

# COAL & GEOTECHNICS

Reference: CS-18

The optimisation of slopes within an opencast mine has a significant bearing on possible coal recovery, mine layout and direction and style of working. GWP Consultants LLP is one of the few UK firms with experts in coal measures slope design. Expertise in coal geotechnics is one of the foundations of our work with two of the Partners having coal geotechnics related PhD's funded by the former UK's Coal Board into the stability of deep coal measures rock excavations and tips.

## Our skills include:

- Geotechnical mapping and core logging
- Slope stability analysis using numerical and analytical techniques
- Tip and lagoon design and stability assessment
- Control of ground waters
- Mine excavated slope optimisation to ensure stability and maximise recovery
- Design of excavation and tipping rules

## Case Study: Stability of steeply dipping footwall slope

Following repeated slope failures resulting in significant loss of coal and loss in efficiency of working, GWP were asked to determine the active failure mechanisms and determine a scheme of works to maximise future coal recovery

The cause of failure (intraformational shear zones) was determined via face mapping and advance core drilling which, in combination with numerical stability analysis, determined the extent of additional excavation to allow for required coal recovery.

The maximum height of footwall slab before failure was determined in order to minimise the required overdig. A 30m high slab was calculated to be stable on the 1:2.5 (v:h) inclined slopes resulting in a saving of c. £0.5M to the client.



## Case Study: Deep opencast pit slope design

GWP currently undertake the update design of a number of deep opencast operations which includes generic slope design, regular geotechnical inspections to review progress and to allow for slope design modification, Regulation 33 reporting for tips and excavations, review of in-pit tipping procedures etc (also advice on vibration from blasting and subsidence predictions for old deep mine workings).

From the excavation designs the coals resources may be assessed and a cost-benefit analysis undertaken to review the practicability to deepen workings to access deeper seams, divert rivers etc.



## Case Study: Diggability assessments

Diggability assessment involving rock mass evaluation to review the requirements for blasting as opposed to digging or ripping. Such analysis is required to specify the method of excavation and the need or otherwise for blasting. This may be extended to determine the characteristics of the excavators required.



## Case Study: Tip design

GWP have undertaken tip slope design and back analysis in order to remediate failing structures in difficult settings.

GWP have considerable experience in analysing such structures using numerical techniques which may also be used to determine any likely surface settlement.



## Case Study: Tipping design rules

GWP have undertaken controlled site experiments and slope failure back analysis to demonstrate tip security and optimise tipping rules.

Expert witness testimony demonstrating slope security and discussing the adequacy of edge protection.

Both numerical and conventional stability analysis techniques have been used to optimise slope designs. From the generic tip designs safe systems of work and tipping rules have been developed.



## Key staff involved in coal geotechnics:

**Dr. Alan Cobb**, Joint Senior Partner and Chief Geotechnical Engineer. Alan has undertaken ground breaking research into the stability of tips in coal measures waste materials and established the soils testing laboratory at Durham University. He is responsible for designing tips, lagoons and excavated slopes and structures. He is involved in blasting and materials handling studies and subsidence computations. E-mail: AlanC@gwp.uk.com

**Dr. David Jameson**, Partner. Following an MSc. in Structural geology and rock mechanics at Imperial College, David undertook research into the role of intraformational shear zones in coal measures rock and their role in excavated slope stability at Newcastle University. He is highly experienced in rock and soil mechanics, specification and control of site investigations, numerical analysis and structural geology. E-mail: DaveJ@gwp.uk.com