THE PENNSYLVANIA STATE UNIVERSITY
Department of Civil and Environmental Engineering
CE 421W: Transportation Design

Spring 2011 Course Information

Educational Objectives:

1. To prepare for a professional career in transportation engineering by demonstrating knowledge of transportation design concepts and decision processes based on a series of homework assignments and exams.
2. To develop an understanding of procurement principles pertinent to the design and construction of a highway engineering project through completion of a semester-long project.
3. To develop effective written communication skills by preparing several technical memoranda describing accomplishments and future plans for the semester-long design project. Preparation of the final project report will also enhance written communication skills.
4. To gain experience in making professional presentations by presenting the findings of the semester-long design project to your instructors and peers.
5. To foster teamwork by working in teams of four when working on the semester-long design project.
6. To develop skills to be able assess alternative highway designs using both safety, mobility, and economic evaluation methods.

Instructor Information:

Instructor/TA	**Dr. Eric T. Donnell, P.E.** **Associate Professor**	**Jonathan Crisafi**
Office	231N Sackett Building	228 Sackett Building
Phone	863-7053	N/A
E-mail	edonnell@engr.psu.edu	jcc5054@psu.edu
Office Hours	M 1:00 to 3:00 PM Th 3:00 to 4:30	Announced weekly in lab

Lecture Hours:

MW	10:10 a.m. - 11:00 a.m.	Sec 1 & 2	173 Willard Building

Lab Lectures:

F	12:20 p.m. - 2:15 p.m.	Sec 1	228 Sackett Building
	2:30 p.m. - 4:25 p.m.	Sec 2	228 Sackett Building

Required Text:

A Policy on Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials, Washington, DC, 2004. (Referred to as *Green Book*)

Principal References:

Highway Capacity Manual, Transportation Research Board, Washington, DC, 2000.

Highway Safety Manual. American Association of State Highway and Transportation Officials, Washington, DC, 2010.

Mannering, F. L., S. S. Washburn, and W. P. Kilareski. *Principles of Highway Engineering and Traffic Analysis,* 4th edition, John Wiley & Sons, Inc., Hoboken, NJ, 2009.

Design Manual Part 1: Transportation Program Development and Project Delivery Process. Pennsylvania Department of Transportation, Publication 10, Harrisburg, PA, September 2010.

Design Manual Part 2: Highway Design. Pennsylvania Department of Transportation, Publication 13M, Harrisburg, PA, August 2009.

Class Overview:

Student evaluation is based upon periodic individual assignments, a mid-term exam, a final exam, and a series of team-based exercises. All individual homework assignments and team-based exercises will be provided by the course instructor or teaching assistant during lecture or laboratory periods. Students will be given adequate time to complete the assignments. The purpose of the individual homework assignments will be to reinforce concepts presented during both lecture and laboratory periods. Individual homework assignments will be both conceptual and computational.

A mid-term will be given and will be focused on engineering computations covered in the first-half of the semester. The mid-term exam will be open-book and open-notes. The final exam will be a combination of engineering computations and conceptual problems. There will be both an open-book portion (engineering computations) and a closed-book portion (conceptual problems) for the final exam. The course instructor will announce the topics to be covered on each exam during regular lecture periods.

All team exercises in the course will be related to the semester-long capstone design project. Students will work in teams of four throughout the semester to complete an alternatives analysis of a local highway engineering project. Two technical memoranda, including a team progress report presentation, will be completed during the semester. Required deliverables for each technical memorandum will be provided by the instructor or teaching assistant during regular lecture or laboratory periods. A final written report, with construction drawings, will be prepared and presented to the instructors and the class during the last week of classes. The final report is intended to demonstrate the safety and operational performance of an existing roadway; describe several alternative designs intended to improve the safety and operational performance within the study area; and, present a series of performance-based analyses to recommend a preferred alternative among those presented. The report will be accompanied by supporting engineering calculations, conceptual plan/profile sheets for the alternatives studied, detailed plan/profile sheets for the preferred alignment, and cross-sections of the preferred alignment. Students will be expected to use both manual and computer-based methods to complete the semester design project. All plan/profile sheets and cross-section details must be completed in Autodesk Civil 3D.

Grading:

Mid-term Examination		= 15%
Homework Assignments	(4 @ 5%)	= 20%
Progress Reports/Technical Memoranda	(2 @ 10%)	= 20%
Final Oral Presentation		= 5%*
Semester Design Project		= 25%*
Final Examination		= 15%
TOTAL		100%

* Each student's grade will reflect their contribution to the project as determined by the instructors and peer evaluations.

Homework Policy:

All work products will be graded and are due on or before the due date and time announced by the course Instructor. Late work products will not be accepted unless pre-approved by the course Instructor. For more details on homework assignment policy, please refer to supplemental handout.

Preparation:

Students are responsible for all readings and assignments prior to scheduled class meetings. Reading assignments are designated (by chapter) in the course outline sheet below. Lecture notes will be posted on the ANGEL website.

Class attendance is not mandatory, but is highly recommended. Active student participation during lecture and laboratory periods is encouraged. The course and laboratory instructors will use ANGEL to post lecture and laboratory materials, and homework solutions. Please visit the course website frequently during the semester.

Preliminary Schedule:

CLASS #	DATE	LECTURE OR LAB TOPIC
1	1/10	Introduction to Course and Course Content
2	1/12	Project Development Process
3 Lab	1/14	Introduction to CAD Lab Autodesk Civil 3D Review Topographic Maps and Route Selection
4	1/17	No class – Martin Luther King Day
5	1/19	Introduction to Green Book and Functional Classification
6 Lab	1/21	Horizontal and vertical curve review **Assignment #1: Horizontal and Vertical Curve Design** **Design Project Review**
7	1/24	Design Project Deliverables Discussion
8	1/26	Safety Evaluation Methods
9 Lab	1/28	Safety Evaluation Examples

CLASS #	DATE	LECTURE OR LAB TOPIC
10	1/31	Design Controls and Criteria
11	2/2	Elements of Design – Sight Distance (SSD, PSD, DSD)
12 Lab	2/4	Design Consistency/Speed Evaluation Methods **Assignment #2: Safety and Mobility Analysis**
13	2/7	Elements of Design – Sight Distance and Horizontal Alignment (Minimum Radius)
14	2/9	Elements of Design – Horizontal Alignment (Superelevation)
15 Lab	2/11	Superelevation Transition Profile Examples
16	2/14	Horizontal Alignment (Sight Distance) and Vertical Alignment (Grades)
17	2/16	Elements of Design – Vertical Alignment (Length of Vertical Curve and Sight Distance)
18 Lab	2/18	**Progress Report #1 (Assessment of Existing Conditions)**
19	2/21	Alignment Coordination
20	2/23	Truck Climbing Lanes
21 Lab	2/25	Truck Climbing Lane Example and Progress Report Feedback **Assignment #3: Superelevation Transition Profiles and Alignment Coordination**
22	2/28	Cross-section Elements (Roadway)
23	3/2	Cross Section Elements (Roadside)
24 Lab	3/4	Flexible and Rigid Pavement Design Review
--	3/7 – 3/11	*NO CLASS – SPRING BREAK*
25	3/14	Life-cycle Cost Analysis and Pavement Type Selection
26	3/16	At-grade Intersection Design
27 Lab	3/18	**MIDTERM EXAM**
28	3/21	At-grade Intersection Design
29	3/23	Intersection Channelization
30 Lab	3/25	Highway Capacity Software Review
31	3/28	Grade Separations and Interchanges
32	3/30	Grade Separations and Interchanges
33 Lab	4/1	**Progress Report #2 (Alternatives Analysis with Safety/Operations Assessment)**
34	4/4	Construction Cost Estimation
35	4/6	Benefit-cost Analysis
36 Lab	4/8	Benefit-cost Analysis Examples **Assignment #4: Benefit-cost Analysis**
37	4/11	Procurement and Plans as Contract Documents
38	4/13	Drainage Design
39 Lab	4/15	Drainage Design Examples
40	4/18	Social/Economic/Environmental Impacts

CLASS #	DATE	LECTURE OR LAB TOPIC
41	4/20	Tort Liability and Risk Management
42 Lab	4/22	Design Project Work Session
43-45	4/25-4/29	Final Class Presentations **Design Project Due on Friday, April 29th by 5:00 PM**
FINAL	5/2-5/6	**FINAL EXAM**

Schedule Notes:

The University drop/add period ends January 19th.

The late drop period ends April 8th.

Final Exam Conflict Exam filing period is February 14th – March 6th

University Academic Integrity Policy:

"Academic integrity is the pursuit of scholarly activity in an open, honest and responsible manner. Academic integrity is a basic guiding principle for all academic activity at The Pennsylvania State University, and all members of the University community are expected to act in accordance with this principle. Consistent with this expectation, the University's Code of Conduct states that all students should act with personal integrity, respect other students' dignity, rights and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts.

Academic integrity includes a commitment not to engage in or tolerate acts of falsification, misrepresentation or deception. Such acts of dishonesty violate the fundamental ethical principles of the University community and compromise the worth of work completed by others.**"**

—From Penn State's *University Faculty Senate Policy 49-20*