

CE 5318: Bridge Engineering

Department of Civil Engineering

General Information

- Instructor: Jeff Weidner, Ph.D.
Office: A-222
Lab: E-214
Office Phone: (915)-747-6913
Email: jweidner@utep.edu
Office Hours: By appointment – Schedule at weidner.acuityscheduling.com
- Meeting Time and Location: Monday/Wednesday: Classroom Building 323 - 4:30PM to 5:50PM
- Final Exam: TBD
- Course Description: From the university course catalog:
General considerations for design and load capacity evaluation of highway bridges. Introduction to load and resistance factor design (LRFD) philosophy. Bridge loads. Influence lines. Grillage analysis of bridges. Reinforced and prestressed concrete bridges. Composite steel bridges. Bridge substructures. Load rating. Introduction to seismic analysis and design.
- My description:
A broad approach to bridge engineering encompassing the full lifecycle of a structure. This course will cover the analysis, design, evaluation, management, maintenance, and preservation of bridges. The focus of the course will be standard multi-girder bridges (steel and concrete) but other bridge types will be discussed. Hand analysis approaches as well as software analysis will be covered. The primary reference will be the American Association of State Highway and Transportation Officials (AASHTO) LRFD Bridge Design Specification, 2010 (5th Edition).
- Class Approach: Course Blocks: The course will be split into five blocks of roughly 3 weeks each. In each five-week block, you will have at most one block project and one homework due. In total, there are five block projects and four homework assignments planned.
- Communication: I will utilize Blackboard as a file repository for the class. I will also post grades on Blackboard.

Lectures: I plan to give lectures in several formats including traditional PowerPoint presentations, chalkboard lectures, iPad lectures, and interactive discussions. I will make lecture resources available via Blackboard as I see fit. Much of the course material was developed by Matthew Yarnold, Ph.D. P.E., a professor at Texas A&M and is being adapted with his permission.

Periodically I will seek your opinion on the class and my approach through anonymous surveys. I encourage you to be open and honest in the surveys.

Textbook: R.M. Barker and J.A. Puckett, Design of Highway Bridges (3rd Edition)
Note that this book is available electronically through the UTEP Library system (<http://0-ebookcentral.proquest.com.lib.utep.edu/lib/utep/detail.action?docID=861697>)

Course Objectives: By the end of this course you should:

1. Understand the lifecycle of a bridge and the role of engineers in the analysis, design, evaluation, management, maintenance, and preservation of bridges
2. Be proficient at identifying bridge type and components and describing bridges in technical vernacular
3. Have a strong understanding of design theory for bridges
4. Have a strong understanding of load rating approaches
5. Understand and be able to calculate demands on a bridge
6. Be able to conduct simple analyses of bridges, where appropriate, without the aid of software
7. Be able to conduct complex analyses, where appropriate, with the aid of software.
8. Be able to design Steel and Concrete Superstructure Elements
9. Be able to navigate the AASHTO LRFD Bridge Design Specification
10. Be aware of issues with curved bridges, skewed bridges, fatigue and fracture, fit up, temperature loading, and other higher-level considerations.
11. Understand the process of bridge management, including inspection and evaluation, rating and posting, maintenance practice and challenges, bridge preservation, and challenges with replacement
12. Be capable of developing a finite element model of a bridge.

Class Policies

Honor Code:	Students are expected to adhere to the Honor Code of the Department of Civil Engineering, which can be found here (http://ce.utep.edu/honorcode.htm). Instances of suspected cheating or other violations of the Honor Code will be handled according to the procedures in the UTEP Handbook of Procedures.
Attendance Policy:	I do not take attendance during class. Your work is your responsibility, and you make the decision to show up in person or not. See the class approach for information about online resources. Student athletes should speak with me at the start of the term to work out a plan for expected absences.
Neatness Policy:	Part of being an engineer is executing tasks in a neat, understandable and repeatable manner. This is a critical aspect of engineering education that is often overlooked. I accept both handwritten and digital homework. Handwritten homework can be completed using pen and paper, or on an iPad. Handwritten homework can be submitted electronically. Digital homework applies to solutions which make use of Microsoft Excel, MathCAD or MatLab. All homework will be submitted electronically through Blackboard.

For handwritten homework:

- Complete homework assignments on engineering paper (available in the bookstore or on Amazon). **Loose-leaf paper is not permitted.** Any work submitted on paper that is not engineering paper will be deducted 25%.
- Use sharp pencils and a straight-edge for your work. Write precisely and neatly.
- Include your name on every page of your homework.
- Number, title and date the pages of your homework.
- Clearly sketch out any diagrams with labels as required.
- Box answers so they can be readily identified.
- List any external references used in the homework (i.e., textbook tables)

For digital homework:

- Include your name on every page of your homework.
- Number, title and date the pages of your homework.
- Clearly sketch out any diagrams with labels as required using an appropriate software tool.
- Box, underline or highlight answers so they can be readily identified.
- List any external references used in the homework (i.e., textbook tables)
- Be sure to comment and explain actions and calculations that are not immediately interpretable. Do this liberally.
- For software like Microsoft Excel, be sure that each calculation is commented and explained.

All electronic submissions (Handwritten or digital) should follow these conventions:

- Preferred format is PDF, with original files for MathCAD, MatLab, Excel or any FE software attached as well.
- Filename should follow this format: LastnameFirstInitial_Assignment#

Group Work Policy: Working in groups is encouraged for homework assignments, but everyone must submit their own work. Blatant copying is not permitted and both the copier and the person who provided their work to be copied will lose credit for the assignment.

Coursework and Grading Expectations

Grading: Grade Breakdown:

Exams:	10% for Mid-term 1 10% for Final Exam
Project 1:	10%
Project 2:	10%
Project 3:	10%
Project 4:	20%
Project 5:	20%
Homework:	10%

Final Grade Thresholds:
 A \geq 89.5
 89.5 > B \geq 79.5
 79.5 > C \geq 69.5
 69.5 > D \geq 59.5
 59.5 > F

Exams: Exams will be in-class and closed book. Makeup exams are only provided after **advance** discussion with me. If you miss an exam due to unexpected circumstances (e.g., car crash, family emergency, etc), notify me immediately and we will discuss options. Extended exams (longer than the allotted class period) are only provided through the Center for Accommodations and Support Services (<https://www.utep.edu/student-affairs/cass>). This includes exceptions that result from acute events that occur throughout the term.

Homework: The homework assignments will be conceptual and comprehensive problems that you will solve completely and I will grade. These will be challenging and time-consuming. Your work must adhere to the neatness policy provided above. Work must be done on an individual basis, within the confines of the group work policy.

Block Project #1: Due Date: End of Block #1 – February 7, 2018

Article
Review

Project Description: Review an article describing a bridge construction, rehabilitation, retrofit or replacement project and extract from the article the primary design challenges and how they were addressed. From that, you are to develop a short document providing a review of the article with discussion on the design challenges and how they were addressed. You are only required to use the one source provided, but you are free to do additional research if desired. You will be graded on your ability to construct a cohesive picture of the project and the design challenges.

Submission: You will submit a short (less than 5 pages) document in PDF format electronically.

Block
Project #2:
Essay

Due Date: End of Block #2 – February 28, 2018

Project Description: For this project, you are simply to answer the following question as best you can: What would happen if Congress passed a law making it illegal to use federal funds to build new bridges? This is a thought exercise and there is no “correct” answer. I am interested in seeing your approach to answering this question, the ideas you come up with, and your ability to frame an argument. You can focus solely on the impacts to bridges, to transportation in general, or even go as far as health impacts and outcomes. Be sure to cite any sources you use. You will be graded on how you present your opinions.

Submission: You will submit a short (less than 5 pages) document in PDF format electronically.

Block
Project #3:
National
Bridge
Inventory
Data
Analysis

Due Date: End of Block #3 – March 22, 2018

Project Description: Using the publically available National Bridge Inventory data housed on the Federal Highway Administration website, you will tell an interesting story. You can look at the national level or at one or more specific states. You can focus on all bridges, or a single type of bridge. You could focus on a particular time period. Here are a few example questions:

- Across the entire country, how many movable bridges are there, where are they located, and how are they performing?
- What type of bridge is more popular: concrete or steel?
- When considering bridges that are structurally deficient, which states are the best and which are the worst, and what is the best way to show this?
- Focusing on interstates only, what is the condition of our bridges?
- Is there any correlation between clearance height and superstructure condition?

You are encouraged to develop your own questions or modify the ones above. You will be graded on your arguments for the selected questions, your presentation, and your data visualization.

Submission: You will submit a short (less than 5 pages) document in PDF form electronically. This document will present the answer to the question you selected, including arguments for why, and data visualizations that summarize the NBI Analysis.

Block
Project #4:
Bridge
Design

Due Date: End of Block #4 – April 11, 2018

Project Description: In teams of two, design a *safe and efficient* prestressed concrete girder alternative and a steel rolled beam alternative for a simple span bridge. The design requirements will be provided separately. Each member of the team is responsible for one design alternative. Additionally, each member of the team is responsible for checking the design calculations of the other team member. The marked-up calculations must be kept and included in the report appendices. Both team members are responsible for all design calculations and the report.

Submission: Each team of two will submit one report. The report will include cover page, a write-up explaining the design process, the final design results, and appendices with marked-up and final calculations for both alternatives. These calculations must be well organized with clear indicators of what the calculations is doing, who was the designer, and who was checking.

Block
Project #5:
In-class
Debates

Due Date: End of Block #5 – April 30, 2018 to May 2, 2018

Project Description: In two teams of two, you will debate a bridge related motion in front of the class. Prior to the start of the debate, the class will vote on what side of the motion they believe. After the debate they will vote again, and the side with the largest positive change wins. You will create an opening statement, then address questions from the audience, then a closing statement. One team member is responsible for delivering the opening statement, and one must deliver the closing statement. You're permitted three minutes on each statement. You may use simple visual aids or Powerpoints. Either teammate may address the questions. Personal insults are not permitted. You will be graded on your arguments, your presentation, and your ability to think on your feet. Example motions include:

- Bridge expansion joints are the most important part of the bridge
- Every bridge deck should have an overlay – no exceptions.
- All bridges should be historically preserved as they age.
- Stop using Steel! Concrete multigirder bridges are the way to go.
- Visual inspection every two years is the best solution to managing our bridges

Submission: You will submit written statements to Dr. Weidner by April 29, 2018 at 5pm. You and your opponents will debate in front of the class on April 30, 2018 or May 2, 2018.