Learning from Catastrophes: Incorporating Natural Disasters into the Undergraduate Civil Engineering Curriculum

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with:

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1. The world of geotechnical engineering
2. Hurricane Katrina, 2005
3. Oso landslide, 2014
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ENGINEERING:
the application of the principles of math and science to solving real-world problems

Civil/Environmental Engineering:
the branch of engineering that deals with infrastructure and the environment

Geotechnical/Geoenvironmental Engineering:
the branch of civil/environmental engineering that deals with earth materials and their interaction with the built environment
Geotechnical engineering

Applications:

- Foundations
- Earth-retaining structures
- Slope stability
- Tunnels
- Dams
- Canals
- Highways / pavement design
- Earthquake engineering
- Geo-environmental engineering

Boston, Massachusetts
Geotechnical engineering

Content areas in an introductory course:

- Soil composition and classification
- Subsurface exploration
- Groundwater
- Stress
- Settlement
- Shear strength
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Hurricane Katrina: Background

- August 29, 2005
- 1,833 dead
- $108 billion damages
- 85% of New Orleans submerged
Mechanisms of Levee Failures

• Overtopping and erosion

[Diagram of floodwall and levee with overtopping water]

www.tulane.edu/~sanelson/  
ILIT (2006)

• Underseepage-induced soil failure

[Diagram of levee with crack and underseepage]

www.tulane.edu/~sanelson/  
ILIT (2006)
Hurricane Betsy, September 1965, New Orleans:  
76 dead, $1.4 billion damages
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2014 Oso, Washington, landslide: Background

- March 22, 2014
- 41 dead, 2 still missing
- 10 million yd$^3$ of earth moved

United States Geological Survey (2014)

Seattle Times (2014)

www.npr.org
History of landslides in Oso

Prior landslides at this location:
1949  1967
1951  1988
1964  2006

Implications of policy decisions:
- Residential development
- Logging
- Lack of geotechnical engineering analyses

January 2006, Oso, Washington: 0 dead
Conclusion

New Orleans, 2005

Oso, 2014

Japan, 2011