# Learning from disasters: Extreme events and their impact on infrastructure, engineering and society

Spring Semester 2019

ARTSCI 1137.xx

1 Credit

Day, Time, Place TBA

## Course Description:

Extreme events such as hurricanes Maria, Irma and Harvey in 2017, Katrina in 2005, or the 2011 Tohoku earthquake and Tsunami in Japan, have resulted in high death tolls, and devastating damage to housing units, urban infrastructure, and lifelines (water, power …). Emergency response to extreme events is difficult due to their large impacts, and recovery often very slow, as exemplified in New Orleans after hurricane Katrina in 2005, and currently in Puerto Rico after hurricanes Irma and Maria in 2017 (both events with estimated total costs in excess of $160B). In developing countries, where resources tend to be limited, extreme events such as earthquakes and typhoons, often result in medical threats from infectious diseases due to the limited availability of clean water and emergency medical services (e.g., 2010 Haiti and 2015 Nepal earhquakes). Furthermore, historical decisions in planning, engineering and/or urban development, play important roles that often magnify the destructive effects of extreme events (e.g., the levee construction/design methods and urban planning used in New Orleans, and the urban planning in the center of Kobe, in Japan). Since many global warming models predict a sharp increase in the number, as well as severity, of extreme events it is important to learn from past disaster, in order to reduce their potential for destruction. In this seminar, we will examine six major disasters, including local case histories, and discuss engineering design methods/concepts, as well as, their effects in terms of preparedness, vulnerability, robustness, flexibility, and resilience.

## Course Objectives:

1. To expose students to the main impacts and threats caused by extreme events;
2. To provide beginning understanding of the engineering design methods used to prevent and/or mitigate extreme events, and their later consequences;
3. To provide beginning understanding of how engineers apply design procedures, and how building codes and methods evolve following extreme events;
4. To introduce current topics in resilience and civil engineering.

## Course Website

All course material, including student work expectations and course updates, will be posted on our Carmen site at <http://www.carmen.osu.edu> .

## Required Activities:

* Students are expected to attend class and participate in all seminar discussions.
* Weekly readings, student presentations, and individual research are expected;
* Prior to each student presentation, students will submit a one page (~250 words) “executive report” regarding an aspect (assigned by instructor) of a case history;
* Student presentations in groups of two to three students (depending on the size of enrollment) will focus on a particular impact (assigned by instructor) of an extreme event (e.g., flooding, transportation, power generation, clean water, medical needs, etc.). Depending on the topic assigned by the instructor, student presentations will address some or all of the following:
  + A brief description of the assigned topic and its main effects (e.g., type of devastation, health threats, economic impacts);
  + Preparedness of the city/region/country prior to the extreme event;
  + Remedial measures implemented after the extreme event;
  + Short vs. long term consequences of the extreme event;
  + Prevalence of the impact and increased risks following the event;
  + Societal and behavioral impacts;
  + Strategies for reducing similar threats (e.g., implemented elsewhere).

## Expectations

Students will arrive prepared and on time for each class and lab session. Students’ PowerPoint slides will be posted on Carmen ahead of the lecture, and students are expected to have researched the case history in advance of the lecture.

## Attendance Policy / In-class pop quizzes

Attendance is expected to all lectures, so that students can obtain the information necessary to comprehend the course content, thus enabling students to successfully discuss the topics covered.

While attendance is generally not taken in lectures, there will be quiz questions submitted in class through ***Top Hat*** on a regular basis to assess students’ learning.

Excused absences include illnesses for which you have a doctor's note or other documented extenuating circumstances.

## Academic Misconduct

Students are reminded that academic misconduct is a violation of the Code of Student Conduct and, per faculty rule 3335-31-02, must be reported to the Committee on Academic Misconduct. Do not ask anyone for help and do not give anyone help with assignments, lab reports and/or exams, unless the instructor specifically authorized such collaboration. If you have questions about what is permitted, ask the instructor.

## Disability Accommodations

Students with disabilities (including mental health, chronic or temporary medical conditions) that have been certified by the Office of Student Life Disability Services will be appropriately accommodated. The Office of Student Life Disability Services ([www.slds.osu.edu](http://www.slds.osu.edu)) is located in 098 Baker Hall, 113 W. 12th Avenue; telephone 614- 292-3307, email: [slds@osu.edu](mailto:slds@osu.edu).

Any student who feels s/he may need additional accommodations (e.g., during lectures) based on the impact of a disability should speak to the instructor privately to discuss specific needs. Students should inform the instructor as soon as possible of their needs.

## C:\Users\zamanian.2\Desktop\Grade table.PNGGrading (A – E assessment):

* Group presentations 50%
* Class participation 15%
* Final exam 25%
* Top Hat quizzes 10%

Boundaries between grades are firm (no rounding)

## Tentative schedule:

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| **Week**  **No.** | **Title** |
| 1 | Introduction and organization of the course, discussion of Syllabus and student deliverables. Group assignments |
| 2 | Instructor presentation on the causes and effects of the 1928 St Francis Dam Failure (California). Assignment of specific topics for student presentations |
| 3 | Dam failures and flooding: Student presentations |
| 4 | Instructor presentation on the effects of Hurricane Katrina in New Orleans  Assignment of specific topics for student presentations |
| 5 | Katrina: Student presentations |
| 6 | Instructor presentation on the landslide at La Conchita in California  Assignment of specific topics for student presentations regarding landslides and mudflows (e.g., 2014 Oso Landslide in Washington) |
| 7 | Landslides and mudflows: Student presentations |
| 8 | Instructor presentation on the effects of the 2011 Tohoku Earthquake and tsunami in Japan. Assignment of specific topics for student presentations |
| 9 | Tsunamis: Student presentations |
| 10 | Instructor presentation on the effects of the 2015 Gorkha Earthquake in Nepal. Assignment of specific topics for student presentations |
| 11 | Earthquake effects in a developing country : Student presentations |
| 12 | Instructor presentation on the effects of Hurricanes Irma and Maria in Puerto Rico. Assignment of specific topics for student presentations |
| 13 | Puerto Rico’s recovery from Hurricane Maria: Student presentations |
| 14/15 | In-class discussion and conclusions (topics: vulnerability to extreme events, effects of global warming, lessons learned from case histories, preparedness, infrastructure robustness, and measures to enhance flexibility and resilience |

## Required Texts

None

## Suggested Readings/Resources

2015 Gorkha Earthquake (Nepal)

Tiwari B., Pradel D., et al. (2018), “Landslide Movement at Lokanthali, during the 2015 Earthquake in Gorkha, Nepal ASCE Journal of Geotechnical and GeoEnvironmental Engineering, 10.1061/(ASCE) GT.1943-5606.0001842

GEER/NSF report from <http://www.geerassociation.org/index.php/component/geer_reports/?view=geerreports&layout=build&id=26>

2011 Tohoku earthquake and tsunami (Japan)

Pradel D., Tiwari B., and Wartman J. (2011), “Landslides Triggered by 2011 Tohoku Pacific Earthquake: Preliminary Observations”, Geo‐Strata (ASCE’s Geo‐Institute) Sept./Oct. 2011, 28‐32

Pradel D., Wartman J., and Tiwari B. (2014), “Impact of anthropogenic changes on liquefaction along the Tone River during the 2011 Tohoku Earthquake”, ASCE Natural Hazards Review. Vol.15, 13‐26.

Pradel D., Wartman J., and Tiwari B. (2013), “Failure of the Fujinuma Dams during the 2011 Tohoku Earthquake”, ASCE Geo‐Congress 2013: Stability and Performance of Slopes and Embankments III, GSP 231, 1566‐1580.

2005 Hurricane Katrina (New Orleans only)

FEMA (2006) “Hurricane Katrina in the Gulf Coast Mitigation Assessment Team Report Building Performance Observations, Recommendations, and Technical Guidance” FEMA 549 report

NIST (2006) “Performance of Physical Structures in Hurricane Katrina and Hurricane Rita: A Reconnaissance Report” NIST Technical Note 1476

2005 La Conchita landslide (California)

Pradel D. (2014), “The Progressive Failure Reactivation of La Conchita Landslide in 2005”, ASCE Geo‐ Congress 2014: Geo‐Characterization and Modeling for Sustainability, GSP 234, 3209‐3222.

2017 Hurricane Irma & Maria (Puerto Rico only)

GEER/NSF report from <http://www.geerassociation.org> (scheduled for publication in May, 2018)

1928 St Francis Dam Failure (California)

Rogers, J. D. (2006, 6:2). Lessons Learned from the St. Francis Dam Failure. Geo-Strata, 14-17.

Rogers, J. D. & Hasselmann, K. F. (2013). The St. Francis Dam Failure: Worst American Engineering Disaster of the 20th Century. AEG Shlemon Specialty Conference: Dam Failures and Incidents. Denver: Association of Environmental and Engineering Geologists.

VandenBerge, D. R., Duncan, J.M., & Brandon, T. (2011). Lessons Learned From Dam Failures. Virginia Polytechnic Institute and State University.