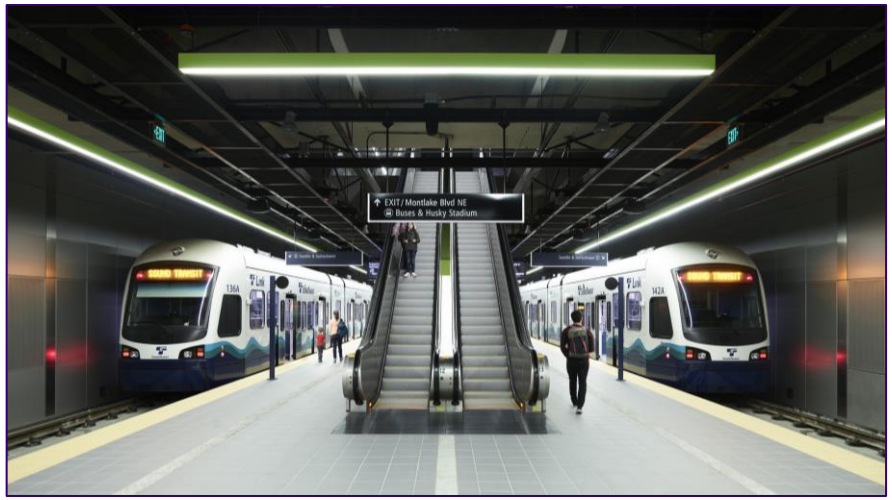
# Welcome to UW Geotechnical Engineering!


CIVIL & ENVIRONMENTAL ENGINEERING

UNIVERSITY *of* WASHINGTON

# Life @ UW





***6 minutes from Husky station to downtown Seattle (students receive UPASS = train, bus, ferries)***

# Life @ UW

***West Seattle***

***Mount Rainer National Park***

***Alki Beach***

***Puget Sound***

# Department of Civil and Environmental Engineering

**Structural** | **Geotechnical** | **Transportation** | **Construction** | **Environmental** | **Water**

- **Five Full Time Faculty:** Pedro Arduino, Mike Gomez, Steve Kramer, Brett Maurer, Joe Wartman
- **One Emeritus Professor:** Bob Holtz

**W** Department of Civil and Environmental Engineering

Structural | **Geotechnical** | Transportation | Construction | Environmental | Water

- **Additional instructors from industry and government**
  - e.g., CESG 571: Case Histories in Geotechnical Eng.
- **Guest speakers and seminars throughout year**
  - Honorary lectures, ASCE Seattle chapter, GIGGS lunch seminars, visiting academics, geotechnical firms…

# UW Geotechnical Engineering

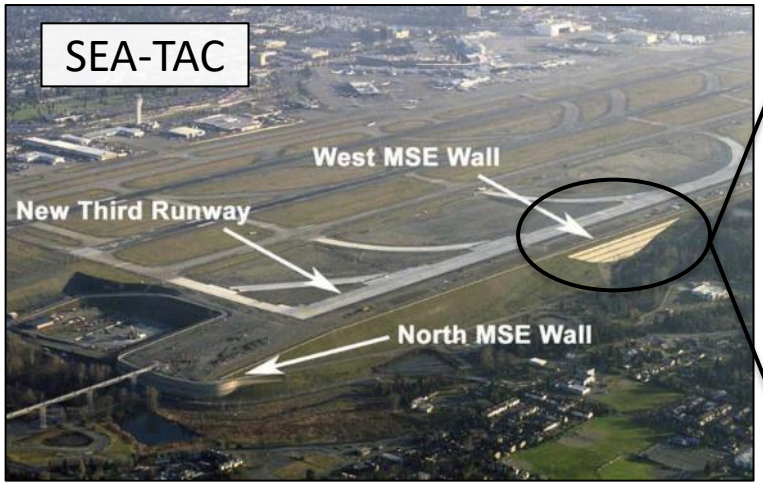
## What might you do as a geotechnical engineer?

Design structural foundations (infrastructure doesn't float)

# UW Geotechnical Engineering

## What might you do as a geotechnical engineer?

### Design retaining walls




# UW Geotechnical Engineering

## What might you do as a geotechnical engineer?

### Design tunnels

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# UW Geotechnical Engineering

## What might you do as a geotechnical engineer?

Design dams and levees

# UW Geotechnical Engineering

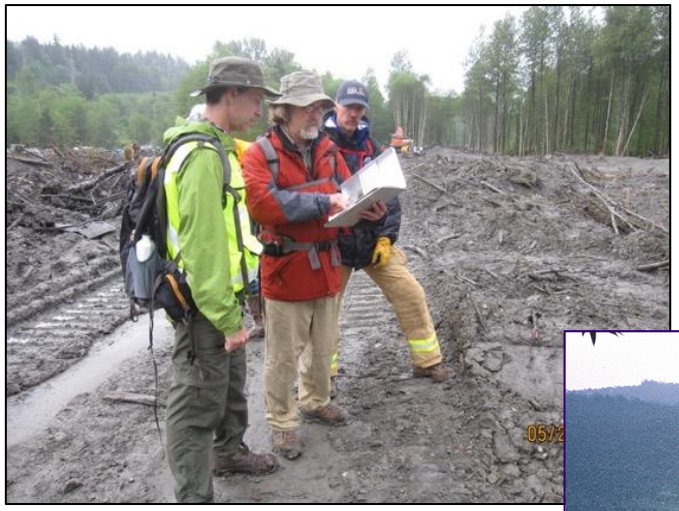
## What might you do as a geotechnical engineer?

Predict and mitigate various geohazards

# UW Geotechnical Engineering

## What might you do as a geotechnical engineer?

### Conduct reconnaissance to learn from failures



**Joe Wartman**
**Oso WA landslide**

**Steve Kramer - Taiwan**

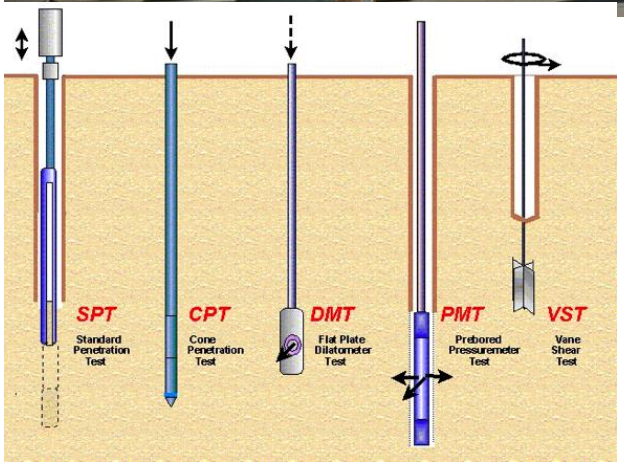
**Brett Maurer – New Zealand**

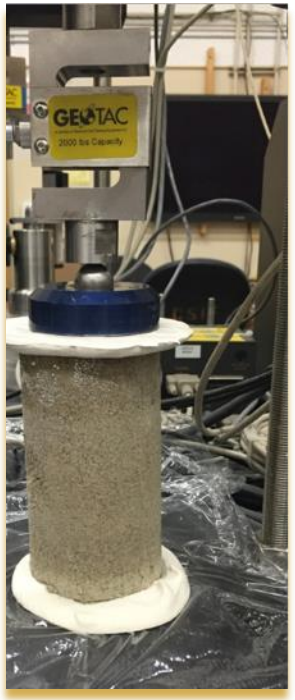
**Pedro Arduino – Mexico City**

# UW Geotechnical Engineering

## What might you do as a geotechnical engineer?

### Measure material properties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# UW Geotechnical Engineering

## What might you do as a geotechnical engineer?

### Improve problematic geomaterials

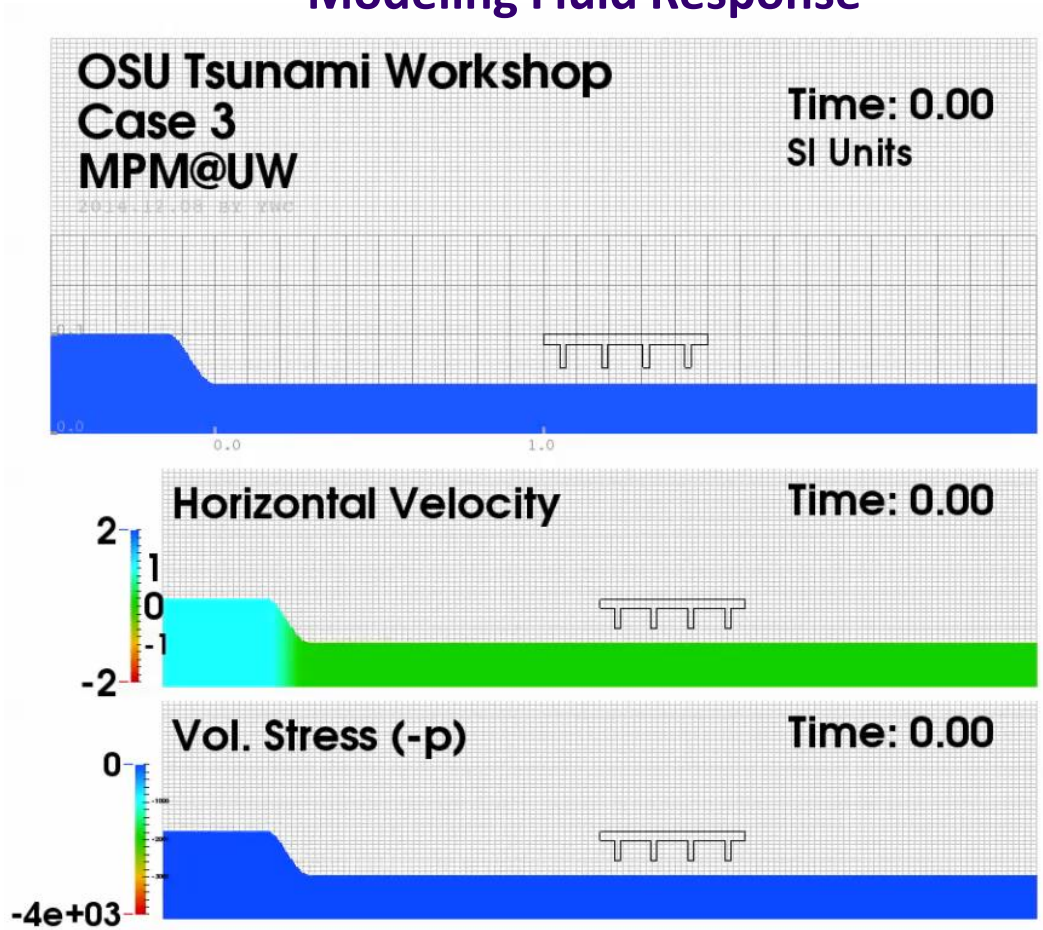
# UW Geotechnical Engineering

## What might you do as a geotechnical engineer?

Apply numerical modelling to geotechnical problems

**Modeling Granular Material Response**

**Modeling Fluid Response**



# UW Geotechnical Engineering

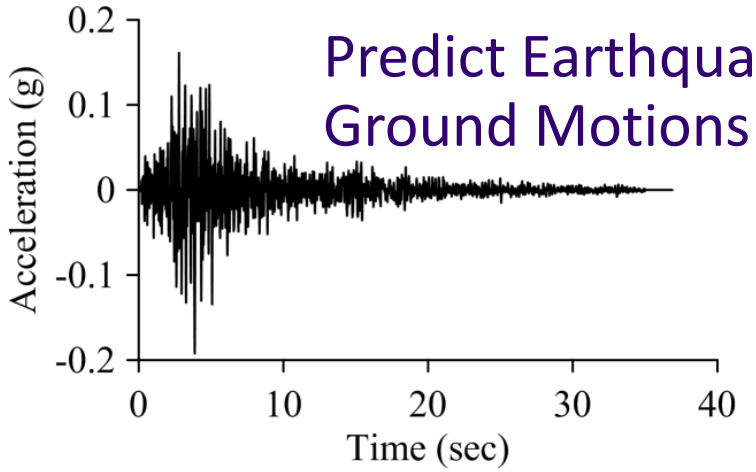
## What might you do as a geotechnical engineer?

…and solve many other problems involving geomaterials

Settlement

Sinkholes

Polluted Soils




Predict Earthquake Ground Motions

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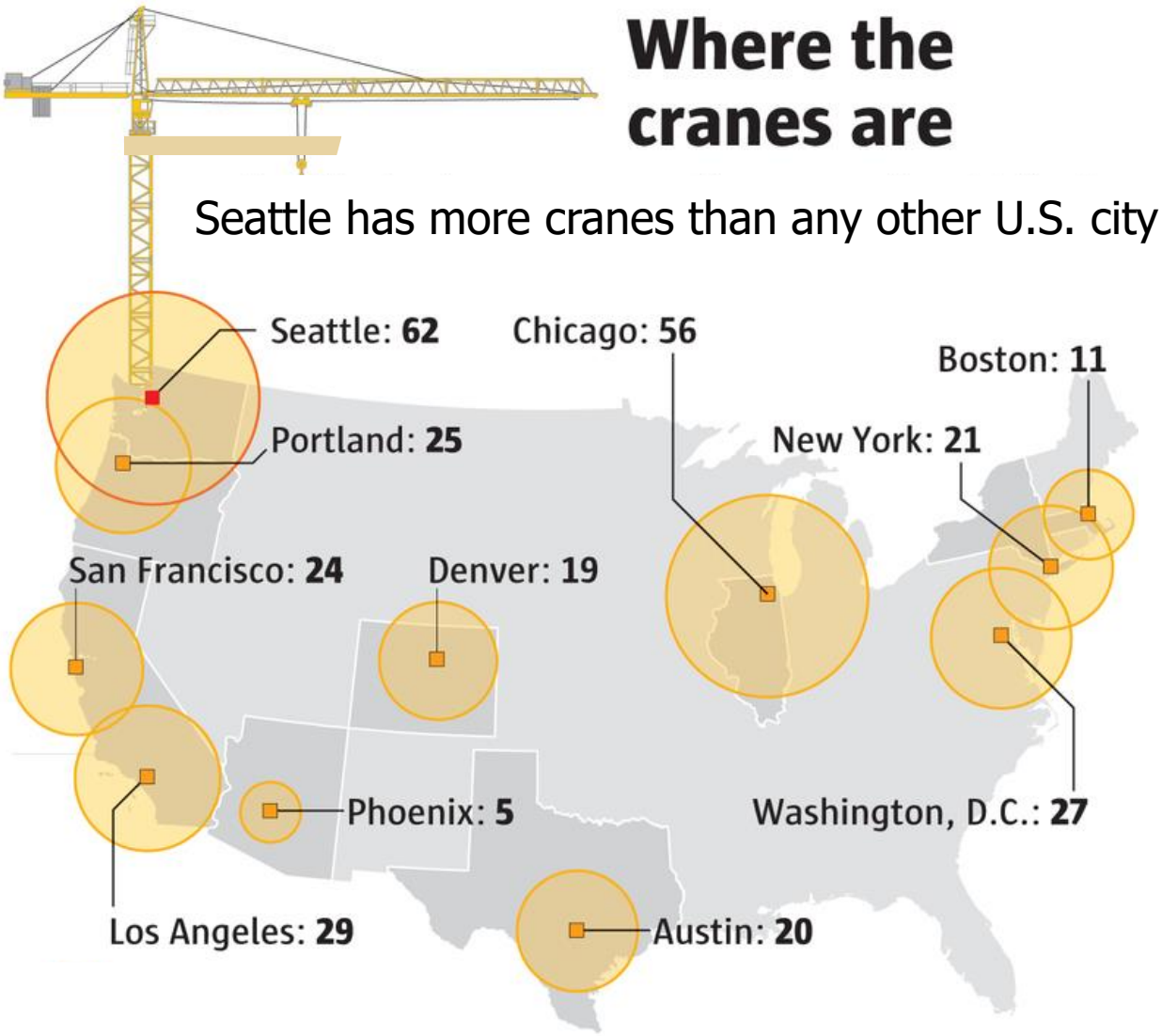
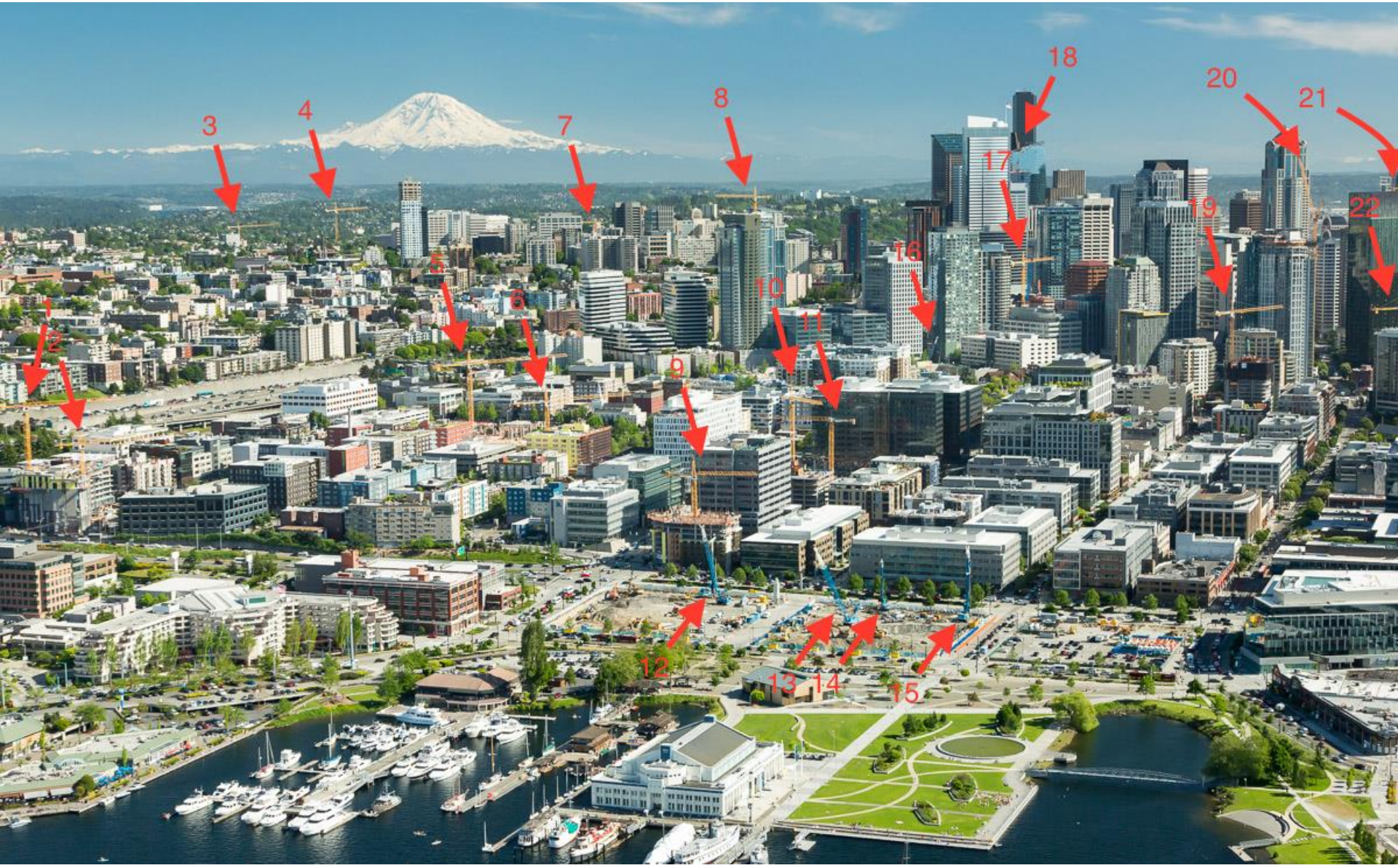
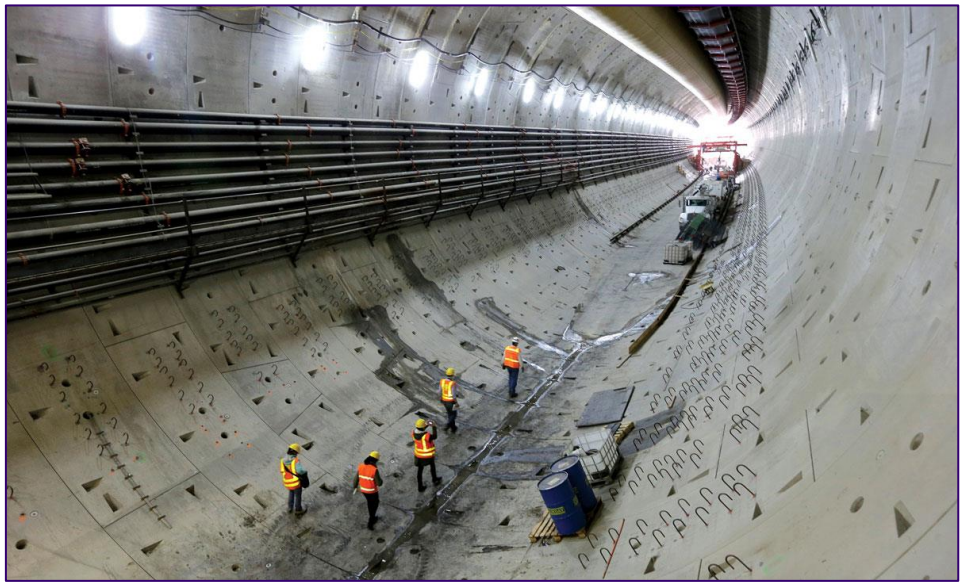
# Geotechnical Engineering in Seattle

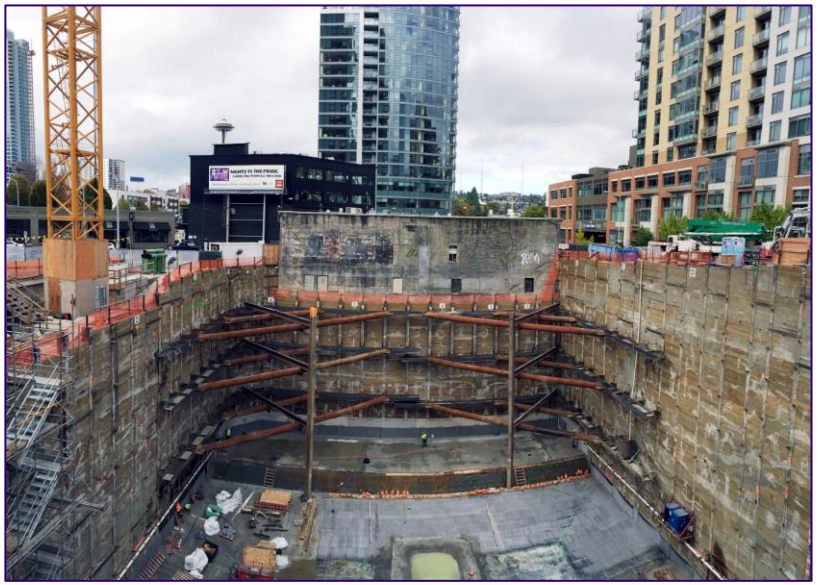


# Geotechnical Engineering in Seattle



# Geotechnical Engineering in Seattle






***= An active geotechnical scene, robust community of practicing engineers, and extensive network of UW alumni***

# Degree Programs

- **Master's Degree (M.S.)**
  - Two options resulting in same degree

  - **Professional Master's Program**

    Intended primarily for students who are interested in going directly to professional practice. No thesis required.

  - **Research Master's Program**

    For students who are interested in significant research experience prior to professional practice, or to pursuing a PhD. Generally requires a thesis.

- **Doctor of Philosophy (Ph.D.)**

# MS Degree Requirements

- **Two options:**
  - **Professional Track (42 Credits Total):**

    42 credits coursework

    Research experience can still be acquired via ind. study with faculty (which replaces elective credits)

  - **Research Track (42 Credits Total):**

    33 credits coursework

    9 credits thesis research (CEE 700)

# MS Degree Requirements (Specifics)

## 42 Credit Coursework Option:

1. **The following four courses must be taken (13 credits):** CESG 561: Advanced Soil Mech (4); CESG 566: Slope Stability and Landslides (3); CESG 567: Advanced Foundation Engineering (3); CESG 569: Geological Eng (3)

2. **19 to 24 credits must be taken from the following list:** CESG 563: Adv Geotech Lab (5); CESG 562: Phys-chem Aspects of Soil Beh (3); CESG 564: Computational Geomechanics (4); CESG 565: Soil Dynamics (3); CESG 571: Case Histories (3); CESG 568: Geotechnical Earthquake Eng (3).

3. **5 to 10 credits of electives** in any department/program (must take CEE 436 if lacking an UG foundation eng. course)

# MS Degree Requirements (Specifics)

## 42 Credit Research Option:

1. **The following four courses must be taken (13 credits):** CESG 561: Advanced Soil Mech (4); CESG 566: Slope Stability and Landslides (3); CESG 567: Advanced Foundation Engineering (3); CESG 569: Geological Eng (3)

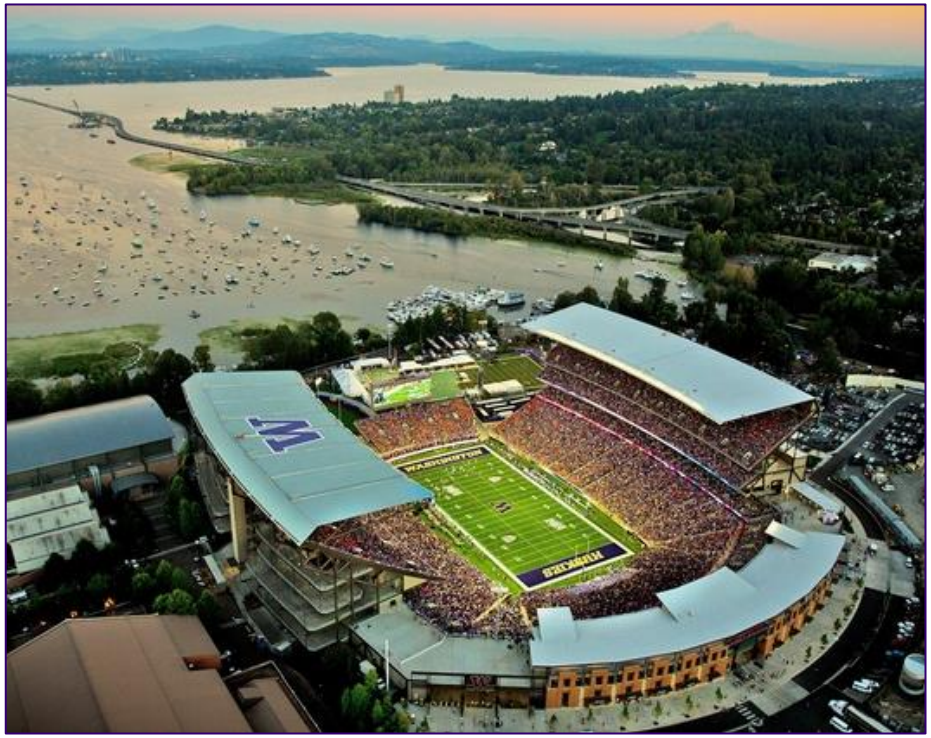
2. **15 to 20 credits must be taken from the following list:** CESG 563: Adv Geotech Lab (5); CESG 562: Phys-chem Aspects of Soil Beh (3); CESG 564: Computational Geomechanics (4); CESG 565: Soil Dynamics (3); CESG 571: Case Histories (3); CESG 568: Geotechnical Earthquake Eng (3).

3. **9 credits of CEE 700** (Master's thesis)

4. **0 to 5 credits of electives** in any department/program (must take CEE 436 if lacking UG foundation eng. course)

# PhD Degree Requirements

- 90 credits total
- M.S. degree counts for 30 credits
- At least 18 course credits
- At least 27 research credits
- Additional Exams



# 2021-2022 Graduate Geotechnical Courses

| | |
|---|---|
| CESG 561 – Advanced Soil Mechanics (4) | *Fall* |
| CESG 562 – Physiochemical Aspects of Soil Behavior (3) | |
| CESG 566 – Slope Stability and Landslides (3) | |
| CESG 563 – Advanced Geotechnical Laboratory (5) | *Winter* |
| CESG 564 – Computational Geomechanics (4) | |
| CESG 565 – Soil Dynamics (3) | |
| CESG 571 – Case Histories in Geotechnical Eng (3) | |
| CESG 567 – Advanced Foundation Engineering (3) | *Spring* |
| CESG 568 – Geotechnical Earthquake Engineering (3) | |
| CESG 569 – Geological Engineering (3) | |
| CESG 570 – Geosystems Engineering (3) | |

***11 Courses***
***37 Credits***

# Example 9-Month MS Degree Plan (42 Credits)

| **Autumn Quarter 2021** | **Winter Quarter 2022** | **Spring Quarter 2022** |
|---|---|---|
| Adv. Soil Mechanics (4) | Soil Dynamics (3) | Adv. Foundations (3) |
| Slope Stability (3) | Comp. Geomech. (4) | Geological Eng. (3) |
| Phys. Chem. Aspects (3) | Adv. Geotech. Lab (5) | Geotech. Eq. Eng. (3) |
| U.G. Foundations* (3) *and/or* Elective Credits (0-3) | Case Histories (3) | Elective Credits (0-5) |
| | Elective Credits (2-5) | |
| ***13-16 Credits*** | ***15 Credits*** | ***12-14 Credits*** |

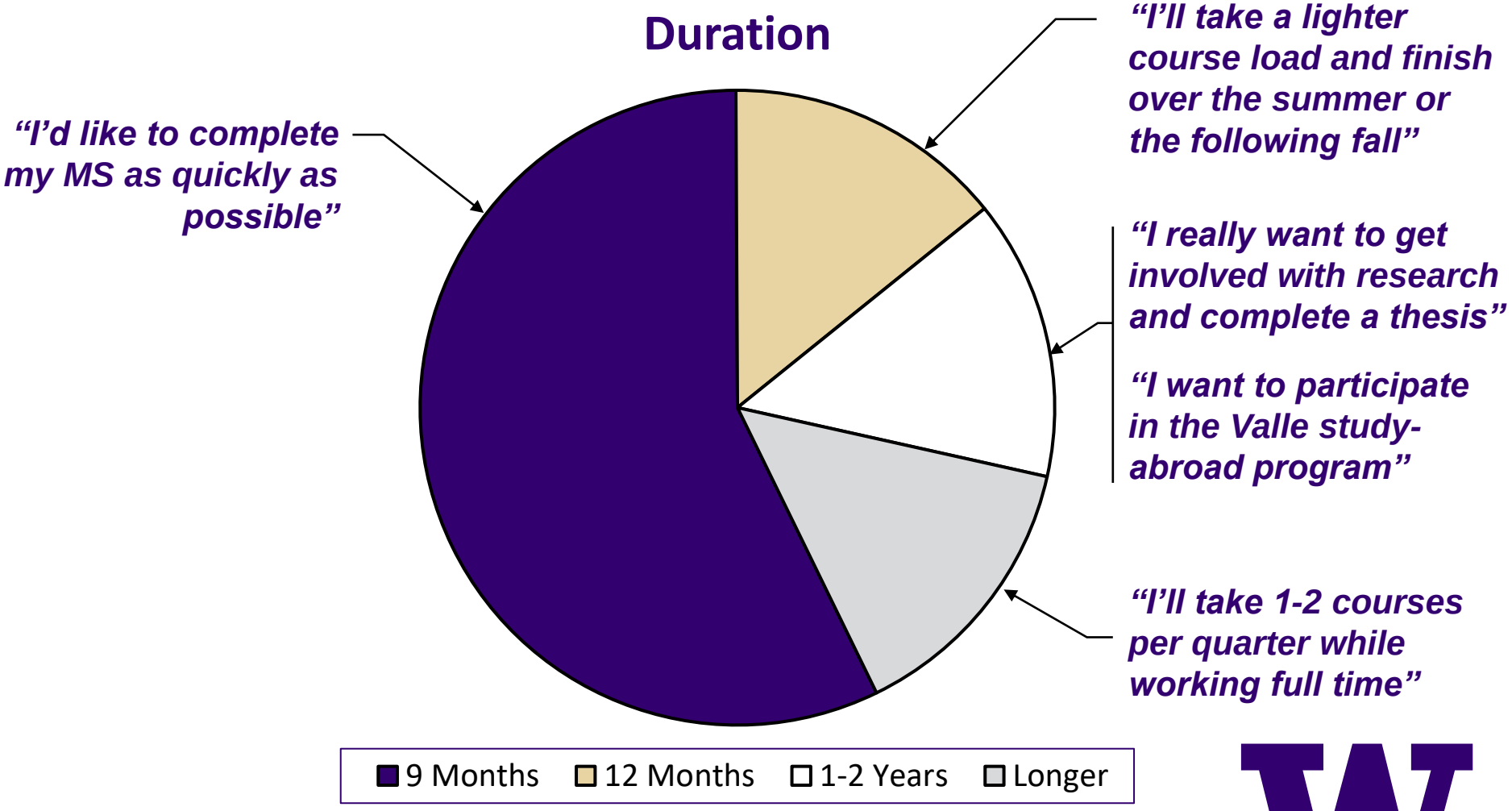
** Required if missing an equivalent undergraduate course; otherwise optional*

# Graduate Elective Courses

- **Other Programs in CEE**
  - Remote Sensing, Risk & Reliability, Programming Languages, Mechanics, Materials, Hydraulics, Coastal Engineering, Pavements, Construction, Transportation…
- **Other Departments**
  - Earth and Space Sciences: Geology, Geophysics, Seismology, Geomorphology
  - Statistics, Applied Math, Comp Sci
  - Law School, Construction
- **Ind. Research/study with geotech faculty**

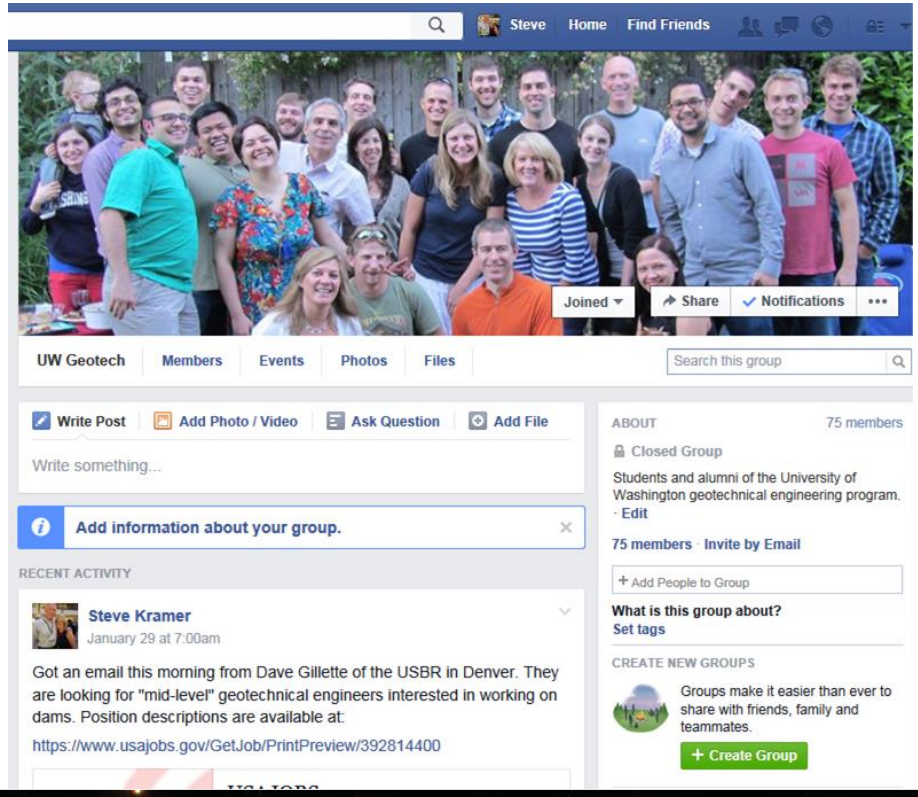
***Mix and match with geotechnical coursework to satisfy graduation requirements and personal interests***

# How long does it take to complete an MS at UW?



# Graduate Program

- Typically 20-25 students
- Currently ~50% women, ~50% men
- GIGSS (student group) – seminars, field trips, social activities, ASCE activities




# Facilities

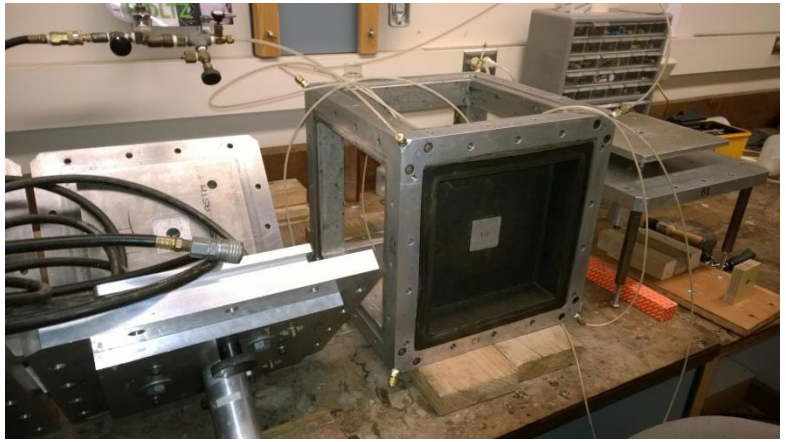
**Laboratory Equipment**

- Soil classification
  - Permeability
  - Consolidation
  - Direct shear
- Triaxial testing device
- Direct Simple Shear (New)

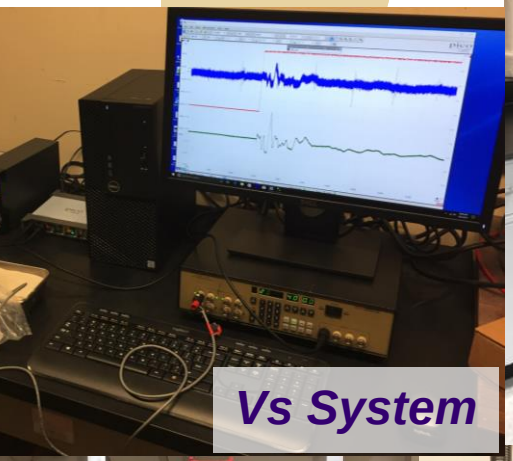
# Facilities

**Specialized Laboratory Equipment**

- Computer-controlled GDS actuators and Bishop-Wesley cell for stress path testing.
- Large cuboidal shear (true triaxial) device, 250 mm on a side
- Smaller cuboidal shear device (100 mm)
- SBEL (Stokoe) resonant column
- Large scale ring shear device
- New $K_o$ oedometer ring
- Shaking table with 2 x 2 x 1.5 m soil bin.
- Geosynthetics equipment for specialized research on filtration, separation, and reinforcement properties



# Facilities



Vs System

More Hall Room 14 Lab Space

Triaxial Apparatus

UCS/ Multitest

Dynamic DSS

RAPID NHERI
Natural Hazards Reconnaissance Facility

*EARTHQUAKE EXAMPLE* ILLUSTRATING LINKS BETWEEN STRATEGIC APPROACHES, INSTRUMENTATION, AND DATA COLLECTION PRODUCTS

*Overarching Strategic Reconnaissance Research Approaches*

1. Collect data across temporal scales, e.g. evolution of co-seismic landslide with time, recovery and return to home for affected persons
2. Collect data across geospatial scales, e.g. community-level and site-specific damage mapping, regional geology trends and site period
3. Collect data and integrate across disciplines, e.g. collect building damage and socio-economic data in identical effected communities

**UAS lidar**: Aerial mapping of ground failure to obtain high-resolution, bare-earth DEM

**UAS camera**: Aerial mapping of building damage patterns to obtain orthophotos and DEM

**Seismometer**: measure natural period and aftershocks to obtain site characteristics

**Camera and geomatics control**: SfM survey to map building damage to obtain 3D model for interrogation

**iPad App**: interview affected persons to obtain social science data

**Terrestrial lidar:** map ground failure and affected structures to obtain high-resolution DEM

**AUV/single beam**: submarine mapping to obtain bathometry

# Questions?