INTRODUCTION TO CIVIL ENGINEERING
CIVE 105
BACKGROUND AND HISTORY OF THE PROFESSION

Notice the first paragraph in chapter 1 of the text:

“The big idea”

“Entrusted by society to create a sustainable world and enhance the global quality of life, civil engineers serve, competently, collaboratively, and ethically as: master planners, designers, constructors; stewards of the natural environment and its resources; innovators and integrators; managers of risk and uncertainty; and leaders in discussions and decisions shaping public environmental and infrastructure policy.”

Notice the stipulated ABET outcomes on page 4 of the text:

1. An ability to apply knowledge of mathematics, science, and engineering
2. An ability to design and conduct experiments, as well as analyze and interpret data
3. An ability to design a system, component, or process to meet desired needs
4. An ability to function on multidisciplinary teams
5. An ability to identify, formulate, and solve engineering problems
6. An understanding of professional and ethical responsibilities
7. An ability to communicate effectively
8. The broad education necessary to understand the impact of engineering solutions in a global and societal context
9. A recognition of the need for, and an ability to engage in, lifelong learning
10. A knowledge of contemporary issues
11. An ability to understand techniques, skills, and modern engineering tools necessary for engineering practice

Four additional outcomes have been added as part of the ASCE body of knowledge 2 (page 6):

12. An ability to apply knowledge in a specialized area related to civil engineering
13. An understanding of the elements of project management, construction, and asset management
14. An understanding of business and public policy and administration fundamentals
15. An understanding of the role of the leader and leadership principles and attitudes

Notice that the text is published by the ASCE press. What is “ASCE”? Why is it important and significant that the book was published by the ASCE press?

On page 8 there is a box that describes the role of engineers in society and how that role is changing. What do you think about those ideas and concepts?
“By 2020, we aspire to a public that will understand and appreciate the profound impact of the influences of the engineering profession on sociocultural systems, the full spectrum of career opportunities accessible through an engineering education, and the value of an engineering education to engineers working successfully in non-engineering jobs.

We aspire to a public that will recognize the union of professionalism, technical knowledge, social and historical awareness, and traditions that serve to make engineers competent to address the world’s complex and changing challenges.

We aspire to engineers who will remain well grounded in the basics of mathematics and science, and who will expand their vision of design through solid grounding in the humanities, social sciences, and economics. Emphasis on the creative process will allow more effective leadership in the development and application of the next-generation technologies to problems of the future.”

Notice on page 9 a table that describes the learning outcomes expected from a program in civil engineering. These outcomes are from abet, which is the accrediting agency for our program, and the American Society of Civil Engineers, which is the premier professional organization of our profession. These are what the people who practice civil engineering and the people who practice the teaching of civil engineering think students should learn in college. Read through that table; it is a very interesting compendium of what you are each going to be taught during the next four years.

Turn now to the background and history of our profession. This appears in chapter 2 of the text.

Notice that until modern times there was no real distinction made between architects and engineers. A person skilled in one area was expected to be an expert in the other, as well. It was not until the end of the 18th and early 19th centuries when military engineers began to do civil projects that the concept of a separate field of civil engineering was born.

Notice on page 143 of the recommended text by Petroski there is a statement suggesting that the ideas and lessons learned from the successes and failures of even the ancient engineers are very helpful in developing the designs for today and the future. Materials and physics have worked the same way since the earth was created and they will continue to work the same way until the world ends. Therefore, by examining the projects of the past, we can be better informed about how to design and build the projects of the future. (Which is why, by the way, that recommended text was assigned – do read through it; you will find it interesting and fascinating)

Recall the seven wonders of the ancient world.

Note that only the great pyramid still survives in recognizable form today

The materials available in Mesopotamia were not suitable for sustainable construction. The interiors were lined with sun-dried bricks which deteriorate rapidly in wet or damp conditions. When the interiors failed, so did the kiln-dried exteriors of the structures.
When the ancients built things that were intended to survive great loads, however, such as bridges, they used excellent structural concepts, like arches and hard stone work and paving blocks that often do survive to this day. They built great foundations that have not shifted or moved and that continue to sustain the structures over the years.

We can learn from those exercises – from the things that survive and from those that did not – and need to do so.

Read through the rest of chapter 2 for some interesting history of the Persian engineers, Greek engineers, roman engineers, and others. Note the discussion on page 33 and 34 of what happened with an early water tunnel project in Algeria in 152 ad. The tunnel was started from both ends, but never met in the middle due to blunders by the constructors. The engineer had not been on site during construction and had not verified daily that the work was progressing properly.

There is a discussion on page 41 of the text regarding the construction of Machu Picchu in Peru. That was a major challenge because of the steepness of the slopes, the altitude of the site, the very thin top soil and serious groundwater and runoff issues. The solutions use by the ancient Incans to solve these issues were extraordinary and very much worth reviewing.

There are two key components to this course that drive directly toward achievement of the learning objectives of the course and the learning outcomes we discussed earlier today for the entire program.

The first is the need to learn how to write. Professionally.

This is very different from the writing you will be doing in English class, but the concepts of good writing are the same. There are two key rules and lots of format issues to contend with.

The first rule is that any professional paper must be clearly and neatly organized. The second is that any claim made must be carefully and fully justified in such a way that even if the reader does not agree with you, he or she will at least fully understand your position and know why you hold that view.

These two rules hold equally true for personal opinions as well as for carefully researched data. Those who cannot express themselves well will not be successful in engineering – regardless of how competent they might otherwise be as engineers and designers.

When we prepare papers in this class we are going to follow most of the same rules you will see in English class – with some notable changes and adjustments, as follows:

1. Use cover sheets and a table of contents (even for a 2 page paper) in accordance with the outline in the writing guide I emailed to you

2. We will always, always, always write in the third person. That means we will never, ever, use words like “us”, “we”, “you”, “our”, “your” “I”, “me” etc. Or any pronoun that refers to any of those types of words, such as using the word “one” to refer to a person. We also
will not use titles, such a “the engineer” or the “constructor” or other such words to refer to a person. Instead, we will write the sentence to avoid the need for such a construct. For example, instead of writing “the engineer built the bridge of stone.” We would write “the bridge was built of stone.” It does not matter who actually did it. In fact, in this case, it was more likely a small army of stone masons who actually built the bridge, not the engineer.

3. We do not use apostrophes for any reason in professional writing. Contractions are generally not acceptable anyway and most of the time that apostrophes are used they are used incorrectly. Therefore, to avoid an incorrect use, we will not use them at all.

That means, of course, that we also have to write the sentences so that they are not needed. For example, instead of writing “engineering in today’s world is better than in the past.” We would write “engineering is better in the world today than it was in the past.” This eliminates the need for the possessive and therefore the need for an apostrophe.

Note, too, that there is no word in the English language that uses an apostrophe to form the plural. This is true for words and for numbers. For example, when discussing things that happened between 1960 and 1970 we could say that those things happened in the 1960s, but we could not say they happened in the 1960’s. This use of an apostrophe is incorrect. See the writing guide for other examples.

4. Remember that you are writing a professional document to a professional audience. IM, texting, and tweet language is not acceptable in professional writing. Slang is also not acceptable, but proper punctuation is not only acceptable, but required.

5. See the writing guide for further requirements

In addition, when we write professionally, we need to organize properly. I generally expect a paper to follow the following outline as closely as is reasonably possible. There will be documents and circumstances where following this guide too closely will lead to a strange look to the report, so outside of this class it may make sense to follow a slightly modified version. In this class, however, I expect to see this outline in everything you write, regardless of how it feels to you.

Put the title of the paper centered at the top of the first page of text. This does not go in a “header”, but rather at the top of the page below the header.

Then there needs to be an “introduction” section. This section will explain what the paper is all about, identify the issue to be resolved or the problem to be solved, and answer questions such as why is it being written and what it provides to the reader. This section is generally about ½ page or so in length, but can be longer if warranted.

The second section is the “problem statement.” Here the issue to be resolved is described in full detail, including any constraints or obstacles that will need to be overcome and any performance
criteria that need to be met. Note that if the problem is not stated clearly, it will not be possible to find a clear solution to it.

The next section, the research section, is a description of possible solutions to the problem. In our work in this class I expect at least five possible solutions to be identified here and clearly described. Be sure to describe each possible solution in the same degree of detail so that they can be fairly evaluated later. Note that there is no evaluation done in this section. It is merely to identify and describe possible solutions, without evaluation, critique, or comparison.

Section four is used to identify and define various criteria that will be used to evaluate the options. These criteria need to be universally applicable to all of the options described in the previous section and suitable for solving the problem at hand so that they can be applied to each of the options fairly.

This is perhaps the most difficult of the sections to do well, so let’s look at what we mean by equally applicable and suitable for solving the problem at hand. I expect at least five suitable criteria for each paper you write.

Section five is where the evaluation of the options occurs. In this section there is a narrative for each option that evaluates that option with respect to each of the specified criteria – no other criteria. These evaluations will need to rank each alternative with respect to each criterion so that a total numerical score can be derived for each alternative. Note that the narrative has to clearly justify each number in the numerical ranking system and that a separate paragraph or set of paragraphs is used for each alternative being evaluated.

In section 6 you will select the best option from those evaluated and recommend a course of action to the client.

In section 7 you want to design the solution as much as possible without extensive investigations. For example, if you need a tank, tell the client how big it needs to be. If you need a series of cables, tell the client how to attach the cables to poles or stanchions or in what other way the cables will be suspended. Etc. Also describe here any design or construction problems or obstacles you have identified that may need to be addressed during the final design of the solution.

In the last section, called “conclusion”, you summarize the entire report in about 1 paragraph and end the paper.