United Kingdom Quality Ash Association

Bilston Urban Village a case study

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PFA widely used for grouts …

- The Bilston Urban Village site is 38 hectares of land on which there has been built;
  - furnaces, mills, factories, workshops, collieries, ironstone mines, etc over a period of hundreds of years.
  - There are >100 mine shafts on the site
  - Extensive working of Staffordshire coal seam for 150 years
- It needed extensive remediation before it was safe to develop
- PFA grouts were used for remediating the mine shafts and coal workings

The before – the site…

The after - an artists impression...

Remediating the site…

➔ **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.**
- **M&J Drilling were employed to remediate the mineshafts, etc.**

Grout placing…

How it was done…

- 1500 boreholes, typically 30m in depth bored
  - Grouted using a 10:1 PFA:cement grout
  - Water solids ratio of 0.40.
  - A total length of 45km of boreholes
  - Spaced at 6m intervals in a square grid pattern
  - The Leisure Centre, car parks and various access roads areas were treated
  - Some secondary boreholes drilled where mining activity greater than expected.

How it was done…

- Conditioned PFA supplied from Ratcliffe power station
- Mixing plant and PFA storage surrounded by container units
  - To reduce dust and noise.
- Computer controlled batching
  - Efficient dust filtration system
- Colloidal electric mixer used
  - Pumped through 68mm diameter pipe work to boreholes
- Electric pump used to place grout
- Grout strength of 0.7MPa @ 28 days required

Dust prevention…

Efficient dust filtration must be used and conditioned PFA stockpiles kept moist

Grout mixing …

- PFA grouts can be highly fluid and therefore able to fill voids, fissures, etc very effectively

- NB: The guard has been opened here for the purposes of taking this photograph to show the fluidity of the material. Such equipment should only be operated with the guards in place

Why PFA for grouting ...

- PFA grouts have many advantages over traditional sand/cement grouts:
  - Economical.
  - Reduced water/solids ratios compared to sand.
  - Less Portland cement needed for same strength.
  - Increasing compressive strength with time.
  - Extended setting times.
  - Lower shrinkage.
  - Lower permeability.
  - Its able to permeate the fineness of fissures in the ground.
  - Excellent pumpability.
  - Higher resistance to chemical attack.
  - PFA readily available in large quantities.

Particle density ...

The lower particle density of PFA can be an advantage when weight is an important factor.

PFA particle density is 2.15 compared to 3.12 for Portland cement and 2.7 for sand.

Conditioned PFA is normally supplied.

You get more grout with PFA per tonne than other alternatives!

Available in large quantities…

Why use PFA – the environment?

- ➔ **Some parameters:**
  - **Every 1 tonne of CEM I replaced**
    > reduces emissions by ~860kg of CO_2
  - **21kg of CO_2 produced per tonne of virgin aggregate**
- ➔ **More complex than simple calculations**
  - **PFA is pozzolanic – increasing strength with time**
  - **Lower water content – enhances strength and durability**
  - **Lower particle density – goes farther volumetrically than virgin aggregates**

Why use PFA grouts...

- **PFA grout in comparison with sand/cement grout;**
  - **Less CEM I required for same strength**
  - **No virgin aggregates required**
  - **Lower density grout**
    - > Less truck movements, therefore less environmental impact
  - **More economical**
    - > One site estimated 40% saving in vehicle movements
    - > Reduction in cost by ~20%

Overall environmental benefits of PFA/fly ash...

- Currently ~720,000 tonnes of CO_2 saved annually by the use of PFA in all applications
- About ~2,800,000 tonnes of PFA disposed to landfill annually
  - Potential for a further ~60,000 tonnes of CO_2 savings if used as an alternative to virgin aggregates
- Further information available on UKQAA web site and CD;
  - 38 datasheets and case studies available to download
- Visit us at our exhibition stand for more information

For more information about PFA or the UKQAA contact us ...

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