



Geotechnical/Geological Engineering

WHAT DOES A GEOTECHNICAL/GEOLOGICAL ENGINEER DO?

Geological engineers identify and try to solve problems involving soil, rock and groundwater, and design structures in and below the ground, using the principles of earth science and engineering. Geological engineering includes a number of ground engineering specialities such as geotechnical engineering, land remediation, rock mechanics, groundwater hydrology and engineering geology.

Geological engineers may perform the following tasks:

- investigate the engineering feasibility of planned new developments involving soil, rock and groundwater
- plan and undertake site investigations for proposed major engineering works such as bridges, dams and tunnels
- design measures to correct land contamination and salination
- design major structures in rock such as tunnels, basements and shafts
- supervise construction and performance of major engineering works involving the ground
- work out strategies to control landslides and areas of potential instability
- coordinate of multi-disciplinary study teams
- perform computer analyses, use computer databases and generate computer-aided designs.

Geological engineers may work with other professionals including environmental scientists, geologists and hydrologists on solving land degradation, groundwater and salination problems; with civil engineers in the design and construction of better transportation links; or with mining engineers in designing open-cut and underground mines, and on rehabilitation works on completion of mining. Geological engineers typically spend up to half of their working hours on field investigations and supervising construction of their designs. Responsibilities of the role typically include ensuring geotechnical activities are conducted safely in order to provide a safe working environment for employees and contractors in accordance with company standards and government legislation.

Geologists and Engineers (usually civil or mining) can do postgraduate study to specialise and work as geological/geotechnical engineers. Postgraduate study is often more flexible than undergraduate study to fit in with full time work.

Geotechnical Engineer - Open Pit

Open Pit Geotechnical Engineers have responsibility for operational ground control issues in the open pit where open pit mining methods are used. They collect geotechnical data on the rock mass; monitoring of the performance of the excavation slopes and installed support systems. They are responsible for the design, installation, maintenance and use of geotechnical instrumentation to assess the response of the rock mass to

the mining activities; and for the interpretation and reporting of data collected. Typically they will deal with slope stability issues, erosion and the effects of weather conditions on the pit stability.

Geotechnical Engineer - Underground

Underground Geotechnical Engineers have responsibility for operational ground control issues underground where different underground mining methods are used. Underground geotechnical engineers collect geotechnical data on the rock mass; monitor the performance of the excavations and installed support systems; design, install, maintain and use of geotechnical instrumentation to assess the response of the rock mass to the mining activities; and interpretation and reporting of data collected. Underground geotechnical engineers spend time underground in the mine investigating and designing against rock bursts and falling of the development's walls.

Geotechnical Engineer - Civil

Civil geotechnical engineers often inspect proposed construction sites to work out soil and foundation conditions by conducting drilling and sampling programs. They oversee and participate in field and laboratory testing of soils, make sure that test equipment and machinery is properly set up, prepare reports of test results and make recommendations for the solution of engineering problems identified in test reports. They can also prepare specifications of soil mixtures for use in roads, embankments and other construction, calculate and advise on the required slope at cuttings and the thickness of soil dams and retaining walls.

Geotechnical Engineer - Consulting

Consulting geotechnical engineers will often be exposed to both underground and open pit projects depending on the company they work for and their area of expertise. Consulting geotechnical engineers will often be based in coastal capital cities and fly to their projects as necessary. Depending on the company they work for they may also be involved in civil engineering and/or construction projects.

Geotechnical Engineer - Computing/Modelling

Geotechnical Engineers who specialise in computing and modelling often design and apply computer programs and models to characterise and predict rock and ground behaviour. The models often look at stress regimes and rock strength by looking at the rock properties and then varying the situation parameters whether they be geometrical, material etc. to see how the model responds to the changes.

Geotechnical Engineer - Academic/Research

Academic and research geotechnical engineers investigate why and how things behave the way they do or are the way they are rather than looking primarily at the economic issues of how to mine most economically and locating the boundaries of ore deposits for this reason. Academic and Research geotechnical engineers often work in universities or CRC's (cooperative research centres).

MARNIE PASCOE

BSc Geology (Hons) and working on finishing MEngSc Workplace Trainer / AssessorMAusIMM (CP)

Why did you choose your particular career?

At the time WMC Kambalda were looking for a geologist with a structural geology background who wanted to learn new things. I worked with an experienced rock mechanics engineer and did a lot of learning on the job. Since then I've found the job very interesting and rewarding with good advancement opportunities and diversity.

What have you done so far in your career?

I worked for 3 years at Kambalda as the "sorcerer's apprentice" providing a geotechnical service to the 15 or so Nickel and Gold Mines in the region. I then joined BHP Minerals' Cannington Project as part of the feasibility team and helped set up the Cannington Mine. I was there for 4 years and saw the mine go from feasibility project to producing mine. I moved to AMC Consultants in Melbourne and worked there for 5 years doing all sorts of project work on existing mines and working on scoping and feasibility studies as well as training courses for miners and technical staff. RMIT University engaged AMC to teach their 4th yr rock mechanics unit which I did for 4 years. I rejoined WMC at Olympic Dam as the Geotechnical Superintendent and was there for 3 years as part of the team that stabilised mine production and improved mine design and technical practices. Following the BHPBilliton takeover of WMC I now work for Exploration and Mining Technology as a technical expert providing support to mining operations and identifying and implementing new technologies to mining operations.

What have you enjoyed most about your profession(s)?

Working with a wide variety of people across the operation. Being involved in more than one discipline. The job requires that you have a sound working knowledge of all aspects of the mining operation to be able to contribute effectively. Being part of the group that often leads change in the workplace.

For someone considering a career in your profession, are there any words of wisdom to pass on to them?

Move around every 3 yrs or so (you need about this length of time to become really familiar with most aspects of the ground behaviour at a site) to broaden your experience of mining methods and conditions. Be prepared to sometimes be last in line for praise ie sometimes letting people "claim" your improvements as a way of getting them to change. Try not to say "I told you so" too many times. Learn to communicate your ideas effectively, the engineering is the easy bit, getting someone to do something they may not want to is the hard bit. Be open to review of your ideas and find a

mentor that will give you this input "without fear or favour".

STEVE WEBBER

Geotechnical Engineer, Consolidated Minerals, Beta Hunt Mine

What formal qualifications do you have?

B.Sc., (Physics), B.Sc. (hons), M.Sc. Both Geophysics all from Victoria University of Wellington, New Zealand, M.Sc. (dist) Mining Geophysics from University of the Witwatersrand, South Africa, Ph.D. (Geological Engineering) University of Oklahoma, U.S.A.

What have you enjoyed most about your profession(s)?

Being exposed to things relatively few people get to see. Not having to dress formally to go to work. Being exposed to different conditions and problems every day – the job/profession is never the same on any two consecutive days.

What are the negatives and low points in your career?

I suppose being retrenched twice would normally be considered to be career low points. However, each time I was retrenched my career changed direction and life got a lot more interesting so getting retrenched was brilliant.

For someone considering a career in your profession are there any words of wisdom to pass on to them?

Do what you enjoy doing. Chase the fun not the dollar. Just be aware of the consequences of your decisions. Choosing a niche field is great but it can limit your career options at times. Don't be scared to change career directions and start at the bottom again. Take advantage of any opportunities to go on courses, go to conferences, receive training or to broaden your knowledge. Ask questions all the time.

BRUCE HEBBLEWHITE

BE(Mining, Hons 1) PhD Dip(AICD) MAusIMM Head of School & Research Director, Professor of Rock Mechanics – School of Mining Engineering, The University of NSW.

What formal qualifications do you have?

I did my first degree in Mining Engineering at UNSW, graduating in 1974. I travelled to England to do a PhD in rock mechanics at the University of Newcastle upon Tyne, whilst working for Cleveland Potash Ltd. After returning to Australia, I undertook a Diploma offered by the University of New England, run by the Australian Institute of Company Directors.

Why did you choose your particular career(s)?

Having completed my undergraduate degree, I chose to pursue a PhD in rock mechanics, my interest in the field having been captured by the topic itself, but also by a very capable and inspiring lecturer. I did not want to just sit and contemplate theoretical concepts, but

was taken by the practical applications of rock mechanics in mining. The opportunity arose to study for my PhD at the internationally famous centre of mining geomechanics at the University of Newcastle-upon-Tyne in the UK. There was the added bonus of working for Cleveland Potash Limited at their Boulby Mine, on a range of geotechnical issues associated with mining potash at 1,100m deep, under the North Sea – the deepest mine in Europe at the time. This time spent in the UK was an extremely rewarding experience – not just academically, but as a life experience, studying and living in a different part of the world.

What have you done?

During my undergraduate degree, I had three periods of industry industrial training – all very different – spent in WA at Mt Newman, at Broken Hill, working in the old South Mine, and in Tasmania with Aberfoyle Ltd, working in the north-east, and also at Cleveland Tin on the west coast at Luina. After completing my PhD in 1977, I returned to Australia and joined the Australian Coal Industry research Laboratories Ltd (ACIRL) in Sydney. I spent 17 years with ACIRL, during which I saw many changes across the coal industry. For the last 10 years I headed ACIRL's Mining Division and had the opportunity to work on a large range of mining projects – both applied research and consulting – in many parts of Australia and around the world. In 1995 the opportunity arose to join academia at UNSW as a Professor of Rock Mechanics and Research Director. This was an industry-funded position which ensured I would be able to maintain my close involvement with the industry, as well as entering the new field of teaching and university research. I took over at UNSW as Head of School in 2003, moving back into a management role, but still active in teaching, research and industry consulting.

Do you have any regrets about how your career has developed?

None whatsoever. I would never have contemplated the move to academia, but having done it at the stage of my career that I did, I have absolutely no regrets.

What have you enjoyed most about your profession(s)?

The exposure to so many different parts of the industry and the people in them – in all parts of the world. It is a big industry, but in many ways it is very small and close, in terms of people and the contacts you make. I have also really enjoyed being able to make a difference – both through technical project work, and now education.