ASH DEVELOPMENT ASSOCIATION

GOOD CONCRETE –
Can you afford not to use it.

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FLY ASH TECHNICAL NOTES

No. 1 1995

A good fatty mix similar to that used in many of the structures in this skyline.

INTRODUCTION

What is "good concrete" and how does it differ from the concrete you may have been using? "Good concrete" is a term long used in the construction industry to signify a product which does the right job.

To borrow a definition widely used in the Quality Assurance industry, the essential characteristic of concrete that makes it "good" is its "Fitness for Purpose".

Thus we propose a definition relevant to the specifier of concrete - "Good concrete is a product which is specifically designed to be appropriate for its proposed application, ie Fit for Purpose."

WHAT DOES FIT FOR PURPOSE MEAN?

The final reason for designing and constructing any structure must be to perform a defined role for a defined period of time. Whether it is to keep the mud off the shoes of pedestrians (a footpath) or to form a stable offshore oil drilling platform there will be a number of performance criteria which have to be met.

In the first instance, the criteria would be expected to include freedom from excessive cracking, and ability to last for the design period.

In the case of the oil platform long term durability in an aggressive marine environment is essential. The durability may also be specified in terms of specific environmental factors such as a need for resistance to sulphate attack or chloride penetration.

HOW DO I ARRIVE AT THE APPROPRIATE REQUIREMENT?

As the designer it should be straightforward to arrive at a required level of performance for most items. A list of some of the common criteria for the concrete to be used in a structure might include:

- Strength and loading
- Workability and pumpability
- Curing requirements
- Limits on cracking, shrinkage and creep
- Permeability, resistance to water penetration
- Shape and form
- Resistance to the effects of sulphate attack
- Resistance to the effects of disruptive alkali aggregate reactions
- Long term marine durability including particularly protection of reinforcement against corrosion

WHAT DOES FLY ASH HAVE TO DO WITH THESE?

Fly ash is a by-product of combustion of pulverised coal in high efficiency power station furnaces. It has long been used as a concrete component, where it can significantly improve performance against the criteria listed above.

The Ash Development Association of Australia has information covering the above topics. In a series of publications, the use of fly ash in good concrete to provide very specific performance characteristics is explained. The brochures specifically include the results of Australian research and experience and as such, are extremely relevant to your requirements.

Thus if your objective is to design concrete which needs to meet any or all of the performance criteria above, then the use of an appropriate quantity of fly ash will assist in making it Fit for Purpose. Put simply, if you want Good concrete, it should contain fly ash.

WHAT ROLE DOES THE FLY ASH PLAY?

The small particles of fly ash perform several functions which can be beneficial to concrete performance. As a void filler to improve density, a water reducing agent to reduce cracking, or to reduce the heat generated during curing, fly ash offers benefits.

The use of fly ash is also the result of a conservative approach to design. Traditional design practice has relied on the criterion of strength as the dominant means of specifying a conservative design. Thus if a designer needed 40 MPa concrete but was concerned about its durability in an adverse environment, he might have specified 50 MPa.

In fact, recent research by the CSIRO has shown that 40 MPa concrete containing fly ash, can have a **greater** resistance to sulphate attack than 50 MPa plain portland cement concrete. This greater resistance to adverse environmental conditions would be expected to give a longer service life to the structure. It is also known as durability.

Good concrete using fly ash, is a cost effective means of achieving durability.

WHO IS USING FLY ASH FOR THESE REASONS?

A large range of concrete users in Australia have constructed a complete range of structures using fly ash concretes. Fly ash has been commercially available in Australia for over 30 years, and the durability performance of many of the structures built with it have been exceptional.

Pacific Power, as Australia's largest producer of fly ash, has pioneered its use in concrete since the early 1960's. Over that time it has constructed more than 10 billion dollars worth of power stations, with a total use of over 800,000 m^3 of fly ash concrete.

Many of the structures have been designed for exposure to a range of chemical and environmental conditions well beyond those experienced by the average concrete user. The use of fly ash has been critical to the ability of concretes to withstand that exposure.

After inspecting the concrete at several of the coastal power stations in New South Wales, Associate Professor Harold Roper, from Sydney University's School of Civil and Mining Engineering stated to Pacific Power "If all Australians who own as much concrete as you had as few problems as you, there would be a lot less worried people in this country."

WHY SHOULD I CONSIDER USING FLY ASH?

A large body of long term experience, backed by scientific research from groups such as CSIRO, will provide ample reassurance to the customer. All the normal requirements to achieve a quality project will apply, but through using fly ash you are getting good concrete and peace of mind.

Further Information

Information about the properties of fly ash concrete can be obtained from the Ash Development Association direct, or from any of the members located in most capital cities.

In particular, the reader is referred to the companion brochures becoming progressively available through 1995:

Technical Notes Nos.:

TN-2 Sulphate Attack on Concrete - What it is and how to stop it.
TN-3 Can you afford to risk an Alkali Aggregate Reaction?
TN-4 Concrete for marine environments.
TN-5 Low cost pavements using fly ash.
TN-6 Cost effective embankment construction.
TN-7 How fly ash can help to reduce shrinkage and thermal cracking in concrete.
TN-8 How fly ash can reduce the variation in concrete quality.

Reference Data Sheets Nos.:

RD-1 Economical mix design - Optimising the use of fly ash in concrete or bound pavement mixtures.
RD-2 Sulphate resistance in concretes using fly ash.
RD-3 Alkali Aggregate risk reduction using fly ash.
RD-4 Fly ash in marine concretes.
RD-5 Pavement design using fly ash.
RD-6 Embankment construction using fly ash.

Other titles may also be available and the Association has access to a wide range of publications in areas that may be of interest to readers.

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