GEOTECHNICAL

GWP Consultants LLP (GWP) mining and geotechnical engineers have extensive and specific expertise in surface mining, quarrying and related waste disposal. Geotechnics is one of the cornerstones of GWP's work, being integral to the overall viability of a project and to the detailed planning of excavation and tipping operations.

Geotechnical feasibility and design studies to define the extent of a problem, including targeting of critical geological boundaries, geological structures and determination of rock mass and material parameters.

Optimisation of excavation batters to maximise recovery through secure design. This may require innovative design in restricted areas to deliberately oversteepen and appropriately reinforce weak overburden slopes to release mineral below. The Practice has designed quarry highwall slopes exceeding 300m in height and footwall slopes in excess of 250m length with inclined strata dipping at 1:2 (v:h), with appropriate phasing of works to avoid failure. Such designs require a sound understanding of the nature of interbedded weak materials.

Design of remedial works following slope failure or change in circumstance with emphasis on investigation and implementation of appropriate and cost effective measures.

Stability analysis to demonstrate the security of proposed operations or back-analysis of failures. Conventional limit equilibrium or numerical modelling (FLAC and UDEC) techniques are used.

Design of tips, stockpiles and lagoons and the production of reports as required by the UK Quarries Regulations (1999). The Practice has designed tips comprising many millions of cubic metres and up to 100m high. Internal tip drainage measures are incorporated into the design where construction rates are high and permeability low.

Stability risk assessment and face workers' safety training for managers and face workers on the practical aspects of face stability and rockfall.

Rock mass characterisation and diggability assessment for tunnel, face and blast design, block size distribution and to determine whether blasting is required.

Design of hazardous waste facilities, including ground water regulations compliant lined and capped waste cells for flue dust, contaminated kiln linings *etc*; preparation of CQA documentation and qualified monitoring of works.

Rockfall hazard , risk analysis and rockfall containment design, including rapid slope assessment to rank areas of greatest potential danger and predictive rockfall trajectory analysis to size containment measures such as fences, ditches *etc*.

Massive failure of endwall of opencast coal site

Selective experience

Design of steep-dip limestone aggregate excavations.

GWP has carried out site investigation work for several major aggregate producers to locate thin clay bands interbedded with limestones. Numerical modelling was used to determine the lengths of unsupported footwall slabs that could be exposed without buckling. In one instance where faces had been undercut, remediation required the design of a passive rock dowel support.

Maximising sand extraction by progressive buttressing.

GWP has designed progressive excavation and buttressing solutions for clients to allow for the extra recovery of mineral where ordinarily the overburden would have been battered to a much shallower slope.

Slope stability back analysis.

GWP has employed numerical modelling to demonstrate how undermining promoted reactivation of an ancient landslip, stability of cargo within a rolling bulk ore carrier and how differential settlement within fill affected an adjoining slope.

Design of deep excavations within igneous aggregate quarries.

GWP has employed kinematic assessment to determine the potential for breakback of excavated slopes of several hundred metres in height. Slopes have been designed to ensure long term security and continuous access to individual benches. Soil nailing layouts have been utilised on weak overburden slopes to allow access to the mineral below.

Hazardous waste cell design.

GWP has designed hazardous waste containment cells meeting all legislative standards for the containment of flue dust for cement producers and for non-specific hazardous or non-hazardous cells for the general waste industry.

Rockfall hazard and containment design.

GWP developed a site specific hazard appraisal protocol to determine the risks to buildings and people from a 50m high, unbenched chalk rock face where the toe of the slope was as close as 6m to buildings. Rockfall trajectory analysis allowed for the design of a containment fence to assure acceptable long term security.

Progressive buttressing in progress

Tilting of building due to landslide movement

Rockfall

Key contacts

For details and to discuss your requirements, please contact one of the following:

Dr. Alan Cobb, Joint Senior Partner and Chief Geotechnical Engineer. Responsible for designing tips, lagoons and excavated slopes and structures. Involved in blasting studies and materials handling. E-mail: AlanC@gwp.uk.com

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