

# Expanchem Fly Ash\*

## Pulverized fly ash for cement mix

### Uses:

Pulverized Fly Ash is versatile resource material and can be utilized in variety of application. The pozzolanic property of fly ash makes it a resource for making cement, cement mix and other ash based products. The Geo-technical properties of fly ash allow it to use in construction, the major utilization areas of PFA are as under, but not limited:

- Manufacturing of Portland Pozzolana Cement & performance improver in Ordinary Portland Cement (OPC).
- Part replacement of OPC in cement mixes.
- High volume fly ash concrete.
- High strength concrete mix.
- Roller Compacted Concrete used for dam, pavement construction, and all classes of structural concrete used in dams & power plants.
- Construction of road embankments, structural fills, low lying area development.
- Hydration control in concrete slabs, pavements, canals lining, driveways, and runways, and in imprinted concrete.

### Advantages – Benefits

- Improves long term strength, performance and durability of concrete. Fly Ash reaction with lime also improves the strength, durability, chloride, and sulphate resistance of concrete.
- Using Fly Ash reduces the temperature rise in thick sections - with the addition of less cement in a concrete mix the heat that is produced through hydration is greatly reduced.
- Minimizes risk of Alkali Silica Reaction - Alkali Silica reaction is significantly reduced, with the use of more than 25% of PFA. This is due to the fact that PFA readily reacts with sodium and potassium alkalis within the concrete.
- Reduce segregation of the mix
- Cost effective
- Improves finishing
- Better structural integrity protection
- Using Fly Ash as a cement replacement reduces the overall CO<sub>2</sub> footprint of the concrete.
- Reduces permeability, which reduces shrinkage, creep and gives greater resistance to chloride ingress and sulphate attack.

### Description:

Fly Ash is a pozzolanic material which is defined as siliceous or siliceous and aluminous material which in itself possesses little or no cementitious value, chemically react with Calcium Hydroxide (lime) in presence of water at ordinary temperature and form soluble compound comprises cementitious property similar to cement.

### Cement mixes:

Cement is most widely used construction material in the world over, cement chemically reacts with water and produces binding gel that binds other component together and makes the concrete strong.

The reaction process of cement is called 'hydration' in which water is absorbed by the cement, In this process apart from the binding gel, some amount of lime is also liberated. The coarse and fine aggregates act as filler in the mass, the main factors, which determine the strength of concrete is amount of cement used and the water cement ratio in the concrete mix. However, there are some factors, which limit the quantity of cement and water / cement ratio to be used in the concrete. Hydration process of cement is exothermic and large amount of heat is liberated. Higher will be the cement content greater will be the heat liberation leading in distress to concrete.

Water is the principal constituent of the concrete mix. Once the concrete is hardened, the entrapped water in the mass is used by cement mineralogy for hydration and some water is evaporated, thus leaving pores in the matrix. Some part of these pores is filled with hydrated products of cement paste. It has been observed that higher the water cement ratio, higher is the porosity resulting in increased permeability and reduce concrete strength and durability.

Above reactions indicate that during the hydration process of cement, lime is released out and remains as surplus in the hydrated cement. This leached out surplus lime renders deleterious effect to concrete such as make the concrete porous, give chance to the development of micro-cracks, weakening the bond with aggregates and thus affect the durability of concrete.

## How fly ash works with cement?

If fly ash is available in the mix, this surplus lime becomes the source for pozzolanic reaction with fly ash and forms additional (calcium silicate hydrate) gel having similar binding properties in the concrete as those produced by hydration of cement paste. The reaction of fly ash with surplus lime continues as long as lime is present in the pores of liquid cement paste.

The process is exothermic and heat is released which increases the temperature of the mass, When fly ash is present in the concrete mass, it plays dual role for the strength development. Fly ash reacts with released lime and produces binder as explained above and renders additional strength to the concrete mass. The un-reactive portion of fly ash act as micro aggregates and fills up the matrix to render packing effect and results in increased strength.

The large temperature rise of concrete mass exerts temperature stresses and can lead micro cracks. When fly ash is used as part of cementitious material, quantum of heat liberated is low and staggers through pozzolanic reactions and thus reduces micro-cracking and improves soundness of concrete mass.

## Workability of Concrete:

Fly ash particles are generally spherical in shape and reduce the water requirement for a required slump. The spherical shape helps to reduce friction between aggregates and between concrete and pump line and thus increases workability and improve pumpability of concrete. Fly ash use in concrete increases fines volume and decreases water content and thus reduces bleeding of concrete.

## Dosage:

Fly ash can be used as part replacement of cement in between 10 - 40% by weight of total cementitious material, when high early strength is required; the total weight of cementitious material (Cement + fly ash) may be kept greater than the quantity that would be need if Portland cement were the only cementitious material. When high early strength is not required higher percentage of fly ash can be used.

**When fly ash is used in concrete, water to cement + fly ash ratio by weight must be considered in place of the traditional water cement ratio (w/c) by weight.**

## Mixing / Addition:

**Expanchem Fly Ash** can be added to cement mix directly, It is generally recommended to add fly ash at the concrete batching plant during batching or in small mixer at the time of dry mixing. The actual dosage rate will vary depending upon the application and performance requirements for each project.

## Standard compliance:

ASTM C618-03 (Class N & F)

| Properties: (Basic oxide composition) |           |
|---------------------------------------|-----------|
| SiO <sub>2</sub>                      | 45 – 55 % |
| Al <sub>2</sub> O <sub>3</sub>        | 20 – 30 % |
| Fe <sub>2</sub> O <sub>3</sub>        | 02 – 10 % |
| CaO                                   | 02 – 10 % |
| MgO                                   | 01 – 04 % |
| K <sub>2</sub> O                      | 01 – 04 % |
| Na <sub>2</sub> O                     | < 1.50 %  |
| TiO <sub>2</sub>                      | < 1.20 %  |
| SO <sub>3</sub>                       | < 4.00 %  |
| Cl                                    | < 0.20 %  |

## Compatibility:

**Expanchem Fly Ash\*** is compatible with all Fospak concrete admixtures in the same concrete mix. Admixtures should be added to the concrete separately. The trial mixes should assess the resultant properties of concrete.

**Expanchem Fly Ash\*** is suitable for use with all types of cements OPC, SRC, Low Alkali Cement etc.

## Packing / Storage:

**Expanchem Fly Ash\*** 50, 500 & 1,000 Kg. Bag.  
Bulk supply also available

**Expanchem Fly Ash\*** should be stored in dry condition in original bag.

## Health and safety:

**Expanchem Fly Ash\*** does not fall into the hazard classifications of current regulations. It is recommended that gloves and eye protection be used when handling or adding into mixer.

## Additional Information

Fospak manufactures a wide range of products which include:

- Concrete additives
- waterproofing membranes & waterstop
- joint sealants & filler boards
- cementitious & epoxy grouts
- specialized flooring materials

Fospak additionally offers a comprehensive package of products specifically designed for the repair and refurbishment of damaged concrete. Systematic Approach to concrete repair features the following:

- hand-placed repair mortars
- spray grade repair mortars
- fluid micro-concretes
- chemically resistant epoxy mortars
- anti-carbonation/anti-chloride protective coatings
- chemical and abrasion resistant coatings

For further information on any of the above, please consult your local Fospak office - as below.

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