

SOCIETAL-IMPACT & ETHICS COURSE CONTENT DESCRIPTION & OUTCOMES

Course Number: **CEE 120**

Course Name: **Principles of Soil Mechanics**

Submitting Faculty Name: Scott Brandenburg

Faculty Email: sjbrandenberg@ucla.edu

COURSE CONTENT DESCRIPTION

- **Description of specific societal impact topics or ethics issues that are addressed in the course:**

This course is required for all Civil and Environmental Engineering undergraduate students and presents the basics of soil mechanics and geotechnical engineering. This is the first course in geotechnical engineering, and it is therefore very important to establish why the fundamental concepts presented in the course are important with respect to an Engineer's obligation to society. In the very first lecture of the quarter, I spent 60 minutes discussing geotechnical failures, the impacts those failures had on society, and the reasons for the failures. I discuss the Teton Dam, which failed in 1976 killing 11 people and 13,000 cattle in Idaho. The dam was constructed by the US Bureau of Reclamation near the end of the rush to construct dams for flood control and irrigation purposes. The abutments of the dam (i.e., the rock formations on either side of the valley carved by the Snake River) were very porous and ill-suited to dam construction. The engineers thought they could successfully grout the fissures in the rock, thereby making the abutments water-tight, but they were wrong and overly confident. As with many engineering failures, dissenting voices were ignored during dam construction. I then move on to a discussion of the near-failure of the lower San Fernando Dam during the 1971 San Fernando Earthquake. The embankment dam slope failed due to soil liquefaction. Had the dam failed, large portions of the San Fernando Valley would have flooded, likely killing tens of thousands of people. The reason why the dam failed is that it was constructed by a process called hydraulic fill, in which the soil is sluiced in as a slurry and allowed to settle under its own weight. Although cost-effective, this construction method makes dams susceptible to liquefaction. This case history hits close to home for many students because it is so close to UCLA. I then ask students for their opinion about what can be done to solve these problems and discuss the formation of the California Division of Safety of Dams and subsequent retrofit for all hydraulic fill dams in the State. In a separate lecture, I discuss professional licensure, including the requirements to obtain a Professional Engineering license. The rules have recently changed, and students can now take the 8-hour principles and practice portion of the exam soon after graduation. I also describe the Professional Engineers act and describe professional licensure in other fields including geology. I also provide a brief overview of geology and discuss typical interactions between geotechnical engineers and geologists in engineering projects.

- **Time dedicated to cover this content through lecture and other in-class learning activities:**

The first lecture devotes an hour to presenting and discussing engineering failures. The lecture on professional licensure occupies about 20 minutes, and the lecture on geology and interactions between engineers and geologists occupies 40 minutes.

OUTCOMES

- **Aligned with ABET Student Outcome Criteria #4:** *The ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.*

Outcome 1: Students will understand the impacts of engineering failures on society by learning about past case histories of dam failures, consequences of the failures, their causes, and the responsibility of Engineers to prevent such failures.

Outcome 2: Students will understand professional licensure for Civil Engineers, including the process for obtaining a Professional Engineers license and the legal responsibilities it entails via the Professional Engineers Act.