



Quantum Readymix Concrete

THE LONG TERM STRENGTH DEVELOPMENT OF CONCRETE CONTAINING FLY ASH

The use of fly ash in South Africa has increasingly gained momentum since the mid 70's to the point where today it is virtually impossible to purchase concrete/cement that does not contain fly ash.

It has gained wide acceptance in structural concrete, high strength concrete as well as water retaining structures where a lower heat of hydration is mandatory, particularly in dams. The recently completed Katemba-Maputo bridge in Mozambique is a case in point. This bridge, the longest suspension bridge on the continent, built on the coastline where high humidity is prevalent will require less maintenance and will be more durable due to the fact that the mandatory use of fly ash was incorporated in the concrete mix.

The superior performance of modern day concrete is in no small part owed to the ongoing strength development of fly ash concrete whose post 28-day strength development has no peer. So much so that in fact specifications are being changed to accommodate this phenomenon, albeit only partially. One such application is in dams and in particular roller compacted concrete but also in most all water retaining structures. The specifications for structural concrete, however, have not. The reason for this is that few specifying authorities are inclined to change the criteria for the strength of concrete beyond a 28-day strength which is understood. Nevertheless, this strength gain is very much an undeniable fact and can be quite phenomenal depending on the circumstances. The strength gain is dependent on not only the post 28 day strength at which it is ascertained but also the curing conditions as well as the percentage fly ash utilized.

Concrete made with cement containing no fly ash would typically in days gone by gain an additional 20% of the 28-day strength if measured a year after casting. **Mixes containing approximately 30% fly ash can double the 28-day strength over the same period.** Even more astounding is that it is no more susceptible to cold weather or non-curing than its Cem I (OPC) brother. Fly ash functions as a Pozzolana and combines with water and free lime to form additional cementitious compounds. Cement incorporated in concrete produces free lime and it is with these compounds that the fly ash reacts with. The greater the proportion of fly ash the lower the available free lime.

Free lime is susceptible to being leached out of concrete and ultimately leaves voids behind. A good quality fly ash capable of reducing water for a given workability produces a far better quality, denser, more impervious concrete, better able to withstand chemical attack. Concrete contains some 10% water and by reducing this water for a given workability a superior concrete is in the making.

The following 3 facts make for every day concrete containing fly ash and used by virtually all construction being superior in the 21st century than that which was produced in the 20th century.

- Concrete with a lower water requirement for a given workability is denser with less shrinkage characteristics.
- By combining with free lime it is more impervious and better able to withstand chemical attack.
- The ongoing strength development like no other pozzolan can match, produces a concrete of far superior strength

STRENGTH GAIN OF STRUCTURAL CONCRETE CONTAINING 30% FLY ASH

Structural Concrete containing 30% fly ash		
Cement Type	Cem 1 (OPC)	Cem 1 + 30% PFA
28 Day Strength (%)	100	100
56 Day Strength (%)	115	130
90 Day Strength (%)	125	160
365 Day Strength (%)	135	190

Note Percentages expressed are expressed as a percentage of the 28-day strength

