

Penygawsi Primary School

Drilling and Grouting works create value for education project in historic Welsh mining region

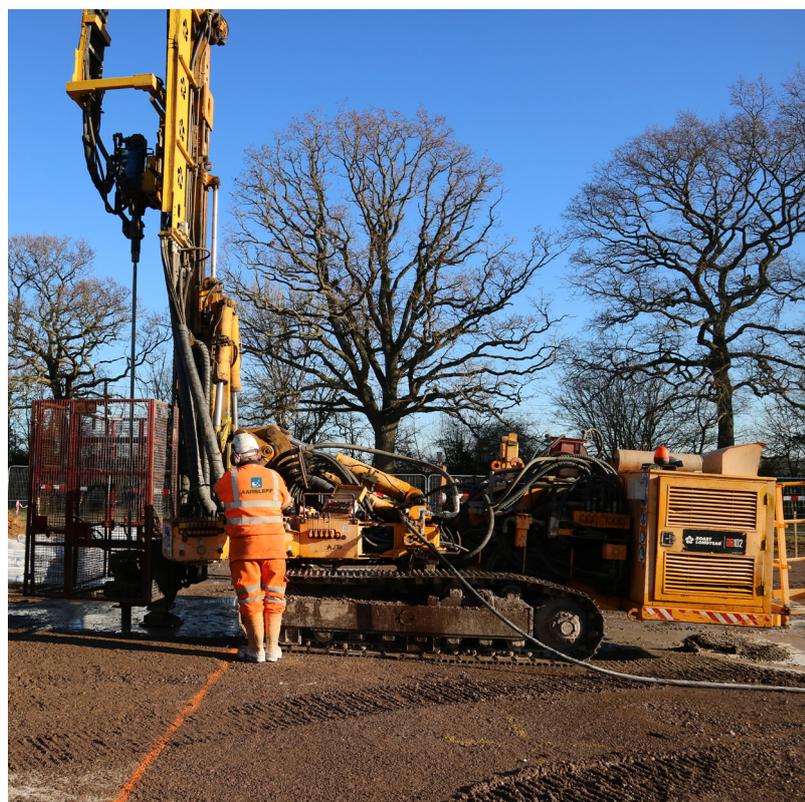
The Rhondda Valley in Glamorgan in Wales was once one of the world's most important coal mining regions. Between 1860 and 1939, the region boasted 79 collieries and levels, mining multiple coal seams across the area. This legacy poses a risk to contemporary development as some of the historic workings are unmapped and were abandoned in an unstable condition.

As part of the Welsh government's plan to deliver Mutual Investment Model (MIM) education projects, Rhondda Cynon Taf County Borough Council awarded Penygawsi Primary School founding to remodel their premises. Situated in the historic Rhondda Valley, the full scope of the project involves the demolition of the existing primary school and the construction of a new two-storey building. Within the wider scope, it will provide a two-court multi-games area, a playing field, and a car park. The project aimed to be Net Zero Carbon in operation whilst providing a stimulating learning environment through new facilities fit for the 21st century. There will also be scope for the wider development to be utilised by the wider community.

The site sits atop the Upper Coal Measures formation, with three key outcrops of coal in the area, and is therefore classified as a high risk development by the Coal Authority. The records do not show workings underneath the site itself, but a shaft entrance was recorded in the north west of the site and therefore, the site is considered to be at risk of subsidence as a result of shallow mine workings.

Aarsleff Ground Engineering were contracted by Morgan Sindall Construction in order to undertake a strict specification of drilling and grouting on a 3m grid across the site. The works included injection of grout into the boreholes to sufficiently fill all cavities, breaks, and fissures in and above the historic workings. This would minimise the risk of measurable subsidence, formation of surface crown holes, and potential damage to structures in the vicinity of the mine workings.

Overall, the work was completed over 7 working weeks. In total, 472 locations were drilled with over 13,500 linear metres of drilling and 101m of steel casing, all completed using 3 Casagrande C6 drilling rigs.



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The sequencing for the mine working treatment was planned to avoid adverse impact from displacement of high groundwater and to mitigate potential risk of flooding to nearby properties. Flush utilised in the drilling and any expelled ground water was drained away from the works platform and drained through a silt removal filter so that it may be recycled into the drilling process.

The works started with a preliminary 15x15m grid of drillholes. This initial phase was to investigate the nature of the layers within the ground and gain a deeper understanding of the dips and thickness of the coal seam. We found that a 26° dip was present underneath the ground and therefore, a perimeter curtain was installed with larger diameter drill holes. This was cut off at 25m below rock head along the north-west perimeter of the site to contain grout within the boundary.

All grout holes within the main 3x3m treatment grid were advance drilled to a minimum of 20m below rockhead, with a mean depth of 30m below existing ground level.

Aarsleff worked closely with Morgan Sindall to ensure their drivers were met with effective collaboration between the two ensuring that the site was effectively prepped for the work and the site team could immediately commence following mobilisation. This ensured that the tender programme was met. There was also focus on concrete mix proportion with the sustainability element of the project at the forefront of the end client's mind. A mix proportion of 12 parts pulverised fly ash (additive replacement for cement in grout) to 1 part cement was used for the infill grouting and a mix of 15:1 with 50% pea gravel was used for the perimeter locations.

Within the main treatment area, grout take was relatively low and we found that the majority of the site contained 'intact' coal seams. However, throughout the progression of the job, additional works were added in the proposed car park and in the area designated for a retaining wall. Whilst probing within these areas, large voids of up to 2m were identified 7.5 to 9m below ground level and therefore, the scope of works was extended, mirroring the main treatment specification.

In total, 385 tonnes of grout was mixed and injected over the project's programme and all locations were pressurised to confirm full treatment, in line with CIRIA guidance and client specification. Grout quality was monitored by flow and bleed testing, with 100mm cubes sent for crushing to certify compressive strength.

17 validation test drill holes were also carried out to ensure that the treatment works were appropriately performed to meet the specification and allow sign off of the completion report. To ensure monitoring of hazardous ground/mine gases during operation, monitoring devices were placed on all drilling equipment to continuously check for the presence of CO₂, H₂S, CH₄ and O₂.

Works were completed within the agreed timeframe, allowing assessment to commence to inform follow on works. Treatment results were delivered within a validation report to the client in order to evidence their planning conditions compliance, all in accordance with the Coal Authority process.



Data

472 drilling positions
13,500m of drilling
101m of steel casing
385 tonnes of grout

Client

Morgan Sindall Construction

Type of contract

Design and build contract

Construction period

February - March 2023

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