



**Course ID:** 11291

**Course:** ARCH 573

**Title:** Seismic Design

**Units:** 2 Units

**Semester:** Spring 2023

**Class Meetings:** One lecture per week (Tuesday: 9:00 – 10:50 am)

**Location:** HAR 101

**Exams:** Final Exam

**Prerequisite:** Physics or Calculus, Approval of Instructor

**Textbook:** FEMA 454: Designing for Earthquakes: A Manual for Architects  
<https://www.fema.gov/media-library/assets/documents/8669> (free download)

**References:** *ASCE7-16 Minimum Design Loads for Buildings and Other Structures*  
Additional supplemental reading if needed will be provided by instructor

**Instructor:** Parbi Boodaghian, PE, SE

**Office:** TBD

**Office Hours:** Tuesdays, 8:00 – 9:00 am in-person, or via Zoom by appointment

**Contact Info:** Email: [pboodagh@usc.edu](mailto:pboodagh@usc.edu). Phone: 213.604.6774

### **Course Description**

Theory, design methodology and practice of how seismicity affects architecture and structural system selection required for robust earthquake performance and seismic sustainability. Develop informed intuition for structural lateral systems strategies and layout for seismic design. Understand the characteristics of earthquakes and the systems that resist them. Integrate seismic design into the overall architectural design of building including the detailing requirements for structural and nonstructural components.

### **Learning Objectives**

Develop an understanding of the terminology, building code, and philosophy behind seismic design as it relates to building structures. Develop an understanding of how architecturally driven design decisions can affect seismic design, lateral system selection, and structural performance of a building. Gain an understanding of the benefits and disadvantages of different seismic systems, and their suitability to different building types and programmatic needs.

## Subject Matter

This course is intended for graduate architecture students. It covers:

- Earthquakes and how they influence building design.
- Earth science behind earthquakes.
- Fundamentals of the physics and behavior of structural systems designed to resist earthquakes motions.
- System and material selection for seismic design considering the structure, façade.
- Nonstructural components

## Course Outline

### Introduction

- Week 1 Introduction to course objectives, polices, term paper  
Earth Science Basics, how the earth moves, the nature of earthquakes
- Week 2 Earthquakes Effects: shaking, liquefaction, damage to building and infrastructure

### Lateral Force Resisting System

- Week 3 Loading and behavior, deformations, dynamics, load path, resultant forces.
- Week 4 Overview of Systems and materials and impact on design

### Lessons Learned from Major Earthquakes

- Week 5 Do's and don'ts of design in earthquake prone areas, societal impact and earthquake preparedness
- Week 6 Earthquake prediction, Code changes dues to earthquakes, performance-based design

### Lateral System Integration

- Week 7 Reinforced Concrete and Masonry System: Selection, Layout & Sizes
- Week 8 Concrete Systems: Impact on nonstructural elements, facades and detailing
- Week 9 Steel Systems: Selection, Layout and Sizes
- Week 10 Steel Systems: Impact on nonstructural elements, facades and detailing
- Week 11 Wood Systems: Selection, Layout and Sizes
- Week 12 Wood Systems: Impact on nonstructural elements, facades and detailing
- Week 13 Retrofit Strategies: Maintaining Functionality and preserving design.
- Week 14 Supplemental Systems: Base isolation, Dampers, Friction System
- Week 15 Term Papers Due and Presentations

**Final Exam: Tuesday, May 9, 2023, 8-10 a.m.**

### Basis for Final Grade

Homework	25%
Term Paper	30%
Term Paper Presentation	15%
Final Exam	30%
<b>TOTAL</b>	<b>100%</b>

To pass the course students must pass the Final and not miss more than two classes without valid written excuses.

## Grading Scale

Course final grades will be determined using the following scale:

**Table 1 Course Grading Scale**

Letter grade	Corresponding numerical point range
A	95-100
A-	90-94
B+	87-89
B	83-86
B-	80-82
C+	77-79
C	73-76
C-	70-72
D+	67-69
D	63-66
D-	60-62
F	59 and below

## Term Paper

Term paper will be due the week before finals. Each student will also be required to present their topic to the class for 10-15 minutes and be able to answer questions related to their topic. Students may select any topic that relates to seismic design. Topics can range from advances in technology in the field of seismic design such as base isolation and dampers, to the study of the lateral system of an existing building. I will be providing a list of topics to choose from, but students are welcome to also propose their own ideas. Students will need to confirm their topic with the instructor prior to commencing work on the paper. Students are encouraged to select a topic early so that they have ample time to work on the paper. Late submission of the term paper will not be accepted.

The term paper shall include a minimum of 3 pages single-spaced text, with academic and other reliable citations, and include graphics as needed to supplement the text.

## Academic Integrity

The University of Southern California is foremost a learning community committed to fostering successful scholars and researchers dedicated to the pursuit of knowledge and the transmission of ideas. Academic misconduct is in contrast to the university's mission to educate students through a broad array of first-rank academic, professional, and extracurricular programs and includes any act of dishonesty in the submission of academic work (either in draft or final form).

This course will follow the expectations for academic integrity as stated in the [USC Student Handbook](#). All students are expected to submit assignments that are original work and prepared specifically for the course/section in this academic term. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s). Students suspected of engaging in academic misconduct will be reported to the Office of Academic Integrity.

Other violations of academic misconduct include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see the [student handbook](#) or the [Office of Academic Integrity's website](#), and university policies on [Research and Scholarship Misconduct](#).

Please ask me if you are unsure about what constitutes unauthorized assistance on an exam or assignment, or what information requires citation and/or attribution. In this class, you are expected to submit work that demonstrates your individual mastery of the course concepts. Unless specifically designated as a 'group project,' all assignments are expected to be completed individually.

If found responsible for an academic violation, students may be assigned university outcomes, such as suspension or expulsion from the university, and grade penalties, such as an "F" grade on the assignment, exam, and/or in the course.

### **Course Content Distribution and Synchronous Session Recordings Policies**

USC has policies that prohibit recording and distribution of any synchronous and asynchronous course content outside of the learning environment.

Recording a university class without the express permission of the instructor and announcement to the class, or unless conducted pursuant to an Office of Student Accessibility Services (OSAS) accommodation. Recording can inhibit free discussion in the future, and thus infringe on the academic freedom of other students as well as the instructor. ([Living our Unifying Values: The USC Student Handbook](#), page 13).

Distribution or use of notes, recordings, exams, or other intellectual property, based on university classes or lectures without the express permission of the instructor for purposes other than individual or group study. This includes but is not limited to providing materials for distribution by services publishing course materials. This restriction on unauthorized use also applies to all information, which had been distributed to students or in any way had been displayed for use in relationship to the class, whether obtained in class, via email, on the internet, or via any other media. ([Living our Unifying Values: The USC Student Handbook](#), page 13).

### **Statement on Academic Conduct and Support Systems**

#### **Academic Integrity:**

The University of Southern California is a learning community committed to developing successful scholars and researchers dedicated to the pursuit of knowledge and the dissemination of ideas. Academic misconduct, which includes any act of dishonesty in the production or submission of academic work, comprises the integrity of the person who commits the act and can impugn the perceived integrity of the entire university community. It stands in opposition to the university's mission to research, educate, and contribute productively to our community and the world.

All students are expected to submit assignments that represent their own original work, and that have been prepared specifically for the course or section for which they have been submitted. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s).

Other violations of academic integrity include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), collusion, knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university. All incidences of academic misconduct will be reported to the Office of Academic Integrity and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see [the student handbook](#) or the [Office of Academic Integrity's website](#), and university policies on [Research and Scholarship Misconduct](#).

Please ask your instructor if you are unsure what constitutes unauthorized assistance on an exam or assignment, or what information requires citation and/or attribution.

### **Students and Disability Accommodations:**

USC welcomes students with disabilities into all of the University's educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at [osas.usc.edu](http://osas.usc.edu). You may contact OSAS at (213) 740-0776 or via email at [osasfrontdesk@usc.edu](mailto:osasfrontdesk@usc.edu).

### **Support Systems:**

#### [Counseling and Mental Health](#) - (213) 740-9355 – 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

#### [988 Suicide and Crisis Lifeline](#) - 988 for both calls and text messages – 24/7 on call

The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, across the United States. The Lifeline is comprised of a national network of over 200 local crisis centers, combining custom local care and resources with national standards and best practices. The new, shorter phone number makes it easier for people to remember and access mental health crisis services (though the previous 1 (800) 273-8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.

#### [Relationship and Sexual Violence Prevention Services \(RSVP\)](#) - (213) 740-9355(WELL) – 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).

#### [Office for Equity, Equal Opportunity, and Title IX \(EEO-TIX\)](#) - (213) 740-5086

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

#### [Reporting Incidents of Bias or Harassment](#) - (213) 740-5086 or (213) 821-8298

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

#### [The Office of Student Accessibility Services \(OSAS\)](#) - (213) 740-0776

OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

[USC Campus Support and Intervention](#) - (213) 740-0411

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

[Diversity, Equity and Inclusion](#) - (213) 740-2101

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

[USC Emergency](#) - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

[USC Department of Public Safety](#) - UPC: (213) 740-6000, HSC: (323) 442-1200 – 24/7 on call

Non-emergency assistance or information.

[Office of the Ombuds](#) - (213) 821-9556 (UPC) / (323-442-0382 (HSC)

A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

[Occupational Therapy Faculty Practice](#) - (323) 442-2850 or [otfp@med.usc.edu](mailto:otfp@med.usc.edu)

Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.