

Ready Mix Perspective

Responsible Use of SCM's in
Performance-Based Specifications



Ready Mix Perspective

Ready Mix Perspective

- The use of SCM's has become common place in concrete production.
- Fly ash is the most common SCM used in this region.
- Fly ash is specified in terms of percentage of the total cementitious

Fly ash

(Cement + Fly ash + Other)

- Leed, Ecosmart and other sustainability programs have significantly increased the demand for SCM usage.
- Most of the fly ash in this region comes from coal burning power plants in Alberta, and Washington State.



2

Advantages of Fly Ash:

- **Improved Workability**
 - Producing lower water to cement ratio for similar slumps when compared to no fly ash mixes.
 - Less Bleeding
- **Lower heat of hydration**
 - Lower temperature differentials
- **Improved permeability**
 - Permeability requirements for C1 and C1X exposure classes in CSA A23.1-04 are difficult to meet without using SCM's.
- **Improved sulfate resistance.**
 - 20% fly ash with Type GU (Type 10) is often equivalent to (Type 50) cement.
- **Improved alkali reactivity**
- **Reduced CO2 emissions**
 - Less cement required.
- **Reduced landfill waste**
 - Reusing an industrial byproduct.

Disadvantages of Fly Ash:

- **Slower set times**
 - increased overtime.
 - premature surface drying can occur in dry or windy weather.
 - tendency to finish too soon which can cause delamination.
 - It is important not to seal the surface to allow for delayed bleeding.
- **Slower strength gain**
 - Slow down production.
 - Increase stripping times.
- **Salt scaling**
 - Higher fly ash contents can produce an increase of salt scaling.
- **Inconsistencies**
 - Fly ash changes air entraining dosages.
 - Changes in carbon content can create fluctuations in air contents.

Ready Mix Perspective

Fly ash Percentages used in Ready Mix production depends on:

- **Acceptable Set Times**

- Concrete placers and finishers expect a reasonable set time when doing flat work.
- Summer – Typically 20-30% fly ash is found to be acceptable.
- Winter – Typically 10-20% fly ash is found to be acceptable (at a premium).
- For shake on hardeners, finishers prefer less than 15% fly ash for a higher comfort level. This will also help to increase bleed water.
- For large flat floors, finishers are more comfortable with fly ash contents of less than 15%.
- The amount of fly ash in flatwork can be increased with proper planning and education (Little Mountain Reservoir).

Ready Mix Perspective

Fly ash Percentages used in Ready Mix production depends on:

- **Project Schedule**

- It is difficult to use higher volumes of fly ash for schedule driven projects such as pre-cast, or multi-story buildings.
- Typically foundations are ideal locations for maximizing fly ash contents as they are typically not on the critical path, and benefit from the low heat of hydration.



Yaletown Develoement (3 towers)

Fly ash Percentages used in Ready Mix production depends on:

• **Mass of concrete**

- Large concrete masses typically require high volume fly ash to control the heat of hydration.
- Thin walls and slabs will require less fly ash to decrease set times.



1800 m³ Raft Slab – Lafarge Silo Foundation

Fly ash Percentages used in Ready Mix production depends on:

• **Special Projects**

- Projects requiring high volume fly ash for sustainability are typically well planned to accommodate the slower set times, and slower strength gain.



Little Mountain Reservoir

Fly ash Percentages used in Ready Mix production depends on:

- **Exposure Class**
 - The new CSA A23.1-04 has requirements for Chloride ion penetrability.
 - These requirements are difficult to meet without using SCM's.
 - C-1 exposure can typically be met with 20% fly ash for a 35 MPa concrete (<1500 coulombs).
 - C-XL may require Silica Fume to meet the <1000 coulombs requirement.
 - Driveways and sidewalks exposed to deicing salts can be subject to increased salt scaling with high volumes of fly ash.



Confederation Bridge

Suggestions for Specifications:

- **Specify concrete strengths @ 56 days for any concrete designed with more than 30% fly ash.**
- **Specifying all concrete @ 56 days can further reduce the overall cementitious in a mix design.**
- **Do not specify fly ash percentages for specific elements. Allow the contractor to have some flexibility that meets their schedule.**
- **If high volume fly ash replacement is a key component of a project, then the schedule has to be planned around the concrete (Little Mountain Reservoir).**
- **Do not insist on ready-mix producers to submit mix designs showing the amount of fly ash used for each mix (prescriptive). The ready-mix producer can provide the overall percentage of fly ash used at the end of the project.**

Title of Presentation

QUESTIONS?