Ethics and Judgment Are About More Than Just Safety

by Dr. Richard Miller, University of Cincinnati

The past few issues of *ASPIRE*® contain articles addressing the collapse of the Florida International University pedestrian bridge. The articles call for engineers to exercise sound engineering judgment and to be willing to stand up to pressure so that these catastrophic incidents do not occur. Clearly, we have a responsibility to ensure the public is protected.

However, does our responsibility as engineers to "protect the public health and safety" end with protection from physical harm? Is our only duty to make sure no one gets physically hurt or dies? Actually, our duty to protect the public extends far beyond physical harm to how engineering designs and projects may affect humans in other ways.

Student learning outcome #4 of the Accreditation Board for Engineering and Technology is "an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts."[1] Thus, we are required to teach our students not just how to complete a safe engineering design, but also how to consider the overall impact of that design or project on society as a whole.

It sounds simple, but it is much more complex and difficult than it appears, especially the part about considering "global and societal contexts." Many engineers and engineering students are uncomfortable with this. Economic or environmental impacts can often be quantified, but societal impacts do not fall into the kind of neat, numerical solutions engineers prefer. Beyond that, engineers often believe that evaluation of global or societal impact is best left to others, such as people engaged in politics, social work, or similar professions. But experts in these other professions might not fully appreciate how an engineering design will impact society, nor be able to suggest solutions that would require input from engineers.

One example I use in my class involves two neighborhoods in Cincinnati, Ohio. The two neighborhoods were one until the early 1970s, when construction of an expressway divided the neighborhood into a north section and a south section. Back then, no one worried about how expressways affected neighborhoods—an expressway represented progress, which was considered a good thing. I don't think there was a lot of room for public comment, either. Since that time, the northern area has become an eclectic neighborhood favored by artists and others desiring a diverse neighborhood. It even changed its name. The southern neighborhood, which was much more industrial, has declined since the industry that supported it closed down. The two neighborhoods have gone in opposite directions. It is impossible to say what the fate of these neighborhoods would have been had the expressway not been built. Maybe both would have thrived, or both would have declined, or maybe the expressway made no difference at all.

The problem, I point out to my students, is that no one back then even bothered to consider what the expressway would do to the people in the neighborhood. Perhaps if the engineers had had a bit of foresight, features could have been included to keep the neighborhood as one. Perhaps some large, wide pedestrian bridges could have connected the two neighborhoods. Maybe the expressway could have been buried, like the "Big Dig" in Boston, Mass. These are expensive solutions, but the cost of neighborhood deterioration, loss of residents, decreased tax base, blight, and crime are often much higher costs in terms of both dollars and the impact on people.

There are also questions of fairness. All of us in Cincinnati benefit from that expressway, but only a few neighborhoods had to bear the burden of its impacts. This is not to say the expressway was not needed or is not beneficial; the point is that the engineers had an obligation to consider the impact on the people living near the expressway and to do what they could, within reason, to mitigate the negative effects.

Many people call this "social justice," which is defined as "the view that everyone deserves equal economic, political and social rights, and opportunities."[2] This is a tricky issue, as the term social justice is fraught with political nuances. However, as I point out to my students, this is not incompatible with engineering ethics. Section III.1.f of the National Society of Professional Engineers *Code of Ethics for Engineers* states, "Engineers shall treat all persons with dignity, respect, fairness, and without discrimination"[3]—almost the same definition provided for social justice, but without the political connotations.

What we are asking engineers to consider is the impact an engineering design or project will have on people. I point out to my students a parallel ethical situation: human subject research. Human subject research requires respect for persons, which involves recognition of the personal dignity and autonomy of individuals and special protection of those persons with diminished autonomy; beneficence, which entails an obligation to protect persons from harm by maximizing anticipated benefits and minimizing possible risks of harm; and justice, which requires that the benefits and burdens of research be distributed fairly.

Engineering projects affect humans, so when assessing societal impact, similar ethical principles should apply. When we design a project, are we considering the

impact it will have on the communities around it? Are we trying to maximize the benefits for all, or just some? Are we treating the opinions and needs of all people fairly as the *Code of Ethics* requires?

Students often ask how this applies to them. They see themselves as designing a bridge or a building or a pavement, and they don't see where they would be involved with these issues. I have three answers to this.

First, some of them eventually will have this power. Graduates of the University of Cincinnati have risen to be state, county, and city engineers who have the power to decide which projects go forward, how those projects are accomplished, and how public funds are allocated. They have the final approval on the plans for these projects. These engineers have the obligation to listen to the public and make decisions about these projects fairly and in accordance with the *Code of Ethics.*

Second, those who do not rise to a decision-making level still have a responsibility to consider the human impacts of designs and inform those with decision-making power what those impacts might be. If an engineer finds a design flaw that causes a safety issue, he or she is required to report it. If an engineer sees a potentially negative impact of a design on a segment of the population, he or she has the same obligation to at least bring it forward for consideration. Again, the point is not whether a project should or should not go forward; it is that we need to consider all of the impacts it may have and try to mitigate the negative ones if possible.

Finally, as engineers, we are also citizens. Section III.2.a of the *Code of Ethics* states, "Engineers are encouraged to participate in civic affairs; career guidance for youths; and work for the advancement of the safety, health, and *well-being* [emphasis added] of their community." Thus, even if we are not directly involved in projects, we have an obligation to inform our civic leaders of social impacts and call for engineering projects that equally distribute benefit and burden.

For a lot of my students, this is heavy stuff. Ethics usually is. Answers are not clear or easy. However, the true ethical issue is not whether you decide one way or the other. The issue is whether you consider the impacts on humans or not.

References

1. Accreditation Board for Engineering and Technology. "Criteria for Accrediting Engineering Programs, 2020–2021." https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2020-2021.
2. The San Diego Foundation. 2016. "What Is Social Justice?" https://www.sdfoundation.org/news-events/sdf-news/what-is-social-justice/.
3. National Society of Professional Engineers. 2019. "NSPE Code of Ethics for Engineers." https://www.nspe.org/resources/ethics/code-ethics.

Dr. Richard Miller is a professor and the department head of civil and architectural engineering and construction management at the University of Cincinnati in Cincinnati, Ohio.