

CE 40240/60240: Structural Systems
Fall 2013
University of Notre Dame
Department of Civil Engineering & Geological Sciences

Course Description: Overview of common structural systems used in building design, focusing on behavior, form and function with specific emphasis on the hierarchy of lateral load resisting systems. Course will also highlight innovative structural systems for tall and complex buildings through state-of-the-art case studies and issues relevant to post-9/11 construction such as collapse mechanisms, robustness and redundancy. Codes and commercial software common to practice will be heavily utilized.

Lectures: TH 2:00-3:15 pm
136 DeBartolo Hall

Course website: sakai.nd.edu

Course Objectives: By the end of the semester, students will be able to:

1. Understand basic principles of structural dynamics necessary to apply building codes and standards
2. Apply ASCE 7 to specify equivalent static wind and earthquake loads
3. Classify common lateral systems for steel buildings and identify systems most suitable for specific applications
4. Specify concrete analogs to common lateral systems in steel and identify systems most suitable for specific applications
5. Specify common floor systems and identify systems most suitable for specific applications
6. Demonstrate basic modeling skills in commercial software in the development of model for an actual high rise building
7. And using this model, demonstrate understanding of structural load paths, system behavior/performance/efficiency, and system redundancy/resilience to collapse

Interface to Practice: Course includes case studies of specific buildings, design philosophies of leading designers of tall buildings, code-specifications for lateral loadings and analysis using commercial software packages such as SAP 2000.

Instructor: Dr. Tracy L. Kijewski-Correa (Dr. K.C.)

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 e-mail: tkijewsk@nd.edu
 Office Hours: Mondays, Tuesdays, Wednesdays 4-5 pm

Teaching Assistants:

Name	Contact Info	Pre-Fall Break Role	Post-Fall Break Role
Tara Weigand	tweigand@nd.edu 107B Cushing	Office Hours: Wednesdays 7-9 pm in 161 Fitzpatrick	Project Advisors Meeting by Appointment
Sally Williams	swilli19@nd.edu 107B Cushing	Grader	

Required Texts:

Structural Analysis and Design of Tall Buildings: Steel and Composite Construction by Bungale S. Taranath, CRC Press, Edition 1, Published: October 18, 2011, ISBN-10: 1439850895, ISBN-13: 978-1439850893.

Referenced Texts:

Designing Tall Buildings: Structure as Architecture, by Mark Sarkisian, Routledge, Publication Date: September 21, 2011, ISBN-10: 0415894808, ISBN-13: 978-0415894807.

Structural Systems for Tall Buildings by Council on Tall Buildings and Urban Habitat, McGraw Hill, 1995, ISBN: 0-07-012541-4.

Engineering Architecture: The Vision of Fazlur R. Khan by Yasmin Sabina Khan, W.W. Norton & Co., 2004, ISBN: 0-393-73107-3.

Art of the Skyscraper: The Genius of Fazlur Khan by Mir M. Ali, Rizzoli Int'l, Inc., ISBN: 0-847823709.

Steel Concrete and Composite Design of Tall Buildings by Bungale S. Taranath, 2nd Edition, McGraw Hill, 1998, ISBN: 0-07-062914-5.

Tall Buildings Reference Book, Council on Tall Buildings and Urban Habitat.

Wind Tunnel Testing Guide, Council on Tall Buildings and Urban Habitat.

Outrigger Design Guide, Council on Tall Buildings and Urban Habitat.

Seismic Design Recommendations, Council on Tall Buildings and Urban Habitat.

Attendance: Due to the highly conceptual nature of the course, many of the concepts will not be apparent from readings or posted lecture notes. Therefore, while lecture attendance is not required, regular attendance is highly correlated with student success in this class.

Web Resources: www.emporis.com, www.ctbuh.org

Grades ¹ :	Midterm Examination	25%
	Projects	25%
	Homework	25%
	<u>Final Exam</u>	<u>25%</u>
	TOTAL	100%

Assignments:

- Any homework received after the due date will have a 10% reduction in score for each day late.
- Use only 8 ½" x 11" paper
- Use only one side of the paper. Staple multiple sheets in the upper left corner.
- Show all work and box final answers from any calculations. The right answer with no work shown will receive zero credit.

Examinations: There will be one midterm examination and one final examination in this course. Individuals with unexcused absences for these exams will be given a zero grade.

Honor Code: Notre Dame students are expected to abide by Academic Code of Honor Pledge. "As a member of the Notre Dame community, I will not participate in or tolerate academic dishonesty." Please see <http://honorcode.nd.edu> for more details on the honor code. The professor's interpretation of these policies is as follows:

- In the context of homework, students are allowed to discuss and work with classmates, however all homework turned in for credit should be one's own. If close collaboration was utilized, students should indicate the name of the collaborator.
- For projects, students will work in teams and turn in one project for that team. Teams may discuss the projects with other teams, but again should conduct and hand in their own work. Further, all members of project teams are expected to equally participate in project work.

¹Appropriate homework, project and examination expectations will be exercised for undergraduate students.

- Of course, all work on examinations and finals shall be the student's own.

Final Examination: Wednesday, December 18, 2013, 10:30 am-12:30 pm
Location TBD

Credits: 3.0 Credit Hours (Lecture)

Target Audience: Elective for senior undergraduate students and beginning graduate students

Pre/Co-Requisites: Civil Engineering Materials, Introduction to Structural Engineering, Structural Analysis, Solid Mechanics, Statics, Probability/Statistics for Engineers, Structural Dynamics (preferred), Finite Element Modeling in Commercial Packages (preferred)

TENTATIVE CLASS SCHEDULE

	No.	DATE	TOPIC	COVERAGE
PREP	1	8/29*	Class business, Basic Structural Concepts & Philosophies	9.1-9.2, Supplements
	2	9/3	Practical Introduction to Structural Dynamics	5.9-5.10, 6.1.1, 6.1.4, 6.1.5
LOADS	3	9/5	Introduction to Wind Effects	5.1-5.4
	4	9/10	Treatment of Wind in Codes and Standards	5.5, 5.11
	5	9/12	Continuation of Wind: Wind Tunnel Testing Guide	5.6-5.8, Supplements
	6	9/17	The Nature of Seismic Loads	6.1.6-6.1.8, 6.2
	7	9/19	Fundamentals of Seismic Design	6.3
	8	9/24	Code Treatment of Seismic Forces	6.3
	9	9/26	OVERFLOW/Seismic Design Guide	Supplements
2 D STEEL LAT. SYS	10	10/1	Birth of Structural Systems...the Steel Frame	1.1-1.2
	11	10/3	Preliminary Analyses of MRFs	9.7
	12	10/8	Stiffening Steel Frames	1.3-1.7
	13	10/10	Interacting Systems	1.8-1.9
	14	10/15	OVERFLOW/Outrigger Design Guide	Supplements
		10/17	MIDTERM EXAM	
		10/22	FALL BREAK	
		10/24	FALL BREAK	
3D SYS	15	10/29	Tube Systems	1.10-1.13
	16	10/31	Beyond the Tube	1.14, Supplements
RC LAT. SYS.	17	11/5	Creating Analogs in Concrete	Supplements
	18	11/7	Going Mega in Concrete	Supplements
	19	11/12	Composite Systems	Ch. 2
	20	11/14	Floor Systems	3.1, 4.1-4.8
MODERN ISSUES	21	11/19	Mitigating Progressive Collapse	Supplements
	22	11/21	Predicting Collapse Mechanisms I	Supplements
	23	11/26	Predicting Collapse Mechanisms II	Supplements
		11/28	Thanksgiving Break	
	24	12/3	Occupant Comfort and Mitigation of Motion	Supplements
WRAP UP	X	12/5	Class Presentations	Student Led
	X	12/10	Class Presentations	Student Led
	X	12/12	Course Recap	
	X	12/18	FINAL EXAM	

*Rescheduling of the first class day (8/27) will occur during 2D Steel Lateral Systems module for an evening or Friday make up lecture introducing the project and basic training in SAP 2000.