Introductory Slides

CVEN 3698 Engineering Geology Fall 2016





- More consuming
- More crowded
- More connected
- Less diverse

...and are more likely to experience conflict at different scales (village, city, megacity) because of limited resources, human condition, and geopolitical issues.







San Pablo, Belize







Hydrologic Cycle



From Laboratory Manual in Physical Geology by Busch et al., 1997.



Geologic Cycle from *Physical Geology*, C. Plummer et al., 1996.

Systems Approach



People



Different Challenges

- In the developed world, the challenge is to consume less and more intelligently and be respectful of natural and human systems.
- In the developing world, the challenge is to ensure that proposed economic solutions address the basic needs of people and are good to the environment



FROM: Figure 1.1, Industrial Ecology, Environmental Chemistry and Hazardous Waste, Stanley E. Manahan

Infrastructure

Infrastructure is that part of the anthrosphere composed of the utilities, facilities, and systems used in common by members of a society and upon which the society depends for its normal function.

Water – Waste – Sanitation -Energy – Shelter - Transportation – Land Use



The built environment is a significant part of a global problem...

- 12% of fresh water withdrawals (340 billion gallons per day)
- 37% of all energy used, 68% of all electricity
- 60% of raw materials used, 25% of wood harvest
- 50% of fossil fuels consumed
- 35% of CO₂ emissions; 49% of SO₂ emissions; 25% of CFC emissions; 25% of NO_x emissions; 10% of fine particle emissions
- 40% of non-industrial solid waste
- \$60 billion in medical expenses (sick building syndrome)



NON-NATURAL SYSTEMS (Built Environment - Anthrosphere)



NATURAL SYSTEMS (Biosphere- Hydrosphere-Geosphere – Atmosphere)



Geology vs. Engineering Geology

Geology

 study of the earths materials and processes through geologic time (Petrology, Mineralogy, Structural Geology, Geomorphology, etc.)

• Engineering Geology

 "exists solely to serve the art and science of engineering" –geologic descriptions of rocks connected with engineering works

Engineering Geology

• Think of a scenario where you would want to hire a classically trained geologist?

• Think of a scenario where you would need an engineering geologist or geological engineer?

Course Objective

- To teach engineering students how to appreciate and identify geologic features that could have short and long-term consequences to the overall performance of various engineering structures and projects that they might encounter in their engineering careers.
- In order to do that, engineering students have to learn some fundamentals of geology. It is not the intent to make geologists out of engineers (this could not be done in one semester).



"Every work of man(kind) is built on, in, or with the Earth, except those things that fly, float or fall down, and these last three must start or end with some Earth contact."

Geotechnical Board (1989)

From Rocks to Soils

Fresh Rocks (I)

Weak Rocks - Stiff Soils (II-V)

Weathering

Soils (VI)



Figure 9-1 Climatic influences on types of weathering processes. (From Peltier, 1950; reproduced by permission from the *Annals of the Association of American Geographers*, 40:219, Fig. 3.)



large right lateral otiset in drainage pattern

SAN ANOR

small-scale drainage pattern also shows right lateral offset





Vaoint Dam (Italy)









http://www.youtube.com/watch?v =uqkFXm2HtMA

Malpasset Dam (France)

Before

After



http://www.youtube.com/watch?v=9_61-wGFlcc&feature=related











Libby Dam (MT)

http://en.wikipedia.org/wiki/Lib by Dam

Earth Dams



Teton Dam (Idaho)



Second hole in face of dam. A few minutes after 11:30 a.m. June 5, 1976.

June 5, 1976

http://www.youtube.com/watch?v=KEdM6Ys6spA http://www.history.com/shows/modernmarvels/videos/engineering-disasters-tetondam#engineering-disasters-teton-dam







Foundations







3. Vieduct across the Molorway A7; characteristic structure across a motorway. The soil composition and the foundation method shown are very common in The Netherlands



Settlement











7 SOL HÉTÉROGÈNE NON EXAMINÉ.









Surface Excavations







 In Rotterdam a rapid transit railway tunnel has been constructed in a district of historical interest by the immersed tunnel method. The photo shows the immersion trench in a strutted cofferdam



















Underground Excavations































BEWARE OF FALLING ROCK







- Ground freezing and TBM <u>http://www.bing.com/videos/search?q=ground+freezi</u> <u>ng+video&FORM=VIRE1#view=detail&mid=4381F3479</u> <u>90BF3EAEC784381F347990BF3EAEC78</u>
- Tunnel Boring Machine <u>http://www.youtube.com/watch?v=qx_EjMlLgqY</u>
- Micro-tunneling <u>http://www.youtube.com/watch?v=_tOx0KTmzbw</u>
- Tunneling Through the Alps <u>http://news.discovery.com/tech/worlds-largest-tunnel-drilled-under-swiss-alps.htm</u>















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- Micro-tunneling <u>http://www.youtube.com/watch?v=_tOx0KTmzbw</u>
- Tunneling Through the Alps <u>http://news.discovery.com/tech/worlds-largest-tunnel-drilled-under-swiss-alps.htm</u>