The University of Queensland - IIT Delhi Academy of Research Joint PhD Project

Project title	**Predictive modelling of settling and consolidation, and desiccation and re-wetting of mine tailings**
Project code	**UQIDAR 00229**
Project description	The aims of the project are:

1. To experimentally characterise the geotechnical behaviour and parameters of various Australian and Indian mine tailings, from a slurry consistency, undergoing settling and consolidation, and desiccation and re-wetting; and
2. To develop a numerical predictive model validated and calibrated using the experimental data, for use in predicting mine-scale tailings behaviour.

Mine tailings are conventionally deposited in a surface or in-pit storage as a thickened slurry, and undergo settling and consolidation, and desiccation of the surface exposed to sun and wind and re-wetting with rainfall. Understanding these processes is critical to predicting the final density and storage volume of the tailings, and their resulting shear strength, compressibility and permeability. The Geotechnical Engineering Centre (GEC) within the School of Civil Engineering at UQ has world-leading testing capability to characterise the settling and consolidation, and desiccation, of tailings from a slurry to a soil-like material. IITD has leading numerical capability capable of simulating and predicting the large-strain behaviour of tailings from a slurry to a soil, enabling the prediction of the mine-scale behaviour of tailings deposits.

UQ GEC has a purpose-built, large, slurry consolidometer, in which tailings slurry may be added in a series of layers at an initial solids concentration representative of field conditions, allowed to settle between layers, and consolidated under one of a range of loading sequences including step-wise and continuous incremental loading. UQ GEC has also developed purpose-built, instrumented columns in which tailings slurry is allowed to settle, undergo self-weight consolidation, and desiccate and re-wet under ambient drying and wetting cycles to which it is exposed.

The slurry consolidometer comprises a cell of internal diameter 150 mm and height of 410 mm instrumented with top and base load cells; seven pore water pressure transducers, one at the base and six at 40 mm centres up the cell, a displacement transducer. The height of the cell allows the tailings slurry to be placed in a number of layers, and allowed to settle between layers, to form a test specimen of up to 300 mm in height. Loading can be applied up to the equivalent of 60 m depth of tailings, including the simulation of the actual rate of rise of tailings at the mine. The instrumented column is instrumented with moisture, suction, temperature and salinity sensors, connected via a data logger to the cloud, plus a weather station to monitor the driving climatic conditions, and a camera to record desiccation cracking and settlement of the tailings surface.

The experimental results will be used to validate and calibrate large-strain numerical models available at IITD, allowing the development of a predictive model for application to mine-scale conditions.

Project outcomes	The project deliverables will include: 1. Training and mentoring of a PhD student; 2. Experimental data on a range of mine tailings from Australian and India; 3. A validated and calibrated numerical model for application to mine-scale conditions. 4. Journal articles, and conference papers and presentations, on the results of the project; and 5. The opportunity for future collaboration between UQ and IITD.
Advisory team	**UQ Principal Supervisor** **Professor David Williams** Civil Engineering D.Williams@uq.edu.au http://geotechnical.civil.uq.edu.au/ **IITD PrincipalSupervisor** **Associate Professor Bappaditya Manna** Civil Engineering bmanna@civil.iitd.ac.in http://web.iitd.ac.in/~bmanna/ **Additional Supervisor(s)** **Dr Chenming Zhang** http://geotechnical.civil.uq.edu.au/ **Dr Partha Mishra** http://geotechnical.civil.uq.edu.au/
Type of student Discipline background of student	Applications are open to: I or q students who meet eligibility criteria. Ideally, this project requires students with a background in: Civil Engineering, Geotechnical Engineering, Mining Engineering, Earth Sciences
Ideal candidate	**Essential Capabilities:** English proficiency **Desirable Capabilities:** Masters in Geotechnical Engineering **Expected qualifications (Courses/Degrees etc.):** Degree in Civil Engineering
Application process	Apply online by the due date: https://www.uqidar.org/students/how-to-apply/