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Mount Pleasant Coalsnaughton

Forkers Limited

Consolidation of Abandoned Mineworkings And Mine Shaft

Completion Report

July 2008

FORKERS LIMITED

MOUNT PLEASANT, COALSNAUGHTON

Consolidation of Abandoned Mineworkings And Mine Shaft

Completion Report

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1.0 INTRODUCTION

1.1 Mason Evans Partnership was commissioned by Forkers Limited (the Client) to undertake the consolidation of abandoned mineworkings and an abandoned mineshaft at Mountpleasant, Coalsnaughton (Drawing No. G2007/533/CR/F/01). Previous investigations indicated the site to be undermined by workings in the Mosie, Lower Five Foot and Alloa Splint Coals, at shallow depths.

1.3 The site investigation information indicated that the proposed development site was underlain by shallow abandoned mineworkings at the level of the Mosie, Lower Five Foot and Alloa Splint Coal seams. Mine abandonment plans for the area suggested the prevalent method of extraction to be stoop and room. In addition, an abandoned mineshaft was recorded at the site which would require to be stabilised.

1.4 It was therefore advised that a surface instability risk could be anticipated in the event of any collapse in the abandoned mineworkings which were within influencing depth of the surface, possibly resulting in subsidence and/or structural damage to the proposed development. Road and development infrastructure were also considered to be at risk.

1.5 Artificial consolidation of the mineworkings by drilling and pressure grout injection was therefore advised to remove the effect of potential collapse from the workings in the above coal seams beneath the proposed development zone. In addition, the mineshaft was to be stabilised by drilling and pressure grouting and finished with a reinforced concrete cap.

1.6 This report presents an account of the stabilisation works and the results of testing to confirm the adequacy of the consolidation of the former coal mineworkings and the mineshaft beneath the site.

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project title:	drawing title:
MOUNT PLEASANT COALSNAUGHTON	SITE LOCATION PLAN

project no:	drawing no:	revision:	date:	drawn by:	approved by:	scale:
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2.0 CONTRACT FOR CONSOLIDATION OF ABANDONED MINEWORKINGS

2.1 The works were designed to achieve effective consolidation of the mineworkings lying within a depth equivalent to a rock cover criteria of ten times the seam thickness. This was determined from examination of mine plans and reviews of borehole data, while the geology was continually reviewed during the drilling of treatment boreholes. In this instance, the detailed analyses indicated that Lower Five Foot Coal to be of an average thickness of 1.50 m while the Mosie and Alloa Splint Coals were recorded to be 1.00 m thick, respectively. A covering criterion of 15 m was therefore required for the Lower Five Foot Coal while only 10 m of cover was required for the Mosie and Alloa Splint Coals.

2.2 The contract duly commenced on 12 March 2008 with practical completion of the majority of grouting works recorded as 13 June 2008. Completion of the shaft treatment was achieved on 19 June 2008.

3.0 DRILLING & GROUTING OPERATIONS - MINEWORKINGS

3.1 General

3.1.1 The area which required treatment of abandoned mine workings in the Mosie, Lower Five Foot and Alloa Splint Coals was assessed from detailed geological correlation and reference to the building layout position. The grouting criterion of rock cover determined the extent of the treatment down dip, with the coal outcrop defining the limits of treatment up dip.

3.1.2 The drilling operations conducted in the treatment operations, indicated ground conditions suggested by the Site Investigation Report with occasional boreholes recording voids and a number of boreholes encountering broken ground and solid coal, indicative of 'stoop and room' workings. The conditions encountered at the level of each coal seam are indicated on Drawing No. G2007/533/CR/F/02 to G2007/533/CR/F/04.

3.2 Borehole Drilling

3.2.1 The drilling operations involved in the consolidation works were as follows:

Total number of boreholes drilled:	1,334 No.
Total metreage drilled:	21,373 m

This represents an average of around 16 metres per hole and was generally consistent with our expectations.

3.3 Grouting Operations

3.3.1 The total volume of grout injected during the consolidation works was 2,160.3 tonnes, which equates to an average of approximately 1.58 tonnes per hole. The approximate volume of grout injected into each of the boreholes is indicated as appropriate on Drawing Nos G2007/533/CR/F/05.

3.3.2 The grout mix utilised for the infill treatment boreholes was generally a 'cement: pulverised fuel ash' ratio of 1:12.

4.0 CONSOLIDATION OF MINESHAFTS

4.1 General

4.1.1 During the drilling of consolidation boreholes the shaft indicated on the relevant mine plan and the Coal Authority Report was found. Subsequent probing at the location was undertaken to confirm the location and size of the shaft.

4.1.2 The drilling of 10 No. probe holes was undertaken to determine the exact location and dimension of the shaft which was recorded to be 2.00 m x 2.50 m at the surface. Drilling indicated the shaft to be 42.00 m deep and loosely backfilled. A total of 168.75 tonnes of grout was injected into the mineshaft to the full depth of 42.00 m while two subsequent test holes confirmed the success of the treatment. Drawing No. G2007/533/CR/F/06 presents the location of the consolidated mineshaft.

4.2 Shaft Treatments

Mineshaft No. 1	-	Total depth of shaft	=	42.00 m
	-	Total treatment depth	=	42.00 m
	-	Total grout tonnage injected	=	168.75 t
	-	Total stone tonnage	=	100.5 t

4.2.1 The shaft was treated by drilling and pressure injection, under our supervision, from 13 June 2008 until the 19 June 2008 when the shaft collapsed. A stone and grout mixture was utilised to infill the void and complete the shaft stabilisation. Test holes confirmed the adequacy of the treatment.

4.2.2 The shaft was capped with reinforced concrete (450 mm thick), with the extent of the cap extending to twice the diameter of the shaft i.e. 4.00 m x 5.00 m.

4.2.2 The shaft has been grouted over its full depth therefore no stand-off exists to the shaft. Detailed discussions should be held with the structural engineer with regard to the construction of any foundations above the shaft.

5.0 TEST BOREHOLES AND GROUT CUBE STRENGTH TESTS

5.1 On completion of the grouting works, twenty three test boreholes were sunk to the levels of the Mosie, Lower Five Foot and Alloa Splint Coal seams to test the effectiveness of the consolidation operations. We also monitored the contractor's method of mixing, grout flows, consistency during the operations and confirmed the adequacy of the grout mixes used and the contractor's method of mixing and injection.

5.2 Pressure injection tests carried out on these boreholes under our direction and supervision indicated effective treatment of the site and the consolidation of the development area was considered satisfactory. Drawing No G2007/533/CR/F/06 indicates the locations of the test holes.

5.3 In accordance with the Specification, grout cubes were obtained at regular intervals during the course of the Contract. Cubes were tested at the end of 14 days and 28 days curing periods. The grout cube strengths have been found to fulfil the specified minimum of 0.70 MN/m^2 after the 28 day curing period.

6.0 CONCLUSIONS

6.1 Borehole drilling and pressure grouting of mineworkings in the Mosie, Lower Five Foot and Alloa Splint has been undertaken and completed at a proposed residential development at Mount Pleasant, Coalsnaughton.

6.2 A total of 1,334 No. boreholes were drilled to the respective coal seams within the site, giving a total drilling meterage of 21,373 m. A total of 2,160.3 tonnes of grout was injected into the workings.

6.3 The workings were consolidated using an infill grid consolidation layout of approximately 3.50 m centres. In areas where adequate rock cover was achieved in the boreholes, the consolidation layout was adjusted as specified by our resident engineer.

6.4 The test boreholes drilled on completion of the consolidation works at locations indicated on Drawing No G2007/533/CR/F/03 confirmed the adequacy of the consolidation works and design philosophy.

6.5 In addition, a mineshaft was located and stabilised by measures of backfilling with inert material and drilling and pressure grouting. The shaft was stabilised over its full depth and capped with reinforced concrete. Detailed discussions with ourselves are recommended should construction of buildings be proposed above the stabilised shaft.

6.6 We are satisfied that the potential surface instability risks to the construction of the proposed building posed by the shallow abandoned coal workings have now been removed. In this respect, the development can proceed without further regard to potential mining instability constraints arising from the Mosie, Lower Five Foot or Alloa Splint Coal seams within the defined consolidation area.

We trust that this will meet with your current requirements. However, if you require any further information, please do not hesitate to contact us.

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