Geotechnical Design Project at the University of Alberta

Civil engineering students at the University of Alberta can elect to take "CIV E 591 - Geotechnical Design" in their last term in Fourth year. In the winter semester of 2001 (Jan – Apr), it was decided to teach the course centred on a design project; 24 students participated. As the City of Edmonton was in the early stages of preliminary design for the extension of their Light Rail Transit from University Station south to University hospital, it was decided to use this as the focus for the "Geotechnical Design Project". The proposed extension consists of twin 6.2-m-diameter tunnels leaving University Station at a depth of 17 m below ground surface and rising to the ground surface near University Hospital Station, a distance of approximately 500 m. The tunnels would intersect, clayshale bedrock, glacial till, sands and clays.

Students were divided into groups (3 to 5) and asked to prepare preliminary design reports on various project options (TBM Tunnel, NATM Tunnelling, Cut and Cover, and Ground Conditioning) covering technical issues, costs and schedules. Students were introduced to tunnelling, through lectures, field trip to a tunnelling project, guest lecture by City of Edmonton Tunnelling Expert, and a visit to the project site (about 300 m from the classroom). Only borehole logs and laboratory test results were provided as background information.

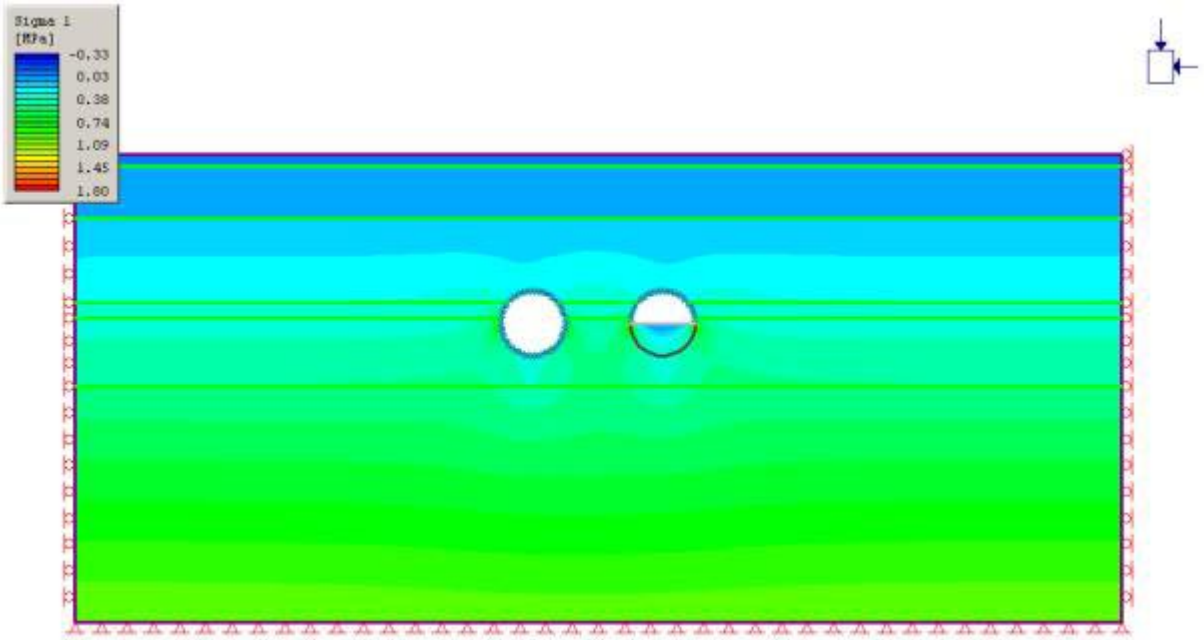

Illustration of a Phase2 model used in the Geotechnical Design Project

Students were introduced to the finite element modelling through lectures and used Phase2 to assess ground movements along the proposed tunnel route. Students also used Phase2 to evaluate the effect of a grouted-ring around the tunnel on surface deformations. To the surprise of the students (but not the professors) a thin complete grouted ring (crown and invert) had a much greater affect on the settlements than a thick grouted ring in the crown. The group responsible for the cut-and-cover section used Phase2 to analyze wall deflections versus anchor locations and also to evaluate the load distribution on the wall against empirical load charts. A final presentation was made by each group at the end of term. Many students went well beyond what was expected and started to ask "what if" questions.

All the students favoured the project based design course compared to the traditional lecture based course. Everyone enjoyed Phase2 and its ease of use. All the student feedback was positive and nearly every student said they would recommend the course. I guess learning can be fun!

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Article prepared as "Top Project" for RocNews e-newsletter, November 2001