

Airdrie to Bathgate Railway, Mining Remediation Works

Client: Network Rail (Scotland)
Engineer: Scott Wilson. **Geotechnical Sub-consultant:** Donaldson Associates
Date: Dec 08—June 09
Value: £5.7m

This was an advance works contract to complete stabilisation and treatment of mineworkings and mineshafts along the rail line which was closed in the 1960's and which was to be re-opened to create the new £300m Airdrie to Bathgate rail link. The contract was completed in a tight 6 month contract period which included Liquidated Damages penalties of up to £50k per day.

Multiple coal seams had been highlighted by the site investigation requiring treatment at seven main locations along the 22km route with treatment depths of up to 50m. Much of the treatment work was carried out from existing embankments and cuttings which necessitated a substantial amount of angled drilling to allow full treatment of the zone of influence of the railway and structures footprints.

Work included;

- Establishment of main compound, offices and welfare at the mid point of the contract.
- Creating accesses and compound areas for the 7 main treatment areas along the 22km route.
- Preparation and fencing of working areas and creation of drilling platforms.
- 20 drilling rigs were resourced to site to complete the shallow mineworkings grouting in the short programme period and which involved drilling 10,000 grout holes and test holes (250,000m of drilling) to max 50m depth
- Use of steel casing drilled to rockhead was a specified requirement. In addition under bridges and other structures steel casing was required to the full depth of drill holes to allow ascending 'end of casing stage grouting' to guarantee full treatment of workings, migrated collapses and broken ground. We would note that we were the only tendering contractor able to comply with this strict specification requirement.
- Holes were drilled with 101mm OD rotary percussive steel casing drilled and sealed into rockhead (or drilled to full hole depth as required above) followed by drilling a 75mm open hole using rotary percussive rigs allowing insertion of a 50mm MDPE grout tremmie pipe.



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- Drilling and grouting in all treatment areas was carried out in an agreed sequence with down-dip perimeter holes being completed first
- Water flush was used for all drilling with water piped to drilling rigs through a delivery main established along the treatment areas. The rigs are also equipped with on board water pumps to ensure optimum hole flushing
- 5 mixing compounds were established with container surrounded bulk pfa storage areas, twin 50t horizontal cement silos, water storage tanks, water collection and treatment facilities, dust and noise suppression
- Due to the short programme period work was carried out in up to 5 treatment areas at the same time requiring all mixing compounds to be operating simultaneously.
- The mixing compounds were situated centrally to the treatment areas allowing 'central batching' of grout which was pumped up to 700m to the treatment areas.
- Central batching reduces the need for multiple grout mixing set ups and gives full control over material storage, deliveries, grout mixing and quality control. It also reduces any impact on adjacent properties.
- Grout was mixed in 2.5m³ hydraulically driven grout mixers and transferred using screed pumps to agitation units in the treatment areas where it was pumped to borehole positions using hydraulic Gardner Denver grout pumps.
- Grout mixes varied from a 8:1 PFA/cement for perimeter holes to 12:1 for infill holes.
- Continuous monitoring and recording of injected quantity and pressure was carried out together with extensive quality control and testing of mixed grout.
- In total 16,000 tonnes of grout were injected
- 15 suspected mine shaft positions within the influence of the line were also probed requiring 10,000 probe holes
- All drilling and grouting plant and equipment was resourced from our specialist in-house plant fleet
- Due to the intensity of the work up to 90 personnel were on site during peak activity.



During the contract continuous liaison took place with Network Rail and all relevant stakeholders including SEPA, West Lothian Council, North Lanarkshire Council, the independent Project Monitoring Officer and various adjoining Property Owners. The combined efforts of all parties ensured that the works were completed on time and on budget and to the satisfaction of all parties.

On completion of the work we received a complimentary letter from Network Rail highlighting our project team for their 'proactive involvement throughout the contract and efficient and effective management of problems encountered'.