

Spring 2021

CE 495-006: Civil Engineering Design II

Simon Shim

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Spring 2021

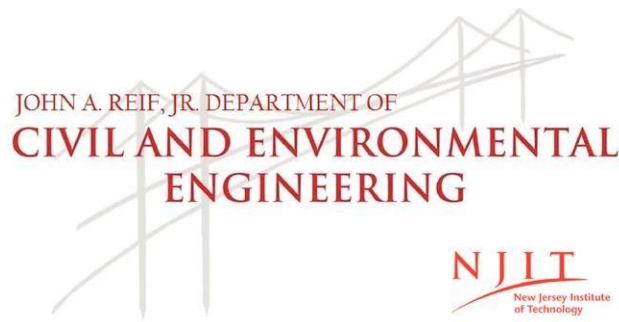
CE495-006: Civil Engineering Design II (Structural)

Simon Shim

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CE 495-006 Civil Engineering Design II (Structural) Spring 2021

Text: Tall Building Design: Steel, Concrete, and Composite Systems, by Bungale S. Taranath
(ISBN: 978-1466556201)

Instructor: Simon Shim, P.E., E-mail: shim@njit.edu (Office Hour: 1:00 ~ 2:00 PM Thursday by appointment)

Location: Online Webex between 9:00 AM ~ 11:50 AM

Prerequisites: CE 332- Structural Analysis; CE 333 – Reinforced Concrete Design; a working knowledge of how to analyze a structure for the applied design loads in order to obtain the shear and moment diagram, as well as deflection of the structure. Some basic knowledge in the design of reinforced concrete members.

statement on academic integrity:

“Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: <http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf>.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu”

Week	Topic	Handout or Homework
1.	Introduction of course work and team project	Handout 1
2.	Understand Design Project team and Communication Design Process and scope of work. Reference: Deliverables: Project drawing package, Specifications.	Handout 2
3.	Overview of structural engineering workflow for existing building and New Building.	Handout 3
4.	Structural Design Criteria: Dead Load, Live Load, Wind Load, and Seismic Load, etc	Handout 4

5.	Gravity floor framing System and Design I Structural element layout practice (Column, Wall, Beam, Slab) Column Load Takedown with Tributary Area Method Finite Element Modelling (FEM) and Analysis Introduction Composite Floor framing Case study	Homework 1
6.	Gravity floor framing System and Design II Finite Element Modelling (FEM) and Analysis Practice Composite Floor framing Case study and Practice	Homework 2
7.	Gravity floor framing System and Design III Finite Element Modelling (FEM) and Analysis Practice Concrete Framing Case study Introduction	Homework 3
8.	Lateral load resisting system I Finite element Modelling and Analysis Practice I	Handout 5
9.	Lateral load resisting system II Finite element Modelling, Analysis, and design Practice	Homework 4
10.	Foundation system I Finite element Modelling, Analysis, Design Introduction	Handout 6
11.	Foundation system II Finite element Modelling, Analysis, Design Practice	Homework 5
12.	Workshop I Final Team Project Walk-through	
13.	Workshop II Final Team Project Walk-through	
14.	Final Team Presentations Deadline of Team presentation and Report Closing remarks and comments: Introduction of new design technologies Introduction digital fabrication on complex form structure. Q/A for career path	Presentation 20 minutes /each team

Grading: Grading will be judged based on weights of various assignments, in-class participation, and attendance and final-term project presentation and report. Completeness = Homework 50% (10% of each) + final presentation 25% + final report 25%. Grade = Participation x Completeness).

**Outcomes Course Matrix – CE 495 Civil Engineering Design II
(Structural focused)**

Strategies, Actions and Assignments	ABET Student Outcomes (1-7)	Program Educational Objectives	Assessment Measures
Student Learning Outcome 1: Understand, Analyze, and design an engineering project (building Superstructure and foundation, etc.)			
Present an area-specific structural engineering design problem-solving and practice.	1, 2, 7	1, 2	Periodic progress homework
Discuss specific code, Design Criteria, performance Goals, cost Implication, and safety objectives.	2, 4	1, 2	Periodic progress homework
Work individually and in Group and present final group project.	3, 5	1, 2	Final project report, and group presentation.

CEE Mission, Program Educational Objectives and Student Outcomes The mission of the Department of Civil and Environmental Engineering is:

- to educate a diverse student body to be employed in the engineering profession
- to encourage research and scholarship among our faculty and students
- to promote service to the engineering profession and society

Our program educational objectives are reflected in the achievements of our recent alumni:

1 – Engineering Practice: Alumni will successfully engage in the practice of civil engineering within industry, government, and private practice, working toward sustainable solutions in a wide array of technical specialties including construction, environmental, geotechnical, structural, transportation, and water resources.

2 – Professional Growth: Alumni will advance their skills through professional growth and development activities such as graduate study in engineering, research and development, professional registration and continuing education; some graduates will transition into other professional fields such as business and law through further education.

3 – Service: Alumni will perform service to society and the engineering profession through membership and participation in professional societies, government, educational institutions, civic organizations, charitable giving and other humanitarian endeavors.

Our Student Outcomes are what students are expected to know and be able to do by the time of their graduation:

1. an ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of

public health, safety and welfare, as well as global, cultural, social, environmental and economic factors

3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

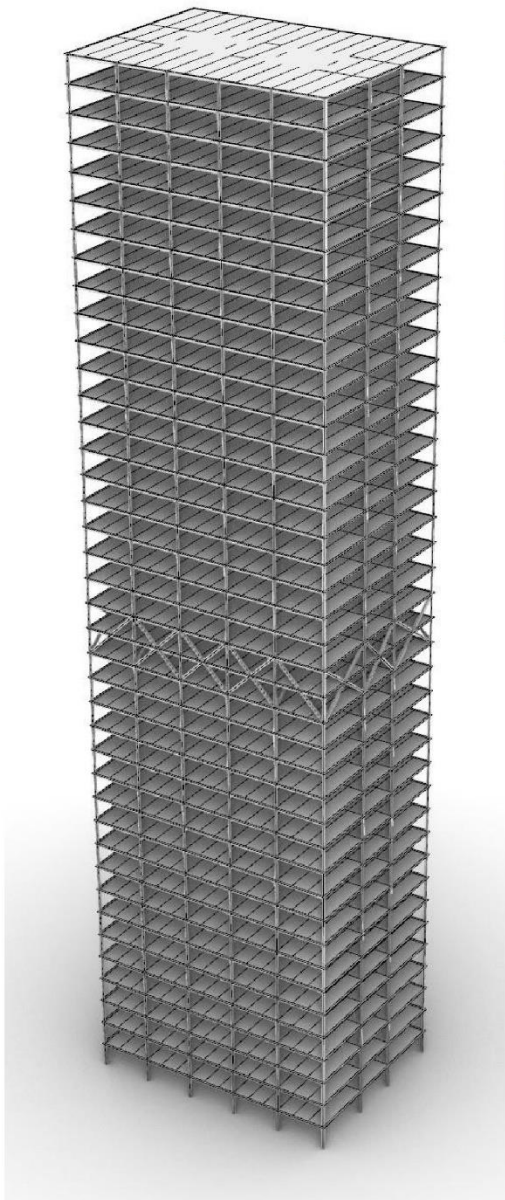
Class Notes:

Goal: This class will provide seniors with the overview of structural engineering design practice routinely conducted in structural design firm. The class team project will be a 40-story commercial building design by walking through structural system selection, analysis, and design.

Students will gather existing high-rise building structural information from various sources and discuss during the class to get familiar to structural systems including floor framing system, lateral load resisting system, and foundation system.

The sequences of the class topics may vary based on class progress. Individuals in group may receive different grades based on attendance, class participation and presentation.

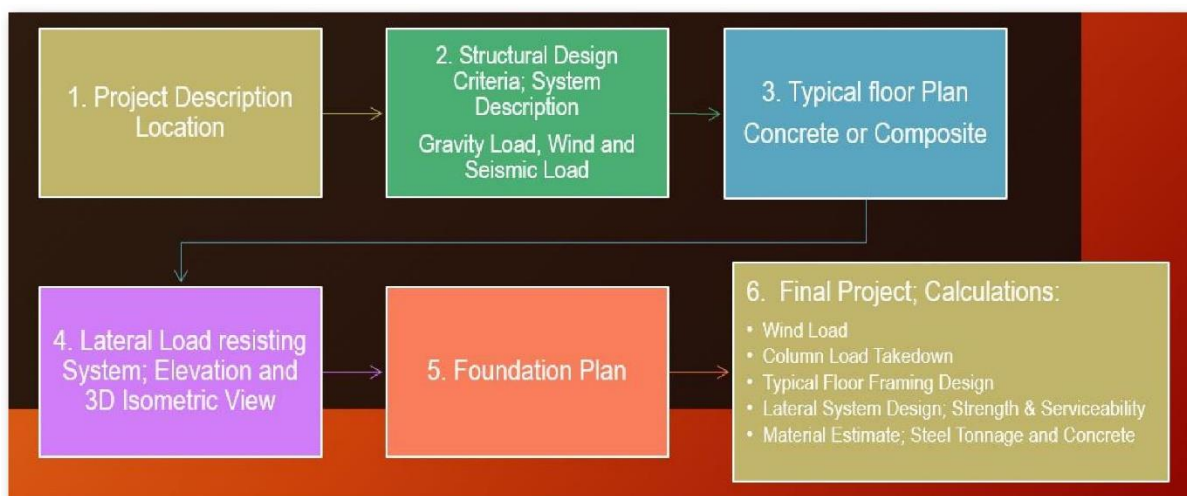
Revised:
01/20/2021



NJIT CE495-105
Fall 2020



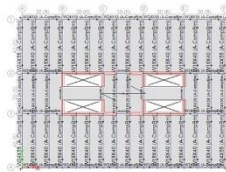
**Outrigger and Belt Truss
At Mechanical & Amenity floor**



TOWER PALACE

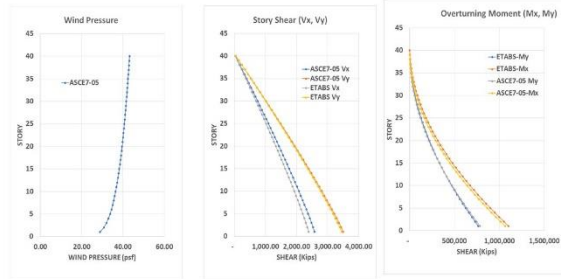
The project is a 40 story commercial building, located at 18 Wes 18th Street, New York, NY
Typical floor plate is approximately 150 feet wide and 110 long.
Typical bay is 30 feet x 40 feet, of which column is spaced at 30 feet on center.

The structure will be a hybrid that combined of concrete and steel.
Typical floor framing is made of 3" Metal deck and 3 1/4" Light Weight Concrete slab supported on steel beams tied with 3/4" diameter shear stud.
Typical floor beam is W16 to W18, and girder W21 to W24.
Column is W14 rolled section.



Typical floor framing is 3 1/4" Light weight concrete on 3" metal deck over steel beam compositely integrated with shear studs.
Ordinary Reinforced Concrete Shear Wall
Steel Column

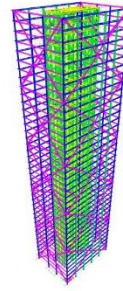
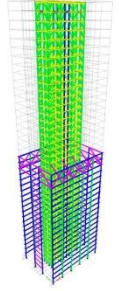
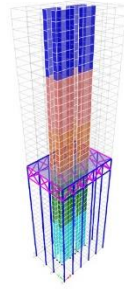
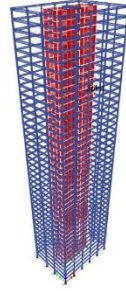
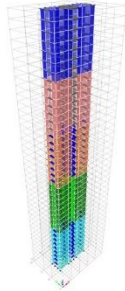
Wind Load (ASCE7-07, NYC Building 2014)
Basic Wind Speed = 98 MPH, Importance Factor = 1.0
Gust Factor = 0.85, Directional Factor = 0.85



FLOOR FRAMING SYSTEM

1. Ordinary Reinforced Concrete System

2. Ordinary Reinforced Concrete System + Ordinary Steel Moment Frame

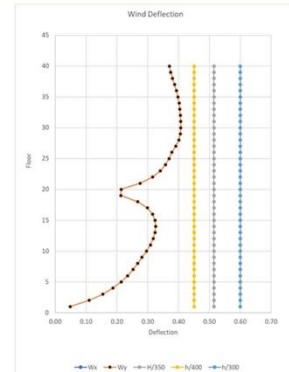
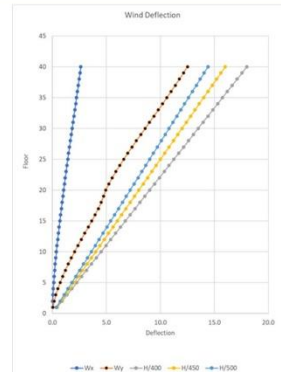
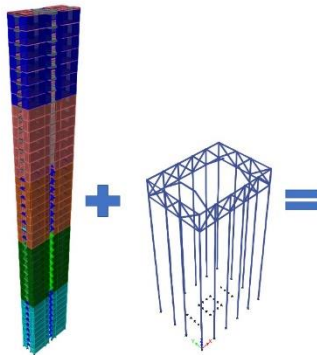


3. Ordinary Reinforced Concrete System + Outrigger Truss + Belt Truss

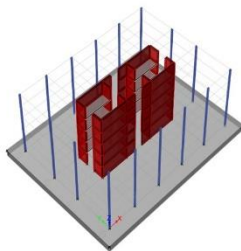
4. Ordinary Steel Concentric Braced Frame + Outrigger Truss + Belt Truss

5. Ordinary Steel Concentric Braced Frame + Outrigger Truss + Belt Truss

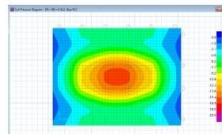
LATERAL LOAD RESISTING SYSTEM ALTERNATIVES



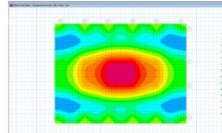
SELECTED LATERAL LOAD RESISTING SYSTEM



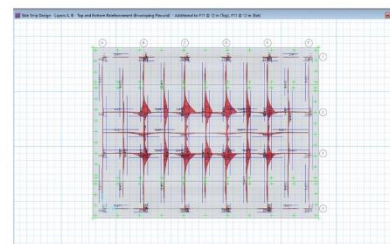
60 inch Mat Foundation on 20 KSF Soil



Soil Reaction Check less than 20 KSF



Soil Settlement Study (DL+SDL+0.5LL)



Flexural Bar #11@1'-0" o.c. E.S. Top and Bottom

FOUNDATION SYSTEM