength
- Reduces heat of Hydration
- Kyoto (reduced GhGs)