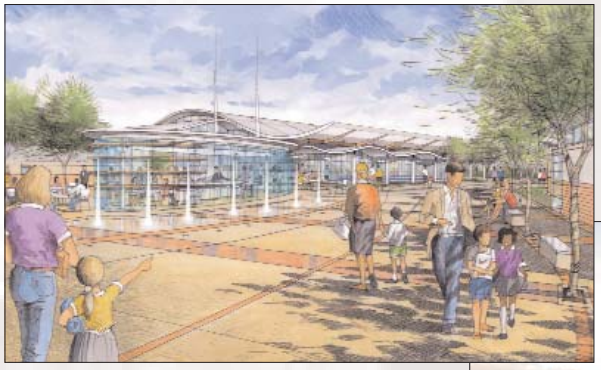
UNITED KINGDOM QUALITY ASH ASSOCIATION

CASE STUDY

Bilston Urban Village - Grouting Contract

Introduction

Bilston Urban Village in the West Midlands is to be built on an area of 38 hectares of vacant land. This land has had many uses over the years and there are a number of problems to resolve before the development can take place. The majority of the site is made up of fill material including colliery spoil, ash, slag, clinker and demolition rubble. In addition about 100 mineshafts have been identified where extensive working of the Staffordshire Thick Coal has taken place in the area over a 150 year period. This land has a complex history with various furnaces, mills, factories, workshops, collieries, ironstone mines, etc occupying the site during the industrial revolution and with GKN Sankey's factory occupying the area in living memory.



A £176 million project to create the urban village was funded by Advantage West Midlands in conjunction with Wolverhampton City Council. Waterman Civils Ltd were appointed as the consulting Civil Engineers for the contract. As part of the site preparation it was concluded that stabilisation of the shallow mine workings in Plot A and the filling of 6 mineshafts in Plot E would be carried out using PFA grout. The £1 million contract was won by M&J Drilling for treating these areas and took 23 weeks to complete finishing in February 2007.

Stabilising the Shallow Mine Workings

In Plot A, some 1500 boreholes, typically 30m in depth, were bored and grouted using a 10:1 PFA:cement grout with a water solids ratio of 0.40. A total length of 45km of boreholes was cut for the contract. These bore holes were spaced at 6m intervals in a square grid pattern across the site of a new Leisure Centre, car parks and various access roads. One well and more mineshafts were discovered other than those identified from the original site surveys during the work. Depending on the amount of PFA grout used when filling each of these bore holes, secondary bore holes were drilled and grouted where the mining activity was found to be more extensive than expected. During the contract some 8,000 tonnes of PFA was used in making the grout for stabilising this area.

Filling the Mine Shafts

In Plot E on the opposite side of the valley and the previous location of a scrap yard, some six mine shafts had to be filled, which had been logged in local records. Firstly these shafts had to be located precisely, which was done by drilling trial holes into the ground. They were all found reasonably close to their expected positions. Then ~28m deep boreholes were drilled into the mineshaft and then grouted with PFA: cement grout. A borehole lining system was used and the grout was pressure injected into shaft in 1m lifts with 10 tonnes of grout being used per lift. The liner was then raised by 1m for the next lift.

Mixing the Grout

The PFA was supplied as fresh conditioned ash from Ratcliffe Power Station delivered in tipper vehicles and stored on a specially prepared area. This storage area was partially surrounded by container units that act as a wind break, reducing the risks of dust and noise and hide the works from the adjacent Black Country Route. The ash was fed by loading shovel into a hopper, where it was weighed by belt feeder in conjunction with the cement into the grout mixer. The cement silo was horizontal with a discharge screw using a lost weight weighing system. The cement silo was filled using bulk tankers and an efficient air filtration system used to prevent dust problems. All weighing and batching was computer controlled to ensue a consistent but fluid grout. Test cubes were taken daily from the grout, the specification required a compressive strength of 0.7MPa at 28 days.

The grout was mixed in a colloidal electric rotary mixer and pumped using 68mm diameter pipes to the various boreholes, again using an electric pump. Back pressure in the grouting pipeline was automatically monitored. Electric mixer and pumps were adopted because of their relatively quiet operation.

The Future

Upon the completion of the ground stabilisation the construction of the Urban Village could start. This will consist of landscaped areas, new housing including apartment blocks, areas for businesses to develop including a Leisure Centre and an enhanced landscape and informal recreation areas.

Conclusion

PFA has proven again to be the ideal material for stabilising land affected by mining from the industrial revolution. Without PFA this type of land remediation would be considerably more expensive and difficult to achieve.

M. & J. DRILLING SERVICES LTD.

Acknowledgments

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In general usage the term ‘fly ash’ is used for pulverized coal ash but it can also cover ash from burning other materials. Such ‘fly ash’ may have significantly differing properties and may not offer the same advantages as ash from burning pulverized coal. UKQAA datasheets only refer to PFA / fly ash produced from the burning of predominantly coal in power stations.