Developing the Next Generation of Structural Engineers

Part 1: A Crisis of Opportunity

By Glenn R. Bell, P.E., S.E., SECB

Note: This is the first article of a four-part series on the opportunities and challenges we face in developing the next generation of structural engineers. It is based on the author's keynote address at the SEI Structures Congress in March 2012.

A Crisis of Opportunity

A year ago, I was invited to join the SEI Young Professionals Committee, which is addressing issues of interest to future generations of structural engineers. The members of this committee have concerns that I share… Our business is becoming commoditized as computers and software are doing more of our work. We face the threats of global outsourcing and competition. Increasingly, we are having trouble attracting and retaining the best and brightest to our profession. At the same time, these young professionals yearn to tackle the future challenges of the world in a much more profound way than they are empowered to do today.

While some may see this as a crisis, I prefer to see it positively, as a crisis of opportunity – a chance to change the practice of structural engineering in a profound way. This starts with developing a new breed of structural engineers, more broadly capable than ever before – more creative, collaborative, and communicative – to become global leaders in society's grand challenges.

The World of Future Engineering Generations

To understand what this new breed of structural engineer will look like, I invite you to consider with me what the world of future generations will look like. I suggest that we glimpse about forty years ahead. This may seem like a long time from now, but it is actually within the likely career span of today's engineering students.

New World Reality No. 1: Developing Population

By 2050, there will likely be about 9 billion people on our planet; 8 billion of them will live in developing countries. Pundits predict that, by 2050, the most prevalent language will not be English; it will be Chinese, followed by Hindi and Arabic, with English and Spanish vying for fourth place. Many domestic industries will not exist in their present forms. Ones that do exist may no longer be headquartered in the United States.

The structural engineer of the future will need imagination to seek different business opportunities in this changed world. The massive population in developing countries will need affordable, sustainable housing and infrastructure on an enormous scale. There is a lot of building to be done!

No. 2: Globalization

In the future, our workplace will be worldwide. The global engineering workforce will be leveled. We already face offshore competition, much of it high in quality and lower in cost. But we also have more opportunities to work elsewhere in the world, especially in developing countries. For American engineers to compete internationally, we must become more mobile – more willing to travel to far-flung places. A globally flattened market means that engineers of the future will need breadth, both in technical and soft skills, to operate in many diverse locations and cultures. Perhaps most importantly, we need to be adept at collaborating on teams with members scattered around the globe.

No. 3: Sustainability

We in the United States are consuming the earth's irreplaceable resources at an unsustainable rate. If developing economies adopt our rate of consumption, we will bankrupt our planet of these resources in short order.

While energy concerns are at the forefront of our public dialogue, the challenges are much broader. For example, a recent report by the United Nations projects that, within the next 20 years, virtually every nation in the world will face some type of water supply problem. Moving forward, the building and operation of all of our constructed works will require a drastically more responsible approach. Balancing quality of life with natural resources will be critical.

No. 4: Climate Change

Recent awareness of the impact of climate changes on natural hazards are causing us to question the efficacy of our criteria and approach for design against natural hazards, particularly wind, flooding, and sea level. This will drive us toward more flexible, performance-based approaches. It also requires that engineers take leadership roles in major policy questions in hazards management, or even in some cases advising societies on where not to build.

No. 5: Complexity

Our large-scale civil/structural systems are becoming increasingly complex, and lessons from recent natural disasters like Katrina and Fukashima Daiichi have pointed out the vulnerability of such complex systems. To manage complexity, we need to understand systems engineering, and we need to be able to work better together on collaborative, interdisciplinary teams.

No. 6: Knowledge Exchange and Global Competition

Access to knowledge is enabling developing countries to educate high-quality engineers at an enormous rate. Many of them are able and willing to work very hard for a fraction of the wage rates within the United States. This means that, for the future, American engineers must offer added value through superior knowledge and skill. Our differentiators will be leadership, innovation, and entrepreneurship.

No. 7: Technology

This last point has perhaps the most significant impact on our practice. Advancements in computer techniques and simulation mean that we simply do not need the manual number-crunching resources that we have supplied in the past. Sure, our engineers will need to be skilled in modeling and knowing how to extract correct and reliable results from simulations; but much of what we have been doing in the recent past will be done by machines in the future. This leaves us wondering what our roles will be.

In the next article, we will consider the opportunities that these New World Realities present to future generations of structural engineers, and the attributes required to meet those opportunities.▪

*Glenn R. Bell, P.E., S.E., SECB (**GRBell@sgh.com**), is the Chief Executive Officer at Simpson Gumpertz & Heger in Waltham, Massachusetts.*