"Use of Fly Ash as a Construction Material"

Agenda

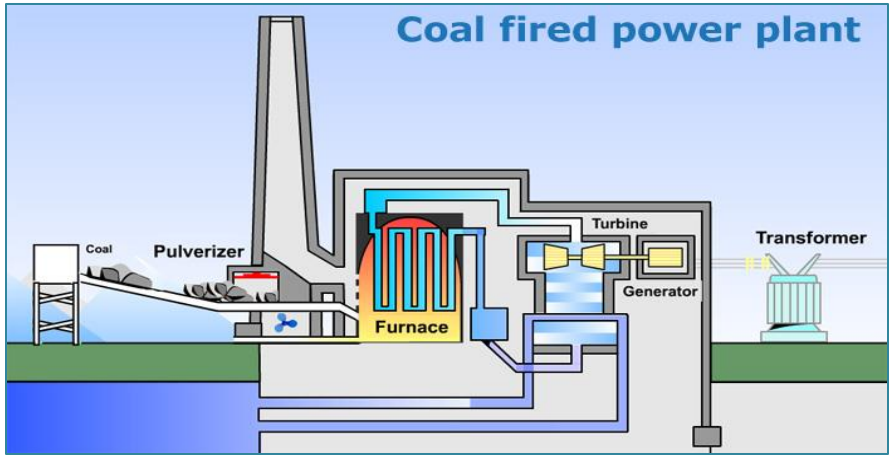
- Source
- Quality
- Benefits
- Projects
- Applications
- Conclusions

Upcoming Coal Fired Power Plants

Station	Location	Capacity (MW)	Status
Jamshoro Coal Power Project	Jamshoro, Sindh	600	Under construction. Dawn, 27 Feb 2015
KE Coal Power Plant	Karachi, Sindh	660	Under construction.
HUBCO-II	Hub, Balochistan	1200	Under construction by GEDC
Sindh Engro Thar Coal Power Project	Tharparkar, Sindh	1200	Under construction.
Fauji Fertilizer Power	Port Qasim	118	Applied for License December 2014
Sahiwal Coal Power Project	Sahiwal, Punjab	1320	Under construction, May 2014. To be completed by 2016. Dawn, 27 Feb 15
Port Qasim Electric Power Co. (Sinohydro)	Port Qasim, Karachi, Sindh	1200	Under construction, May 2014, China's Power & Qatar's Al-Mirqab Group JV.
Thar Coal Power Plant	Tharparkar, Sindh	660	Proposed

6,898 MW to generate **5.2 million ton of fly ash/year** (@ 750 MT / MW)

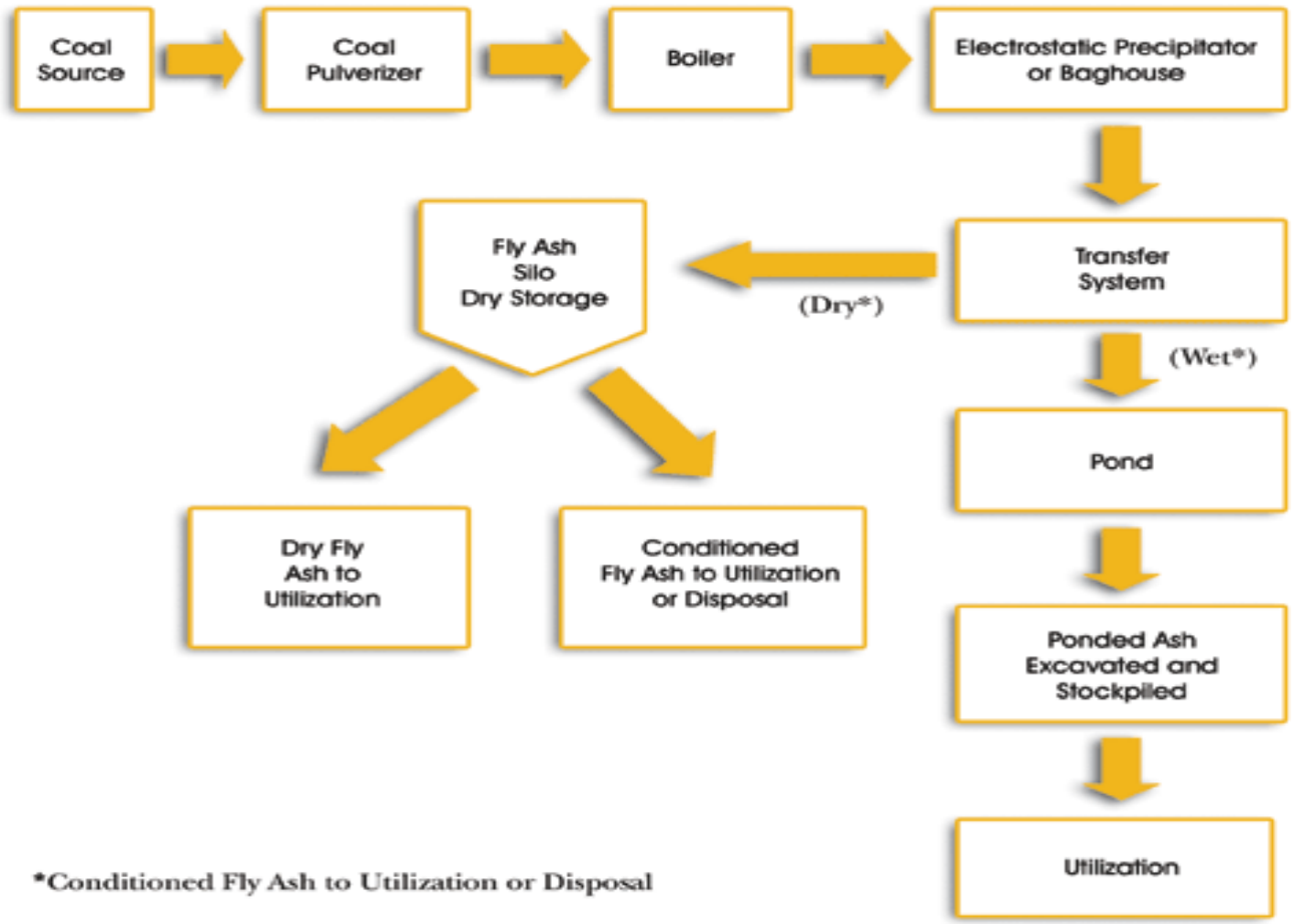
K-Electric Bin Qasim TPS



- Coal fired power plant generate Fly Ash (flue ash).
- Fly ash is fine particles that rise with flue gases.
- Fly ash is captured by electrostatic precipitators or filter bag

Unit 3 & 4 Planned to be Converted From Furnace Oil to Coal Fired

Method of Fly Ash Transfer



*Conditioned Fly Ash to Utilization or Disposal

Fly Ash Parameters

- **LOI** is a measurement of unburned carbon (coal) remaining in the ash.
- **Fineness** of fly ash is defined as the percent by weight of the material retained on the 0.044 mm (No. 325) sieve.
- **Chemical composition** of fly ash relates directly to the mineral chemistry of the parent coal.
- **Uniformity** of fly ash characteristics from shipment to shipment is imperative in order to supply a consistent product.

Fly Ash Standards

Sample Oxide Analyses of Ash and Portland Cement			
Compounds	Fly Ash Class F	Fly Ash Class C	Portland Cement
SiO_2	55	40	23
Al_2O_3	26	17	4
Fe_2O_3	7	6	2
CaO (Lime)	9	24	64
MgO	2	5	2
SO_3	1	3	2

ASTM C-618 & AASHTO M 295

Types of Fly Ash

Hydraulic in Nature with High Calcium (CaO)

Pozzolanic in Nature with Low Calcium (CaO)

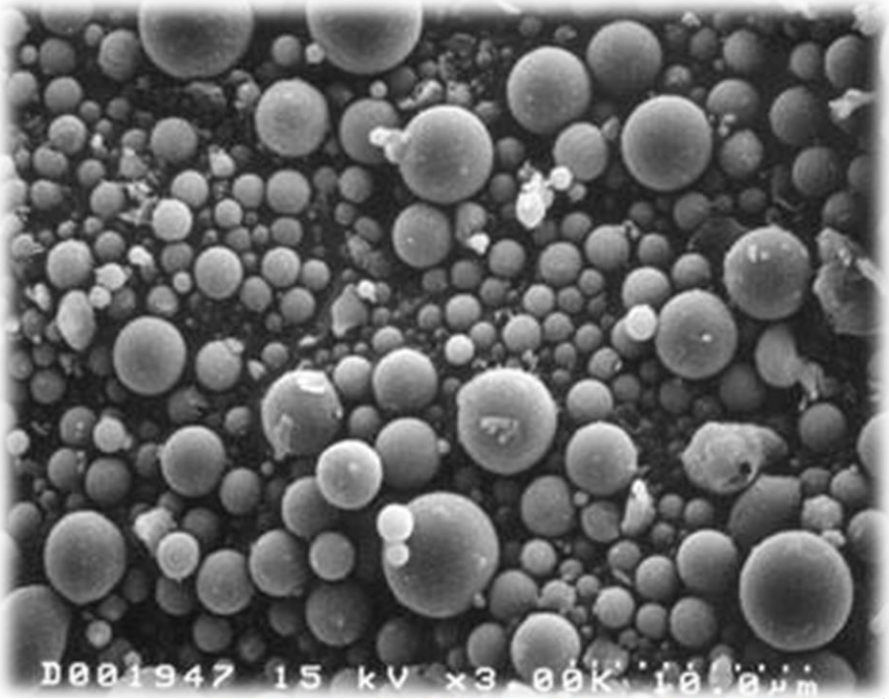
Fly Ash – An Engineering Material

Fly ash improves three important properties in concrete:

1. Workability
2. Strength
3. Durability

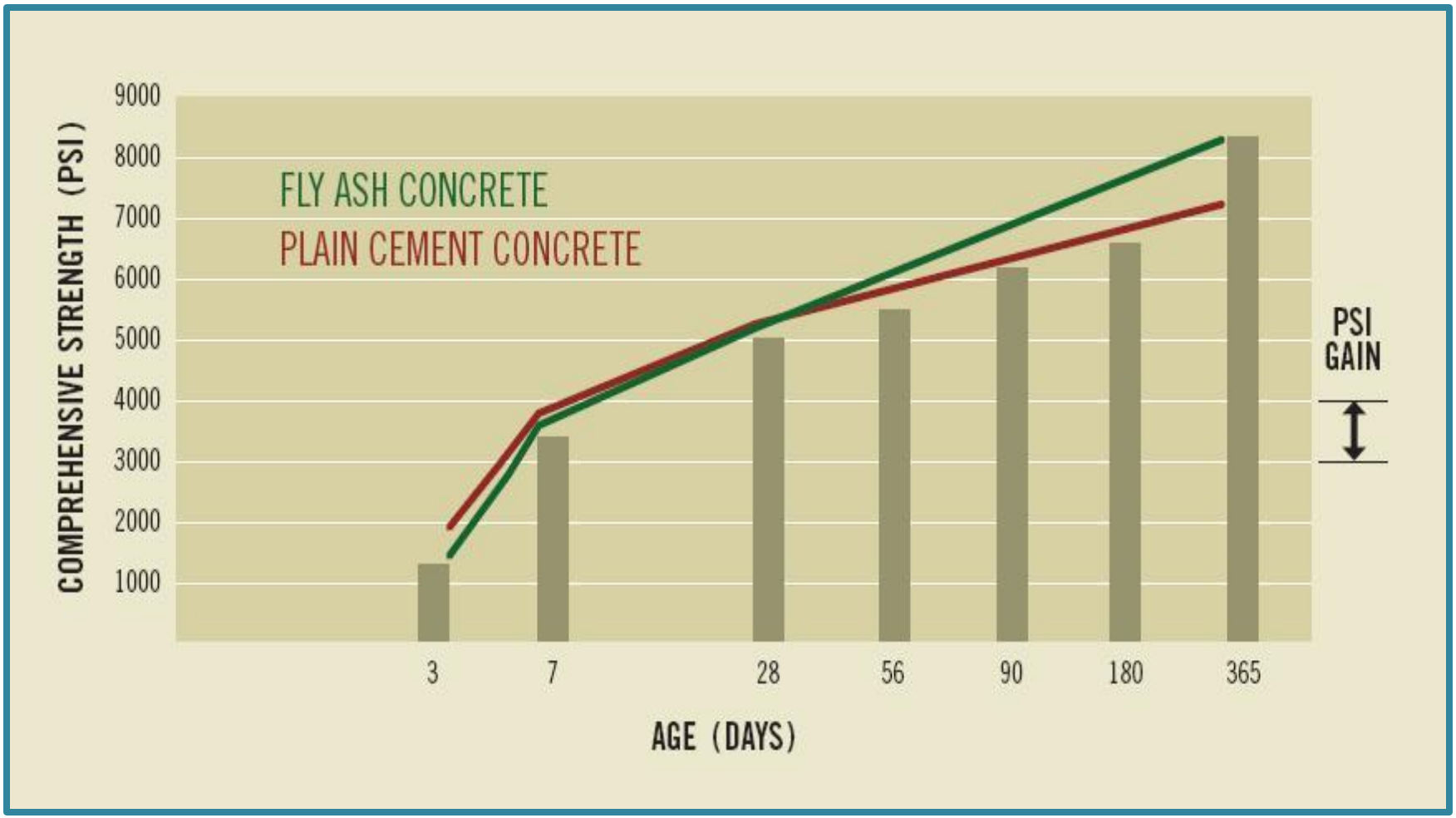
Fly Ash Concrete suitable for concrete structures built in coastal and marine environment with exposure to severe environment.

Workability



- Fly Ash aka mineral admixture gives workability, reducing honey combing and segregation.
- Concrete requires less water.
- Improve finish including fair face concrete.

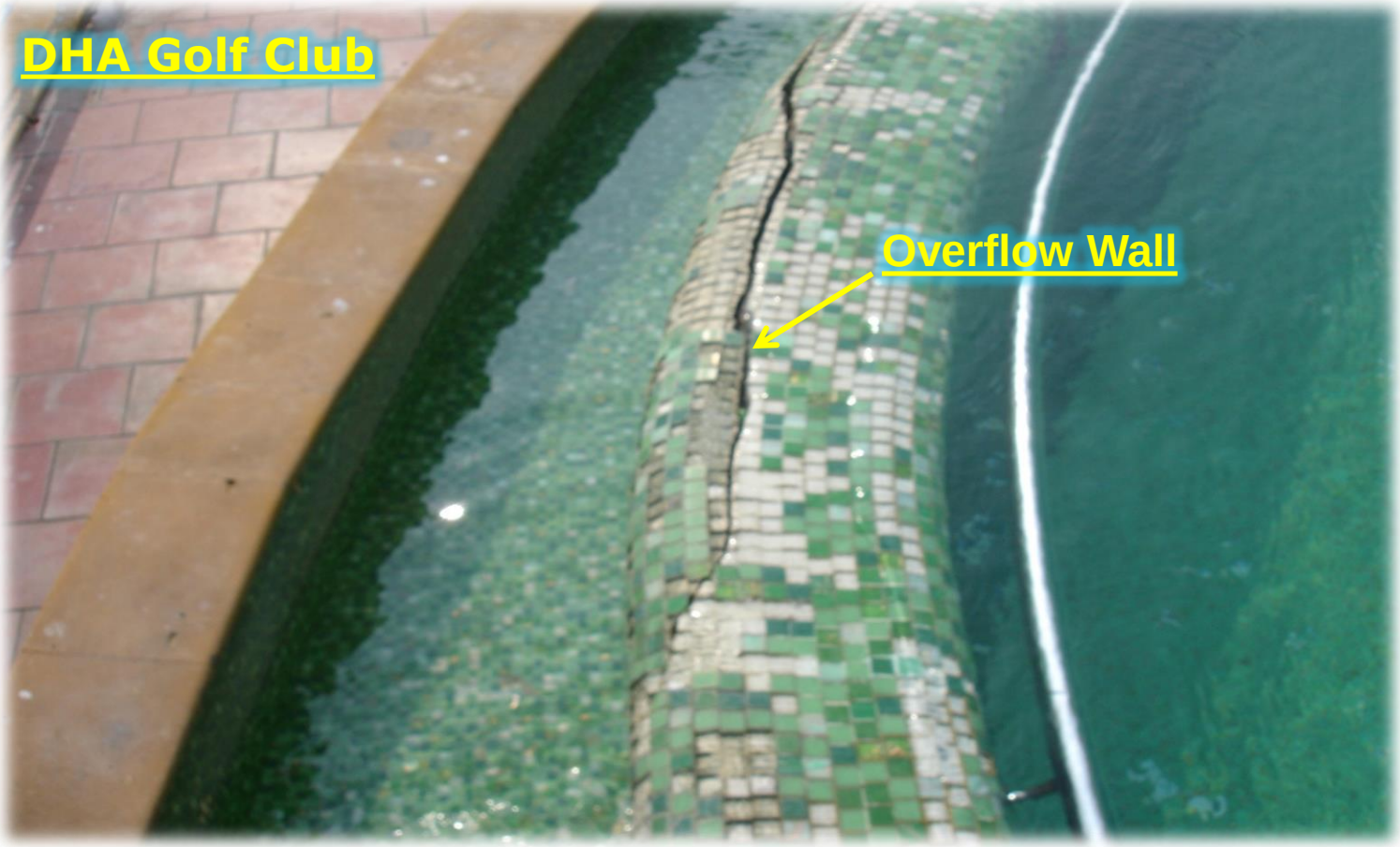
Concrete Strength



Concrete Durability

Swimming Pool

Concrete Durability



Crack most likely due to steel corrosion

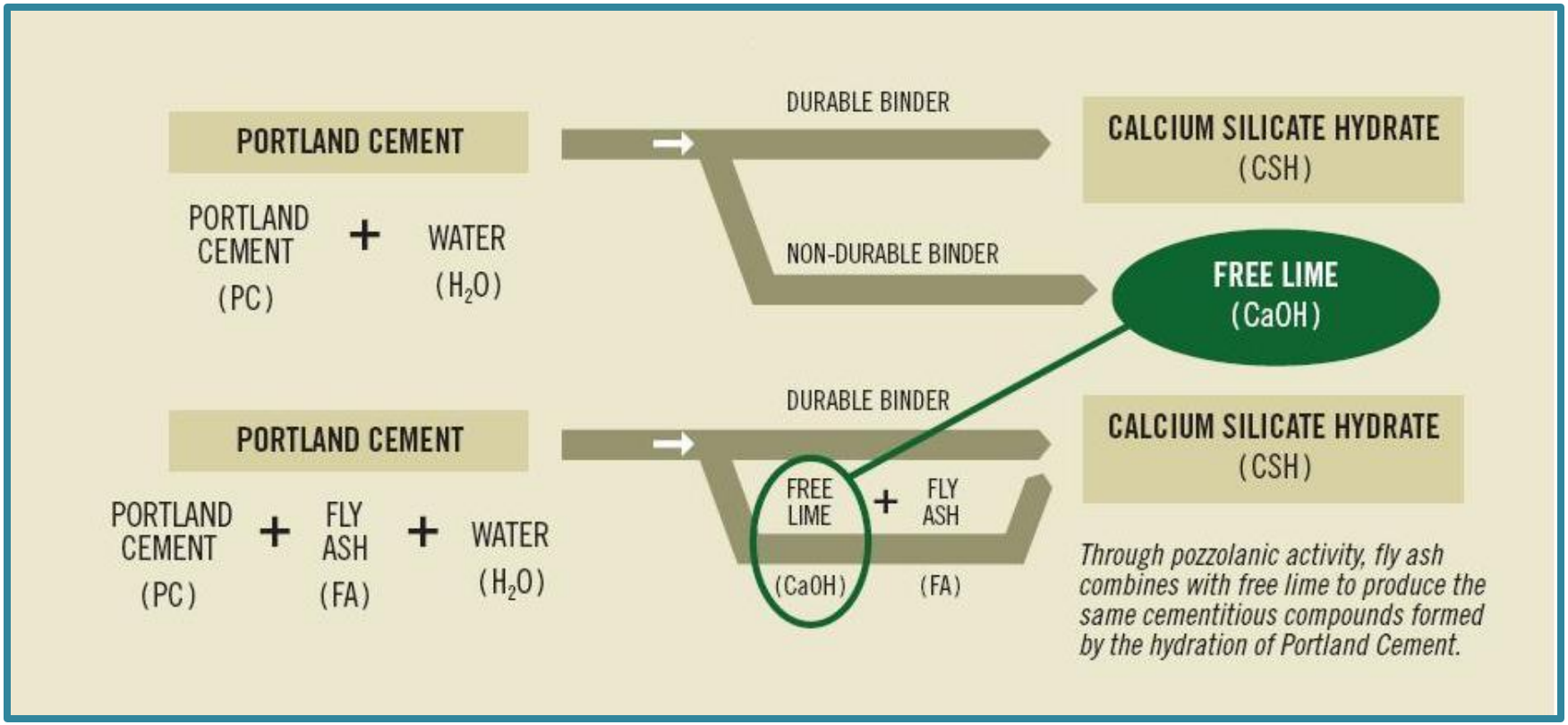
Concrete Durability

Free lime accumulation on overflow wall

Concrete Durability

Close up of free lime accumulation

Durability-Reducing Free Lime



- Fly ash in concrete provides Chloride & Sulfate Resistance not available in SR Cement.
- Make durable concrete (resistance to rebar corrosion and permeability).

More Benefits of Fly Ash Concrete

- Ease of Pumping
- Reduced Bleeding
- Decrease Permeability
- Reduced Heat of Hydration
- Improved Finishing
- Reduced Efflorescence
- Reduced Shrinkage
- Reduced Alkali Silica Reactivity

Darawat Dam

Qasim International Container Terminal, Port Qasim, Karachi

Gwadar Port

Projects

Dubai Marina

Kuwait: Boubyan Bridge

Nepal Middle Marsyangdi Hydroelectric Project

Duqm Seaport, Oman

KASB Head Office, Block 2, Clifton, Karachi

High Strength Concrete with Fly Ash

Burj Khalifa, Dubai

New Doha International Airport, Qatar

World Trade Center, Bahrain

Where is Fly Ash used?

- Flowable Fill
- Marine Concrete Structures
- Concrete Pile
- Basement & Retaining Wall
- Fair Face Concrete
- Plaster Works
- Road Base/Sub-base
- Reclamation of low lying area
- Waste Stabilization / Solidification
- Water Retaining Structure
- Sewage Systems including Tanks & Treatment Plants

Flowable Fill

- Mixture of coal fly ash, water, and Portland cement that flows like a liquid, sets up like a solid, is self-leveling, and requires no compaction or vibration to achieve maximum density.
- Designed to function in the place of conventional backfill materials such as soil, sand, or gravel and to alleviate problems and restrictions generally associated with the placement of these materials.

Benefits of Flowable Fill

- Allows placement in any weather conditions
- 100 percent density with no compactive effort
- Fills around/under structures inaccessible to conventional fill placement techniques
- Increases soil-bearing capacities
- Prevents post-fill settlement problems
- Increases the speed of backfilling operations
- Decreases the variability in the density of the backfilled materials

Back Filling with Flowable Fill

The Way Forward for Pakistan

1. Increasing life of concrete roads and structures by improving concrete durability
2. Net reduction in energy use and greenhouse gas and other adverse air emissions when fly ash is used to replace or displace manufactured cement
3. Reduction in amount of coal combustion products that must be disposed in landfills
4. Conservation of other natural resources and materials.

Green Business

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