

## An Open Letter to the Profession: Civil Engineering Education at a Crossroads

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I write this letter to my colleagues in academia and industry to promote a discussion concerning the direction that civil engineering education must choose for its foreseeable future. The challenge has been set for us by the ASCE Body of Knowledge and the National Academy of Engineering that a new definition of civil engineering education is required. In these documents, it is clearly stated that tomorrow's engineer will have a broader set of knowledge from which to address emerging world issues and challenges. Distinguished colleagues such as Mike Garvin of Virginia Tech and Jeff Russell of the University of Wisconsin-Madison have previously stated the need for our community to address this issue. I follow in their footsteps to renew the challenge that we urgently discuss this matter, not as an argument on the number of units required of a student, but a real discussion on the types of knowledge that a future leader in our industry requires. The challenges in the world are not disappearing, they are only getting larger and it is our responsibility to look closely at how we can prepare individuals to not only meet these challenges, but take a leadership role in directing these efforts.

The election of a candidate with visionary ideals and broad public support motivates this letter and should send a strong message to civil engineering educators. The time of a traditional curriculum with little flexibility is passing. This is the time of a changing generation, philosophical perspectives, national priorities, and student interests. These changes are challenging faculty, administrators, and students. What is the direction that is appropriate to take? There is no handbook, review course, or on-line tutorial that can provide insight to this question. Unless there are faculty members among us who possess the prescience to foresee the future, it is up to current faculty to set the new path. In this, I put forward that we remember the words of Robert Frost who said, "Two roads diverged in a wood, and I-I took the one less traveled by, And that has made all the difference." The time for leadership that is ready to take the path less traveled is now. It is time to recognize that the world's problems of today and tomorrow are broader than the disciplines of yesterday.

Civil engineering builds on a history as deep as recorded civilization. The greatest man-made wonders of the world owe a debt to the innovations inspired by civil engineers. However, just as each generation of great innovators challenged the accepted thoughts of their time, the time is at hand for the current generation to recognize the imperative of change. The facts are indisputable. Consider among others that:

- 20% of the global population lacks access to safe drinking water,
- 900 million rural dwellers in developing countries live without reliable all-season roads,
- By 2030 60% of world's population will live in cities,

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- 40% of energy is consumed by buildings, and
- Peak oil may have passed meaning we are on the down side of the supply slope.

The modern challenges of global warming, mega-cities, natural resource depletion, and crumbling infrastructure are not restricted to individual silos. Rather, the era of collaboration and integration has arrived as the future for this industry. Currently, a significant amount of discussion is emerging from political, academic, and professional circles concerning the central role that infrastructure investment will play in the next round of economic stimulus packages. Civil engineers have the opportunity to influence these policies at the highest levels and shape the next great investments in our infrastructure. The future for civil engineers is at the center of these interdisciplinary projects and organization teams.

However, the ability to understand, interact, and contribute to a broad range of professional issues is the key for success in these discussions. Are departments ready to recognize the growing need, demand, and challenge to introduce courses, tracks, and research initiatives that reflect these new priorities? Relevance to these priorities is not based in discussions of post-graduate requirements or reflections of past degree requirements. Rather, relevance to the challenges of today and tomorrow is rooted in inter-disciplinary perspectives, multi-cultural inclusion, and multi-national collaboration. Relevance is grounded in innovation, integration, and intellectual challenge. Relevance emerges as value in non-traditional knowledge is recognized. To be effective, we need civil engineers who are both technologically savvy and culturally sensitive. We should heed the words of Einstein who said, "We can't solve problems by using the same kind of thinking we used when we created them."

The cultural and generational shift before us requires commensurate change in the civil engineering education experience. We should not be fooled by the temporary upswing in enrollments due to an economic downturn. History shows that downturns in the economy results in students enrolling in traditionally stable career paths such as civil engineering. History also shows that economic upswings often lead to students choosing more lucrative career paths such as information technology or management consulting. This is the time to examine core curriculum beliefs, while enrollments are up and before the next downturn occurs. However, our discipline deserves more than an examination that results in prolonged self-examinations of unit allocations. Our students deserve better than adherence to prior beliefs and experiences. Our country requires more than narrow perspectives. As faculty members, we must acknowledge the need for a new generation of civil engineering education. As researchers, we must recognize the importance of broadening the research questions. As civil engineers, we must recognize the tipping point at which the world exists.

There are many paths to choose from in addressing the new global imperatives. However, each of these paths includes an enhanced body of knowledge that embraces leadership, business, economics, cultural awareness, and global understanding. The discussion of whether these topics are relevant is past. The question is how do we engender these knowledge domains in addition to the traditional knowledge and skills. In answering this question, we need to consider several of the following as priorities:

- Presently social and environmental analyses are often considered adjunct topics to the core civil engineering discipline. This needs to change. These topics need to be recognized for the value they bring and need to be elevated to an equal footing with the traditional core topics.
- The time has come for us to seriously consider if less time should be spent on things that are easily learned in practice and may be company-specific such as detailed cost estimating. It is time to consider replacing these courses with topics that have broader impacts and are not learned through professional practice alone such as infrastructure management or resource generation and consumption.
- The introduction of capstone design courses has been a major benefit to both students and the profession. However, why should integration of disciplines be reserved for senior students? Although a segment of programs are recognizing the importance of integration through the curriculum, it is time that collaboration be an integral part of all stages of the curriculum for all programs.
- Today's project team is a combination of professions, including engineering and a broad set of other disciplines. It is time that we consider the role that the civil engineer plays in this team. Is the civil engineer going to be an integrator of ideas and priorities, or is the civil engineer going to be a technical expert providing data? Currently, our curriculum prepares an individual for the latter role. However, the enabler of solutions is the individual who serves as the integrator. Are we ready to educate integrators, or are we satisfied educating technical experts?

Many individuals believe strongly that technical expertise and tradition are the foundation of a civil engineering education. I agree that a strong technical foundation is critical to long-term career success. The question to consider is how much of this foundation is required and how much of the foundation do we cling to because it is considered a tradition. I urge people to remember when hand drafting was considered an essential curriculum topic, but we realized that we could move beyond that skill and now issues such as 3D modeling and BIM are the foundation of visualization. We should consider that knowledge of economics, political science, and law are the next generation of these changes. If civil engineers are going to sit at the table when decisions are made concerning quality of life, then this is the vocabulary they must learn. If civil engineers are going to enter the public arena of politics, then they must understand the process in which public funding occurs. If civil engineers are going to make informed decisions about the long-term health of their companies, then economics must become as comfortable a topic as statics. Are current civil engineering programs preparing individuals for these decisions and discussions?

The issues of global warming, mega-cities, and natural resource depletion are no longer abstract intellectual discussions. Rather, these are the foundational issues on which to examine the global responsibility of civil engineers. These are the issues that demand intellectual interaction with public health officials, medical professionals, and public policy developers. These are the issues that define the current generation. It is time for education and industry leaders to vocally and ardently challenge the status-quo. This is not a time to reinforce the past. This is a time to stand up, make those that doubt,

believe, make those that abhor change, look at alternatives, and provide those that need somebody else to take the first step, leaders that are ready to redefine who we are, what we do, and reintroduce the concepts of vision, legacy, and impact. We stand at a crossroads. Selecting a path is the first step. Embracing that path is the true test of leadership.

If a country can peacefully change the mantle of leadership every four years, then an academic and professional discipline can once again find its way to achieving the importance that the past and future require. I look forward to a discussion on our future. We owe it to the profession, ourselves, and to the students present and future.