Prestressed Concrete and Segmental Concrete Bridge Design

CIVE 4900 – 045 CIVE 5930 – 045

Spring Semester 2001 MW 5:45-7:00 pm

INSTRUCTOR: D.K. Nims Ph.D., P.E. OFFICES: Nitschke Hall 3021 & 3006E

OFFICE HOURS: MT 1-3, F 1-3 OFFICE PHONE: 530-8122

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Design "causes things to come into existence from ideas, makes the world conform to thought; whereas science, by deriving ideas from observation, makes thought conform to existence."
-Philosopher Carl Mitcham quoted by E. Ferguson in *Engineering and the Mind's Eye*

Basic Course Description

This course will provide students with the necessary background to understand and appreciate the MRC. To achieve this understanding it, is necessary to get a fundamental background in prestressed and post-tensioned concrete design and then develop an understanding of segmental concrete construction and cable-stayed bridge design. Hence, the course will be split into two parts that will run concurrently.

Prerequisites

Concrete design or permission of the instructor.

Text:

Prestressed Concrete, Edward G. Nawy, 3rd edition, ISBN 0-13-020593-1

Conduct of the Course:

The prestressed concrete design portion of the course will be conducted in the traditional lecture, homework and exam manner. The cable-stayed and segmental bridge design portion of the course will focus on presentations by guest speakers who are involved in the design, construction and aesthetics of the MRC. A term project will be required for this portion of the course.

Undergraduate problem sessions and graduate sessions to be introduced to AASHTO will be held approximately biweekly at times to be arranged.

Enrollment options:

Students may enroll for the full three-hour course or may enroll for the one hour cable-stayed and segmental bridge design portion.

Course Goal:

Enable undergraduate students to understand the fundamental design, structural mechanics, and construction of the Maumee River Crossing (MRC) cable-stayed bridge and segmental concrete bridge approaches. Enable graduate students to design the girders for a multi-span prestressed slab on girder bridge.

Role in a Sequence of Courses

Follows concrete design. Deepen and broaden the students understanding of concrete behavior.

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Spring Semester 2001

References:

American Segmental Bridge Institute website:

American Segmental Bridge Institute, Recommended Practice for Design and Construction of Segmental Concrete Bridges, April 2000, ASBI has supplied a copy for class use.

Barker, R.M. and J.A. Puckett, Design of Highway Bridges, John Wiley, 1997.

Collins, M. P., and Mitchell, D, Prestressed Concrete Structures, Prentice-Hall, 1991. (Has been reprinted under a different imprint.)

MRC website: http://www.lookuptoledo.org/

Post Tensioning Institute website:

Post Tensioning Institute, Post-tensioning Handbook, PTI has supplied a copy for class use.

Prestressed/Precast Concrete Institute Handbook, 5th edition, PCI will supply to students.

Grading: 3 hour undergraduates and graduates

Homework	40%
Midterms 1@25%	30%
Project	0%
Final	30%
Total	100%

i-Undergraduates and graduates will be graded separately.

ii-There will be no curve; grading will be on an absolute scale.

Grade Scale:					
	A 93+	B+ 87-89	C+ 75-79	D+ 63-66	F < 57
	A- 90-92	B 83-86	C 70-74	D 60-62	
		B- 80-82	C- 67-69	D- 57-59	

Grading: 1 hour undergraduates and graduates

Chapter 1 Homework	25%
Cable stay homework	25%
Paper outline	10%
Paper	40%
Total	100%

Grade Scale:					
	A 93+	B+ 87-89	C+ 75-79	D+ 63-66	F < 57
	A- 90-92	B 83-86	C 70-74	D 60-62	
		B- 80-82	C- 67-69	D- 57-59	

Please Note:

1. Homework will generally be due on the week after assignment.
2. Homework should be on engineering paper, on one side of the page with the answers highlighted. Homework is to be modeled after design calculations. Illegible work or work which cannot be followed will be returned for resubmission.

3. Homework that does not reflect a fundamental understanding of the assignment (Grade less than 70%) may be resubmitted for credit up to 85%.
4. Credit for late homework is reduced by 10% for each class period it is late.
5. The midterm and the final exam are open book and open notes.

Attendance:

Attendance at the sessions when there are speakers is mandatory. Absences may lead to a lowering of your grade.

Academic Dishonesty:

You are encouraged to work together in groups and discuss assignments. However, any written work you submit must be substantially your own. Specifically, do not submit someone else's computer work as your own. Penalties range from an F on the assignment, to suspension and expulsion.

CIVE 4900 and 5930 Prestressed Concrete and Segmental Bridge
Spring Semester 2001
Course Outline
Rev. 1, September 26, 2006

Week	Prd	Date	Subject	Reading Assignments	Homework
1	1	Jan. 17 W	MRC Overview: Jeff Baker	www.lookuptoledo.org	
			Course Philosophy and Introduction	N. Ch 1	
2	2	Jan 22 M	Basic concepts: Basic Method, C-Line, and Load-Balancing	N. Ch 1	1.1 (Use LL of 3000 lb/ft instead of 3600 in the text.), 1.5
	3	Jan 24 W	Materials and Systems for Prestressing	N. Ch 2	
3	4	Jan 29 M	Partial Loss of Prestress	N. Ch 3.1-3.7	
	5	Jan 31 W	Peter Nix, P.E. DLZ		
			Partial Loss of Prestress		
4	6	Feb 5 M	Partial Loss of Prestress	N. Ch.3.8-3.11	3.1, 3.4
	7	Feb 7 W	Flexural Design	N. Ch.4	
5	8	Feb 12 M	Flexural Design	N. Ch. 4	
	9	Feb 14 W	Basics of precasting: Ed Tumulty, P.E. PCI		
6	10	Feb 19 M	Flexural Design	N. Ch.4	4.1 service load, 4.2 service load
	11	Feb 21 W	Flexural Design	N. Ch. 4	4.1 ultimate Load, 4.2 ultimate load and anchorage
7	12	Feb 26 M	Mike Gramaza, ODOT construction manager, Todd Audet, ODOT		
	13	Feb 28 W	Flexural Design		
8	14	Mar 5 M	Midterm		
	15	Mar 7 W	Project Management: Ken Ishmael, HNTB		
9	16	Mar 19 M	Flexural Design		4.4
	17	Mar 21 W	Shear and Torsional Strength	N. Ch. 5	5.3, 5.4, 5.5
10	18	Mar 26 M	Shear and Torsional Strength	N. Ch. 5	
	19	Mar 28 W	Gene Figg, P.E. Alfred H. Samborn Distinguished Lecture on bridge art		
11	20	Apr 2 M	Continuous Beams	N. Ch. 6.1-6.10	
	21	Apr 4 W	Continuous Beams	N. Ch. 6.1-6.10	6.3, U6.4, G6.5
12	22	Apr 9 M	Camber, Deflection, and Crack Control	N. Ch. 7	
	23	Apr 11 W	Ted Zoli, HNTB, cable stay bridge design.		
13	24	Apr 16 M	Camber, Deflection, and Crack Control	N. Ch. 7	7.1, 7.2
	25	Apr 18 W	Camber, Deflection, and Crack Control	N. Ch. 7	

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14	26	Apr 23 M	Connections	N. Ch. 10	
	27	Apr 25 W	Denney Pate, Figg Bridge Engineers. Cable-Stayed bridge construction.		
15	28	Apr 30 M	Connections	N. Ch.10	10.1
	29	May 2 W	Doug Nims Closure, Project Due		

Final: 5-7 PM May 7