Engineering Faculty Document 3-06
May 9, 2006

MEMORANDUM

TO: The Faculty of the Schools of Engineering

FROM: The Faculty of the School of Civil Engineering

RE: New Graduate Level Course

The Faculty of the School of Civil Engineering has approved the following new course. This action is now submitted to the Engineering Faculty for a recommendation for approval.

CE 686 Underground Construction

Sem 1, Class 3, Lab 0, Cr 3.

Prerequisite: CE 580 or instructor consent

Planning, analysis, design and construction of underground structures in soft ground and rock. Ground structure interaction. Static and seismic stresses on tunnel support. Relative stiffness method. Ground deformations. Construction methods, types of support, and their effects on the surrounding ground. The focus of the course is on the understanding of the interaction between ground and structure.

Reason: To provide students with the fundamental knowledge and skills to plan design, monitor, and build underground facilities in soft ground and rock. The course builds on the geotechnical fundamentals of CE 580 or similar courses.

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M. Katherine Banks, Interim Head
School of Civil Engineering

Supporting Documentation

1. **Justification**: As the demand for additional built environment increases and with limited available land to be built on, more and more facilities are designed and constructed under the ground surface. Only in the highway system in the US there are hundreds of tunnels, which total about 655 miles. Many of the tunnels built in the US are several decades old, and some are more than 100 years old and require major repair or total replacement. The course provides the fundamental knowledge for the design of new underground facilities and for the upgrade and maintenance of existing facilities.

2. **Level**: Graduate Level

3. **Prerequisities**: CE 580 or Instructor consent

4. **Instructor:** Antonio Bobet

5. **Course Objective**s: Students who complete this course should be able to:

   - Understand the fundamental mechanisms of ground-structure interaction
   - Design laboratory and field tests to investigate mechanical properties of the ground for the design of underground facilities
   - Design tunnel support as a function of ground conditions and excavation methods
   - Predict ground deformations during and after construction
   - Design tunnel support for static and seismic loading
   - Design tunnel support below the water table

6. **Course Outline:**

Lectures	**Topic**
3	Introduction and planning of underground facilities
3	Geological and geotechnical aspects of tunneling
6	Ground structure interaction. Relative stiffness method, characteristic curves, analytical and numerical methods
6	Tunnels in rock. Rock mass classification systems
6	Tunnels in soil. Stability number. Face support.
3	Ground deformation
3	Tunnels under the water table
3	Seismic design of underground facilities
3	Other underground structures: cut and cover, shafts, buried pipes
3	Construction methods and effects on surrounding ground
3	Exploration and monitoring

7. **Text:** Class notes and other materials distributed in class.