

Monash Geomechanics Group (MGG)

Preamble

The Monash Geomechanics Group (MGG) within Civil Engineering was formed in 1963 under the leadership of Professor Ian Donald, and has since made significant contributions to the field of Geomechanics in Victoria, Australia, and across the world. In particular, the Monash Geomechanics Group has provided and is providing much needed research expertise and advancement within the local scene and internationally, particularly in the areas of infrastructure geotechnics, geosynthetics, unsaturated geomaterials behaviour, geoenvironmental engineering and climate change issues on geoinfrastructure including CO₂ sequestration and shallow geothermal energy. For example; in infrastructure geotechnics, the MGG has developed novel engineering analysis methods, computer programs, and laboratory testing techniques for the bed rock in Melbourne and its surroundings, known as Melbourne Mudstone, on which many of Melbourne's high rise building and heavy structures, such as Rialto and Eureka towers and West Gate Bridge, are based. More recently, the ROCKET program developed by the MGG was used in the design of the world's tallest building – Nakheel Tower in Dubai, UAE, which is over 1km tall. MGG's contribution is also reflected by a large number of high profile geotechnical engineers, produced over the years with Masters and/or Doctoral degrees, and contributions to local consulting companies, academic institutions, CSIRO and government/semi government bodies. Some of these graduates have held or are holding senior positions such as CEO of large consulting companies, ARC Federation Fellows, Division Head of CSIRO, and Directors and Principals of International companies. MGG is the largest Geomechanics/Geotechnical/Geoenvironmental Engineering Research Group in Victoria and one of the largest in Australia.

Mission and People

The overall mission of the Group is to provide sustainable engineering solutions to geotechnical, geoenvironmental and related problems in the 21st Century, with particular emphasis to the local region. The advancement of knowledge and development of new technologies and expertise with multi-disciplinary input are key aspects of this endeavour.

The MGG is currently driven by four full-time academics (A/Prof A. Bouazza, A/Prof J. Kodikara, Dr P.G. Ranjith, and Dr A. Haque), who work in a diversified range of topics including environmental geotechnics, mining geotechnics including slope stability, unsaturated and reactive soil behaviour and liquid flow, thermo-hydro-mechanical behaviour of porous media, geosynthetics, infrastructure geotechnics (on-shore and off-shore pipeline/ground interaction, pavement, and railway engineering), ground improvement, filter design under static and dynamic conditions, piled foundations, geothermal energy, CO₂ sequestration and climate change effects on geoinfrastructure. The current MGG Academia are well reputed locally and internationally with extensive publication records and hold positions such as Editors of international journals, Fellow of Engineers Australia and Adjunct Professor of a top ranking UK University.

The MGG also employs four post-doctoral fellows (Dr W. Gates, Dr C. Gallage, Dr A. Amarasiri, and Dr Z. Xiao) and 18 Doctoral and Masters Research students. The Group also has five Associates; Dr Chris Haberfield (Senior Principal, Golder Associates, ex MGG), Dr Julian Seidel (Director, Foundation QA Pty Ltd, ex MGG),

Dr Choi SK (Senior Principal Researcher, CSIRO, ex MGG), Prof Bhandari S (Professor in Mining Engineering, University of Jodhpur School of Mine) and Professor Bala Subramanian (Griffith University) and have strong links with several international research institutions and Universities.

Facilities

The geomechanics laboratory facility at the Clayton Campus of Monash University is one of the most extensively equipped geomechanics laboratories in Australia, and especially in Victoria. The facilities include soil and rock characterisation laboratory (low to high pressure (up to 80 MPa), triaxials, basic rock testing devices such as uniaxial testing, static and cyclic filtration apparatus, automatic consolidation device), unsaturated soils laboratory (Tempe cell and pressure plate devices for soil water characterisation, oedometer with air and water pressure control, an unsaturated hydraulic conductivity apparatus, a special tensile testing device, unsaturated water flow columns and a medium size environmental chamber), environmental geotechnics laboratory (chemical hydraulic conductivity testing devices, diffusion test equipment, gas flow testing devices, temperature controlled oedometers, thermo-hydro cells, general physico-chemical characterisation testing devices), and geosynthetic laboratory (apparatus for geosynthetic flow characterisation, salinity flow devices, geomembrane and geosynthetic clay liners testing apparatus).

Also housed in general purpose areas are large direct shear machine (a unique piece of equipment for interface and shear strength testing), a pipe testing facility and a large rock cutter. MGG is also about to house a large triaxial, a unique piece of equipment for undertaking testing for large diameter coal and rock specimens for hydro-thermo-mechanical characterisation, in particular for CO₂ sequestration research. The Group also has a range of field testing devices (stress wave ground characterisation, hydraulic conductivity testing, neutron probe for moisture testing, thermal cameras, and sensors for moisture, suction and temperature measurements) and currently conducts research at three instrumented sites (in-service buried water pipe at Altona, in-service gas pipe at Fawkner, and a landfill site at Clayton). Most equipment is also available for commercial testing and attracts regular use from local and international clients.

In addition, the Group has access to other Departmental facilities (a strong-floor area with large Instron actuators, large environmental chambers and a well-resourced hydraulics lab) and other high-tech University facilities (electronic imaging, Australian Synchrotron, (located next to Monash premises)). It also has access to a large suite of software packages (FLAC, FLAC3D, UDEC, 3DEC, ABAQUS, PFC, PLAXIS, SLOPE/w, SEEP/w, TEMP/w, VADOSE/w, COMSOL, SOILVISION, SVFLUX, CIRCLY) and a cluster of computers to undertake sophisticated numerical studies.

Funding

Much of the funding for MGG activities come from various sources including Australian Research Council, local and federal government grants, industry linkage, and contract research grants, international grants and university internal grants. The Group has attracted cash grants amounting to about 5 million dollars over the last five years. Some highlights of these grants include \$1.1 million dollar grant through ARC Linkage Scheme for water and gas pipe failure prediction, \$800k LIEF grant for large triaxial facility permeability and mechanical measurements of coal and rock and for CO₂ sequestration, \$400k Victorian State Government grant for geothermal energy piles and a number of ARC Discovery Grants for fundamental research.