

# STRUCTURAL FORUM

## Basic Education

### A Practitioner's Point of View

Daniel L. Lavrich, P.E.

Why does it seem that suddenly professionals are concerned about the breadth and quality of an engineer's education? What has created the awareness among design professionals that something needs to be done to improve the education of structural engineers? I submit that most, if not all, of that awareness comes from our own experience.

That experience is from our own educational processes, the transition into the work world, and a lengthy term of practice leading ultimately to the point of becoming principals in charge of organizations.

Having interviewed many seasoned engineers, the process seems to be fairly consistent. Think back to your own experience, as did Craig E. Barnes, P.E., S.E., a graduate of Northeastern University in Boston, Massachusetts. Mr. Barnes has both graduate and undergraduate degrees from Northeastern, his MS received in 1968. Now, seeing students from Northeastern appearing at his office in search of employment, looking at their resumes and querying them on what they are able to do, without a doubt, at least in Craig's mind, it appears that there has been degradation in the quality of education in comparison to what he received. This seems to be a common perception among many engineers, that the education of the structural engineer in the past was much more thorough than it is today.

That educational quality is, of course, what the student brings to the office. It constitutes their "tools of the trade." It is the job of the employer to fine tune the student's ability, but without a full box of quality "tools," the developmental process is more difficult and takes much longer. In a way, perhaps, it is good that a generation of engineers educated in about the same time period has risen to the point of being principals in firms, positions from which they can make these comparisons. Had the educational process always been mediocre, then we would have comparisons by mediocre principals reflecting on incoming mediocre student, providing very little breadth in expectation. In other words, mediocre would see mediocre while never realizing that it is mediocre.

If the process of structural engineering and design were becoming simpler, such that more mediocre engineers could easily handle the task, this problem might be no big deal. However, this is not the case. Buildings and structures are becoming more complex due to advances in materials and techniques of construction. The trend is for lighter, cheaper, more efficient means of construction, all made possible by more complex and innovative design methods and analysis. The resulting buildings and structures have less redundancies built in to their makeup, and are being designed closer to the edge in load selection and material usage. This requires closer attention to detail and more competent and better educated structural engineers. Many can remember when projects were executed in a reasonable time frame giving the engineer an opportunity for thought and reflection on his or her product and a chance to review what he or she had created. Today, in a world where "fast track" is the popular choice, this is seldom the case.

Practitioners, who are applying their trade in the everyday world and understand what is needed from students entering their field, have established by consensus a Basic Education Curriculum for structural engineers. A recent survey undertaken by NCSEA, with co-sponsors SEI and CASE, revealed that these courses are available in a large

number of institutions but for many reasons they are not necessarily a requirement in order to become a structural engineer.

The traditional degree of Civil Engineering has attempted to turn out "general practitioner" engineers that are educated in all of the various phases of the broad spectrum of engineering known as "civil." Several emphasis programs, including structural, have been in place for specialization; however, the "general practitioner" concept has not gone away. There is still the desire on many educators' minds to produce a well rounded engineer that has many options for practice in the future. Although this concept is well founded and well meaning, the increase in complexity of structural design requirements has rendered this concept obsolete for a candidate that desires to be a structural engineer. The well rounded approach just does not give enough tools to a person that wishes to practice structural engineering.

Efforts are underway from within various segments of the professional engineering community, as well as several outside contributors, to increase community interest in the full spectrum of issues surrounding the education of structural engineers. Efforts by NCSEA toward establishing a certification program for structural engineers; the effort promoted by the partnering organizations of NCSEA; efforts by SEI; efforts of the Partners in Education Committee of the American Institute of Steel Construction; input from the professional community toward separate structural licensure; the promotion by ASCE of the master's degree becoming the first professional degree; and, pressure by alumni on their alma maters to improve the educational process... just some of the efforts currently underway.

All of these activities are heading in the right direction. Interestingly, reducing the number of credit hours for the undergraduate degree has contributed to the effort to make the master's degree the basic educational degree. This is a low-tech way to tell school administration, "If you are going to reduce the number of hours for the baccalaureate, you still need to produce structural engineers with a certain amount of knowledge;" thus, the number of credit hours will be increased by requiring students to have a master's degree.

At the same time we push for an increase in the number of credit hours and the broadening of the spectrum of courses necessary to be taken by a structural engineer, we can utilize the existing system to the students' advantage. Make no mistake. We must be committed. If practitioners were no longer to employ engineers with undergraduate degrees in structural engineering positions, an overnight transformation utilizing the master's program would be in place. The master's degree itself is not a panacea. A degree without the necessary content is not the complete answer.

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There seems to be little disagreement that entry level structural engineers need a basic level of education, but there is quite a bit of discussion on how that is to be achieved.

At this point, there is a large spectrum of possibilities:

- Establish an early commitment from students toward discipline as a structural engineer. According to ASCE's education group, establishing the mindset of a student toward structural engineering is easiest at the grade school level. Shortly thereafter the interest may be lost.
- Direct students that are committed to a structural degree, but are not fully knowledgeable on what a structural engineer does, to schools that will guide them with a proper curriculum.
- Find a way for schools with the curriculum capacity to package the structural curriculum appropriately.
- Find a way for schools that have solid core basic structural requirements and educational facilities, but that lack some of the coursework, to interface with other schools in the same geographical area, or to develop a remote campus relationship for the transient, to allow a student to take courses toward their degree.
- Create a baccalaureate diploma that is specific to structural engineering as an alternative to a baccalaureate in civil engineering or a master's in engineering.
- Work with the structural certification requirements to insure that a program recognizes a basic education curriculum.
- Involve more practitioners in exam preparation, so that exams are targeted toward a structural engineer.
- Work with ABET to maximize the benefit of ABET outcome assessment.



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*Craig Barnes shares his experience with a new generation of engineers.*

- Encourage alumni to become more firmly involved with their schools.
- Formally incorporate some of the overall education requirements, such as the hands-on-training that can only come in the office of the practitioner, as part of the degree program. Schools with cooperative education programs and those with meaningful capstones are ahead in this area.
- Prepare a website listing of those schools that offer the Basic Education curriculum.

It is essential for the entry level engineer to understand the minimum requirements in order to achieve early success in the field. It is equally necessary for the prospective employer to insist that the entry level engineer have completed a basic compliment of structural engineering courses, or be prepared to invest in an adequate training program for the engineer to overcome educational deficiencies. Once this program is sufficiently in place, the new graduate will offer skills that are immediately valuable to the employer which, in turn, allows appropriate compensation and encouragement for more quality students to choose our profession.

In order to complete the education process, employers must encourage and promote the efforts set forth in the above discussion, and actively continue the education process by providing guidance and mentoring of young engineers in practicing engineering firms. This final stage of the education process is essential to achieving a seasoned and experienced engineer with the wisdom to apply the principals of engineering competently.

*Daniel L. Lavrich, P.E. has been a structural engineer in private practice in Ft. Lauderdale, Florida, for 28 years. His principal practice has been the design of and consulting regarding various types of buildings and structures. He has been an adjunct instructor in reinforced concrete design in the College of Architecture of Florida Atlantic University, and actively serves on numerous state and local committees relating to the Florida Building Code. He is a member and President Elect of the Florida Structural Engineers Association of NCSEA, and a member of the Business Practices Committee of SEI/ASCE.*

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