Phoenix Collegiate—Treatment of Mine Workings and Mine Shafts

Project Profile

Client: Carillion

Designer: Mott MacDonald

Value: £1.2m

As part of the Priority Schools Building Programme (PSBP), the Education Funding Agency (EFA) proposed to rebuild The Phoenix Collegiate School on the existing site at Clarkes Lane, West Bromwich. The school is built on a former landfill with the existing buildings grouped in the southern third of the site and playing fields occupying the remaining area to the north. The new school buildings were to be built in the southern area of the site occupied by the existing facility. Phasing of the construction work, which included demolition and mine workings treatment, was required to allow the continued operational of the existing school during the re-development

The site is located within the South Staffordshire Coalfield and Coal Authority records indicated coal mining has occurred in at least 4 coal seams from 40m to 160m BGL (Brooch, Thick, Heathen, Little and New Mine coals) and were last worked in 1914. Due to the thickness of the workings associated with the Thick Coal Seam, and reduction of the sandstone cover towards the south of the site, is was feasible that void migration from such a level could reach ground surface, resulting in stability risks for the proposed development. Treatment was therefore recommended to a maximum depth of 55m BGL in order to mitigate the risks of any void migration.

Mine workings treatment under the proposed buildings was scheduled to be completed in 2 main phases, the first phase being split into smaller sub-phases. Within these main phases of work, the site was divided into two main working zones; Main Teaching Block and Sports Hall / Energy Centre areas.

Drilling & grouting treatment works were undertaken as detailed below;

- Building footprint dimensions were extended by 10m to give a FOS against lateral void migration from untreated workings outside the building areas
- A 6m treatment grid was used
- In conjunction with the treatment works a 1.2m centred probing grid was undertaken over the extended building footprints to confirm the location of four known recorded mineshafts as well as remove the risk of any unrecorded mineshafts within the development boundary

At the peak activity, 11 rotary/rotary percussive drilling rigs and 22 personnel were on site. Plant and equipment also included a substantial grout mixing set up.

Phoenix Collegiate—Treatment of Mine Workings and Mine Shafts (Cont'd)

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Summary of the work completed :

- Mine Workings and Mine Shaft Treatment
  - ◊ Main Teaching Block = 220 boreholes drilled & grouted.
  - ◊ Sports Hall & Energy Centre = 150 boreholes drilled & grouted.
  - ◊ 3 x recorded mineshafts located, drilled & treated, depths of between 45m to 99m BGL
  - ◊ Installation of 3 grout caps over the located mineshafts.
  - ◊ Total of 2,100 tonnes 10:1 (PFA:OPC) grout injected.
- Probe Drilling Works
  - ◊ Main Teaching Block = 5439 boreholes drilled.
  - ◊ Sports Hall & Energy Centre = 2929 boreholes drilled.

- Preparation of working areas was completed by Carillion and included creation of drilling platforms, installation of drill flush and surface water collection trenches & sumps.
- Treatment grids serviced with; water feed from three 12,000 gallon water storage tanks and grout pipelines from a central mixing compound. Central batching and servicing removes multiple grout mixing set ups, giving full control over materials deliveries, storage, mixing and quality control.
- Holes were drilled with 101mm OD rotary percussive steel casing sealed into rock head or, where badly broken rock strata was present, installed up to 20m deep to ensure hole integrity. A 75mm open hole was then drilled to the required allowing insertion of a 50mm MDPE grout tremmie pipe.
- A significant amount of inclined drilling was required to treat under existing structures with angles of up to 20° being accommodated by the versatile drilling resources on the site.
- Water flush drilling was used with water piped to drilling rigs via a delivery main along the treatment areas. The rigs were also equipped with on board water pumps to ensure optimum hole flushing.
- Drilling & grouting carried out in an agreed sequence with down-dip perimeter holes completed first.
- Grout was mixed in a 2.5m^3 hydraulically driven batch mixer and distributed directly to treatment area grout holes via pumps. Grout mixes were 10:1 PFA / OPC.
- Continuous monitoring and recording of injected quantity and pressure was carried out together with extensive quality control and testing of mixed grout.
- A 1900mm diameter storm water culvert crossed the site requiring extensive liaison with the Environment Agency regarding the easement and working restrictions adjacent to the culvert.
- As the work was completed in and around the operational school continuous control and monitoring of noise and dust was required together with liaison and programming with the school to avoid noisy work during exam periods.