



A SunCam online continuing education course

Engineering Ethics: Professional Competency

by

David E. Fantina, PE



Engineering Ethics: Professional Competency
A SunCam online continuing education course

Introduction:

The topic of “ethics” covers an extremely broad array of human activities. Even within the somewhat limited field of professional engineering there are myriad ways that ethical decisions arise. Some of these are obvious and others are not. One subset of ethics involves whether an engineer is practicing engineering outside his or her particular field of competence. Determining whether an engineer is actually competent to perform the work in question definitely constitutes an ethical question because the engineer’s employer, his or her client and the general public are operating under the assumption that the engineer is qualified for the work that is being performed.

This course is a discussion of the question of professional competence. While the situations described in this course are hypothetical, they are representative of situations which can occur frequently in real life situations and can cause ethical dilemmas. It is important to see in these situation opportunities to act in an ethical manner and to promote one’s own integrity as well as the integrity and dignity of the profession.

This course will attempt to point out that some questions regarding professional competency are straightforward, whereas others may not be so black and white. In all cases, though, there should be a “right” answer that people can agree is the ethical choice to make (although, in some cases, it might take some discussion before everyone agrees that a particular answer is the correct one). The National Society of Professional Engineers (NJSPE) has published a code of ethics which are supposed to guide moral decisions made by engineers in their professional conduct and this code has been adopted by many state licensing boards.

At the very beginning of the code is a list of fundamental canons, which engineers are enjoined to fulfill in their professional duties, and which are repeated below:

1. Hold paramount the safety, health, and welfare of the public.
2. Perform services only in areas of their competence.
3. Issue public statements only in an objective and truthful manner.
4. Act for each employer or client as faithful agents or trustees.
5. Avoid deceptive acts.
6. Conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.

We will focus on Canon #2 in this course. This is the canon that specifically addresses an engineer’s competency. However, this theme is really implicit in all of the canons. A brief discussion of how the question of competency addresses each of the other canons is as follows;



Engineering Ethics: Professional Competency
A SunCam online continuing education course

1. Canon #1: An engineer is not holding the welfare of the public paramount if he or she is performing engineering in a field in which they are not competent. This is especially true if faulty work could endanger the lives or welfare of the public.
2. Canon #3: An engineer is not issuing public statements in an objective and truthful manner if he or she is writing reports or preparing plans in a field in which they do not have the required expertise. (The reports and/or plans, themselves, being signed and sealed by a professional engineer, will give public the clear impression that the preparer is an expert in the field).
3. Canon #4: By knowingly performing services outside the engineer's area of competency, he or she is certainly not acting as a faithful agent for the client. As stated right at the beginning of this discussion, the client, like the general public, has the right to assume that the engineer is competent in the field for which he or she has been hired.
4. Canon #5: Performing engineering work in an area where the engineer is not competent is certainly a deceptive act. Once again, there is a presumption on behalf of the general public that the engineer is acting in good faith and is not performing work outside their particular field of expertise.
5. Canon #6: By performing services outside his or her field of expertise, the engineer is not acting honorably and is, potentially, harming the honor and reputation of the profession as a whole.

In addition, Canon #2 is amplified in the Code of Ethics under the Section entitled "Rules of Practice". Number 2 of this section states the following:

Engineers shall perform services only in the areas of their competence.

- a. Engineers shall undertake assignments only when qualified by education or experience in the specific technical fields involved.
- b. Engineers shall not affix their signatures to any plans or documents dealing with subject matter in which they lack competence, nor to any plan or document not prepared under their direction and control.
- c. Engineers may accept assignments and assume responsibility for coordination of an entire project and sign and seal the engineering documents for the entire project, provided that each technical segment is signed and sealed only by the qualified engineers who prepared the segment.

Finally, Section III of the Code includes "Professional Obligations". The first three of these obligations all touch on the question of professional competency as explained below:\



Engineering Ethics: Professional Competency
A SunCam online continuing education course

1. “Engineers shall be guided in all their relations by the highest standard of honesty and integrity.” Obviously, deceiving an employer or client into believing that an engineer is competent in a field that they are actually not competent in, is dishonest.
2. “Engineers shall at all times strive to serve the public interest.” Note that the Code of Ethics repeatedly and pointedly explains that engineers have a duty not only to their employers and clients, but to the general public as well. This is another reason why it is essential that engineers only work in fields in which they are competent.
3. “Engineers shall avoid all conduct or practice that deceives the public.” This is really another way of stating the obligation specified in #2, above.

So, what exactly constitutes an engineer’s area of competence? This seems like a very easy question to answer and, in fact, in the great majority of cases it is really very obvious. However, as with any aspect of life, there are “gray” areas where it might not be so easy to decide or where two well-intentioned people might decide differently.

Now we will consider several hypothetical scenarios and see whether the engineers involved are performing services outside their field of competence. (Note that, as in a previous ethic course by this author, in these hypothetical scenarios any relationship to real people, either living or deceased, is purely coincidental. Only first names are used and these were taken from a list of “available dogs” at an animal shelter).

One final caveat before we get into the specific scenarios: After each scenario, I have indicated the “verdict” as to whether the engineer in question is acting in an ethical manner or not. However, I have deliberately tried to make some of these scenarios somewhat “gray” so that the reader is well within his or her rights to disagree with the verdict given. As was said earlier, there are situations where well-intentioned people can disagree.

Scenario #1:

Neal is a well respected professional engineer with 37 years of experience. He holds a PhD from a prestigious university in structural engineering which he obtained prior to beginning his professional career. However, due to a variety of circumstances, he has actually never practiced as a structural engineer. Instead, he has been designing water conveyance systems for a number of cities in the northeastern United States. He is a recognized expert in the field of water distribution network design and is often called in when a city needs to upgrade its water infrastructure. He has even contributed scholarly articles and lectured on the topic.



Engineering Ethics: Professional Competency
A SunCam online continuing education course

Now he is semi-retired and has decided to “go back to his roots” and try his hand at structural engineering. He has been given the opportunity to do the structural design of a proposed 12 story parking deck in a large city where he is well known for his water distribution work. Despite his PhD, Neal is somewhat hesitant to do this work because he has been out of touch with structural design for many decades and has never done this work professionally. He is also aware that there may have been significant changes in the various codes and design procedures in the intervening years. For this reason, he has hired a young Engineer-in-Training, Shanda, to help with the design. Shanda has 18 months experience working in a structural engineering firm and is looking forward to soon taking her PE exam. Neal is planning to rely on Shanda’s recent experience to help make up for his own lack of it. Is Neal competent to take on this work?

Verdict: There may be more than one way to consider this, but it seems clear that Neal is not acting in an ethical manner. He has absolutely no experience in the field and to rely on an unlicensed engineer to provide the expertise is both unfair and unethical. The fact that he has a PhD in the field really does not make him competent. It could be argued, on Neals’ behalf, that he does hold a PhD in structural engineering and is, therefore, definitely qualified for this work. However, his degree was obtained too long ago and has not been backed up with any practical experience. His own hesitancy, which has caused him to hire Shanda, backs up the idea that even he does not feel quite right about this decision.

Scenario #2:

Penny is a well established professional engineer who has spent nearly 20 years designing stormwater management systems for a variety of projects in Florida. These have ranged from the design of simple small drywells for single family dwellings up to and including region-wide, multi-phase flood control systems. Now she has been contacted by the Arctic Development Company that needs to provide stormwater management for a proposed 150 acre residential/commercial facility they are planning in central Alaska. Penny has never worked outside the state of Florida and is excited to take on this project. Is Penny competent to do this work?

Verdict:

In this case it is clear that Penny is competent to do the work. She is not performing work in an area that is outside her field of expertise. Penny has ample experience in stormwater management and the fact that she will be working in a different geographic area does not affect her competence in any way. In order to do the work properly it goes without saying that she will



Engineering Ethics: Professional Competency
A SunCam online continuing education course

need to spend some time reviewing the differences between her current work in Florida and what might be awaiting her in Alaska including researching the following:

1. The differences in storm distributions and intensities between the two regions.
2. The differences in ground water recharge and initial abstraction due to vegetation between the semi-tropical and nearly polar states.
3. The specific governmental entities that will be reviewing her work and the specific requirements of each of these.

However, she clearly has both the educational and experience background to perform this work.

Scenario #3:

Hutch is a professional engineer practicing structural engineering in Maine. Earlier in life, he lived in Mexico City and experienced two major earthquakes while he was there. However, he does not have any experience working with seismic design. Hutch has now moved to California and has taken a job with the ABC structural engineering firm in San Diego. His first assignment in his new position is to oversee the structural design of a new harbor to be built in San Diego Bay. Is he qualified to take on this assignment?

Verdict:

The answer here is a clear “no”. Hutch has no experience with seismic design and California is known to be prone to seismic events. The fact the Hutch has personal experience with earthquakes is meaningless. Millions of people around the world have experienced earthquakes in their lifetimes, but this does not make them experts in earthquake-proof design. He is simply not competent to do this work unless he takes some courses and/or spends some time working under professional engineers who understand seismic design. Quoting from the Rules of Practice cited above, Hutch is simply not “...qualified by education or experience in the specific technical fields involved.”

Scenario #4

Molly is a licensed traffic engineer that works for a New Jersey firm that also has an environmental wing. She has never been involved in this part of the business but has been asked by her supervisor to perform soil testing for a septic system the firm will design and also to sign and seal the soil reports. (Ordinarily, the firm sends one of its qualified technicians to do the work, but the particular township where the property is located requires that a licensed engineer be on site and provide a signed, sealed report of the soils data). The actual septic system design will be done by other professional engineers in the firm. She was hesitant to do this but she has been fully briefed on the procedure by Thor, a professional engineer who heads up the environmental side of the business and has spent many years overseeing soil permeability



Engineering Ethics: Professional Competency
A SunCam online continuing education course

testing. Among other things Thor has reviewed with Molly several photographs of soil test holes (like the one pictured below) and explained the details of the different soil layers, mottling characteristics, and similar criteria.



She has also spent time consulting published sources (including taking and passing SunCam Course #223 entitled “Soil Permeability Testing”). Is she qualified to take on this assignment?

Verdict:

There is some gray area here but it seems that Molly is indeed qualified for this work. It could be argued that she does not have the educational or experience background for this assignment. However, she has had some training from Thor, who is experienced in soil testing. Then, too, she has done some research on her own. Also, she is not being asked to do the actual septic design – that will be accomplished by other competent engineers in the firm. Finally, this is work that is ordinarily done by non-licensed personnel in the firm. Molly should be adequately prepared to perform this task.

Scenario #5:

Kyle is a licensed professional engineer and land surveyor who owns a small consulting firm that provides a variety of land-use services including boundary surveys, site plans, subdivisions, plot plans, and related items. He has been asked by Jared, the owner of a large construction company to provide engineering oversight on a gas pipeline that is being installed adjacent to Interstate

Engineering Ethics: Professional Competency
A SunCam online continuing education course

Route 64 in northern Kentucky. Kyle has absolutely no experience in this field but Jared has explained to him that the process will be as follows:

1. After each length of the gas pipeline is installed they will fill it with water and bring it to a high pressure and let it stand for 12 hours. Readings on the pressure and temperature will be taken every half hour. (This procedure is required by the governmental review agency having jurisdiction over the pipe line installation). Jared has also informed Kyle that the work is potentially dangerous because, if the high-pressure pipe were to explode the results would be disastrous.
2. The construction company will have a foreman and crew on site the entire time who will run the actual test. However, Kyle will be on site as well to observe everything, ask questions, take the readings, etc. He will also be present on site when the pipeline is being brought to pressure with the water.
3. The construction company has a standard Pressure Test Validation Program, which is acceptable to the government, and which will be available to Kyle to use on his laptop in the field. This program takes the pressure and temperature readings and determines if there is any leakage in the pipeline. Therefore, Kyle will be able to interpret the data in real time with the help of this program.
4. The governmental agency having jurisdiction over this project is requiring that an engineer sign and seal the testing reports. This will be Kyle's responsibility.

A photograph of some of the equipment that Jared's company will use to accomplish the pressure testing is shown below:





Engineering Ethics: Professional Competency
A SunCam online continuing education course

Because Kyle does not have any experience in this type of work, his first inclination was to decline it on the grounds that it is not within his field of competence. However, after reviewing the procedures that are outlined above, he is confident that he can perform this work in a competent, professional manner so he has taken the job.

Is he qualified for this task?

Verdict:

This one seems to be a little bit questionable. Kyle certainly has no experience in this field but the procedure has been clearly spelled out and it seems quite straight-forward to follow it. In some respects, Kyle's situation is not unlike Molly's which is described in Scenario #4, above. In both cases, it is may be a step out of their comfort zone but it seems that they are qualified to do the work. Just because an engineer has not previously performed a task does not necessarily mean that he or she can never do it. The foreman and his staff will be on-site to do the actual testing and the software program Kyle will be using has already been approved by the government for this application. Therefore, the verdict is that Kyle is competent to perform the work.

Scenario #6:

Dixie is a structural engineer practicing in New York City. She has taken on a contract for a large structural project in Pennsylvania. However, she is not licensed in that state. Therefore, she has asked her friend, Barney, a Pennsylvania licensed engineer to sign and seal the drawings and accompanying structural calculations. Barney is an electrical engineer with no experience in structural engineering. However, he knows Dixie's quite well, having worked with her in the past, and knows that she is a competent, honest, well respected structural engineer. Therefore, he has no qualms about signing and sealing the documents. He sees it as an easy way to earn a few extra dollars as he does not even have to check the plans or specifications.

Is Barney competent to sign these documents?

Verdict:

This one is a very easy answer: No, Barney is not qualified and should definitely not put his signature and seal on the plans that were prepared by Dixie. It might be a slightly different matter if Dixie was going to involve him in the design/analysis process and give him the tools to review her documents. However, the way it stands, signing these documents is definitely an unethical thing for Barney to do. (By extension, it is also unethical on Dixie's part to ask Barney to sign her plans and calculations under these circumstances). Barney's situation is very similar to Hutch's, which is described in Scenario #3, above. Quoting from the Rules of Practice once again, Hutch is not "...qualified by education or experience in the specific technical fields



Engineering Ethics: Professional Competency
A SunCam online continuing education course

involved.” Also quoting from the Rules of Practice “...Engineers shall not affix their signatures to any plans or documents dealing with subject matter in which they lack competence, nor to any plan or document not prepared under their direction and control.” He is clearly violating both of these provisions. The fact that he does not seem even interested in involving himself in the process only makes his decision more egregious.

Conclusion:

This brief summary has attempted to show that it is imperative that an engineer only works in the areas of his or her competence. Once again it should be stated: the engineer’s client and the public at large both have the right to rely on the engineer to perform work at the highest level of professional competency and this can only be done if the engineer is actually qualified to do the work. At the same time, this course has attempted to point out that exactly what an engineer’s “area of competence” is may be subject to some interpretation. As can be seen in these scenarios there are cases where honest people can disagree as to whether an engineer is competent for a particular task. In all cases, it is up to the engineer to determine for himself or herself whether the actions taken are ethical or whether they are simply self-serving. A few good questions to ask oneself is: If someone were to question my results, do I have the confidence to answer them using sound engineering principles in this field? Is my confidence based on my own engineering knowledge of the principles involved? If the answer to both of these questions is an unqualified “yes”, it is likely that the engineer is, indeed, competent for the work.

Final Thoughts:

As was stated previously, it is generally obvious whether or not an engineer is working within his or her field of competency. However, there are always those gray areas that are not quite so clear. In these cases, the engineer must look to his or her conscience to see if they are acting ethically. Section III1. of the NSPE code can be a help in this regard. It states that: “Engineers shall be guided in all their relations by the highest standards of honesty and integrity”.

This is the yardstick by which each member of the profession must measure himself or herself. When looking oneself in the mirror an engineer must ask:

1. Am I really competent to do this work?
2. Do I understand the underlying assumptions and the pertinent equations?
3. If challenged can I back up my conclusions with good scientific data and well-reasoned conclusion?
4. Have I avoided taking on a project for financial gain when I know that it is really outside my training and experience?



Engineering Ethics: Professional Competency
A SunCam online continuing education course

If the engineer can answer all of these questions with a “yes” then he or she can confidently take on the job and look whoever question them in the face. The engineer will then be a credit to themselves and to the profession.

Remember that the bottom line regarding ethics is spelled out very clearly in the Code of Ethics as follows:

“Engineers shall be guided in all their relations by the highest standards of honesty and integrity”. Each engineer must adhere to the standards at all times.