USE OF FLY ASH AT PREMIER MINE COLLIE W.A.

by W. Murray Stewart Grad. I.E. Aust

ASH DEVELOPMENT ASSOCIATION

CASE STUDY NO. 7

May 1999

This report is a summary of the use of fly ash for works carried out at the Premier Mine development for Wesfarmers Coal Ltd. The parties involved in the use of fly ash were as follows:-

Client:
Wesfarmers Coal Ltd (WCL)
Consulting Engineers:
van der Meer & Associates (VDM)
Contractor:
Cardinal Contractors Pty Ltd (CC)

1. HISTORY

Fly ash/Cement stabilized backfill was used to backfill an 18m high stabilized earth retaining wall designed by VDM. The stabilization was achieved using an "Aran" ASR 200EH portable plugmill, which was specifically purchased for this operation. The plugmill included a;

29 cubic metre cement silo
12 cubic metre feed hopper
10 cubic metre surge bin
5 cubic metre integral water tank around the feed bin
3 cubic metre lower tank.

The cement stabilized backfill on this portion of the project involved approximately 40,000 tonne of lateritic gravel material.

The infrastructure works also required significant areas of hardstand and pavement works for 200 tonne dump truck haul roads. The orginal design intent was that these areas would be covered with lateritic gravel topped with asphalt. It was the opinion of VDM that, due to the in-situ reactive clay soils and the extremes of climatic conditions (very cold winters to hot summers), flexing of the pavement would be likely to allow moisture ingress into the pavement.

2. REASONS FOR USE OF FLY ASH

Varying thicknesses of asphalt topping for lateritic pavements at least 1.0m thick were required for the original design.

VDM's solution was for cement stabilization of local deposits of naturally occurring lateritic gravels. In conjunction, it was proposed that the in-situ cut and filled clays would be stabilized by lime to increase the strength and decrease reactions to moisture.

CC's experience with the use of cement stabilized backfill indicated that it's use was excellent in a bulk fill situation. However the hydration process of the cement meant that the fill needed to be placed and compacted within one hour for satisfactory results. This would allow insufficient time to enable trimming of the pavement to final levels and joining to previous works. VDM suggested the addition of fly ash to extend the working time and increase workability.

As a result a trial pavement was constructed using fly ash from the Muja Power Station fly ash storage silos with addition of cement through the pugmill already on site. This pavement was constucted in a highly trafficked area and following curing of the material was subjected to "destructive testing" using a Komatsu D355 Bulldozer (Caterpillar D9 equivalent). The success of these trials, combined with crushing tests performed on cylinder samples resulted in the adoption of this method for stabilization.

The advantages provided by the use of fly ash and cement additions were as follows:-

Full depth stabilization of the pavement.
Volumetric stability of the pavement.
Moisture stability of the pavement due to lower permeability.
Increase in compressive strength.
Workability of the material for placement due to the hydration process.
Capital cost savings (including savings on the cost of both cement and gravel).
Potential maintenance cost savings.

3. RESULTS

The final design thus consisted of:-

1. 100 mm lime stabilized clay.
2. Sub-base layers varying from 300 mm to 400 mm using 2% cement stabilized gravel.
3. Base-course layers of 200 mm cement with content range 3% to 7% and fly ash content ranging from 4% to 6%.

Design detail of pavements varied depending on the ultimate design traffic for various areas.

The existing pugmill was modified by the addition of a dedicated fly ash silo with a screw feeder. Fly ash was carted by CC to the silo using a bulk tanker. The extreme dryness of the fly ash meant that the water supply needed to be upgraded. During the operation it was attempted to provide a mixture which was at, or above, Optimum Moisture Content, in order to compensate for evaporation losses between the pugmill and the final compaction site. It was also necessary to add moisture to the finished surface during the first three days to aid in curing. It was noted, however, that despite this action fine shrinkage cracks did occur at generally regular spacing on the pavement.

The final pavement area stabilized in this project was in the order of 72,000 square metres and involved the placement of approximately 100,000 tonnes of stabilized gravel. The use of fly ash exceeded 2,800 tonnes.

Compressive strengths achieved (MPa):

4 days 1.5 to 5.25 (average 3.25)
28 days 3.25 to 9.0 (average 5.5)

ASH DEVELOPMENT ASSOCIATION OF AUSTRALIA

GPO BOX 5257, SYDNEY 2001, NSW AUSTRALIA

For further technical information contact:

Barry Butler, Development Coordinator
117 Marmong Street, Marmong Point
NSW 2284 Australia

Phone/Fax. 612 4958 6611-Mobile. 0411 425 586

Supported by: