LEARNING BY DOING

Students at one engineering school learn about steel erection—by actually doing it in class.

BY STEVE KURTZ, P.E., PH.D.

WHEN I WAS A STUDENT, I thought that beams and columns were just thin lines on a piece of paper. Today, many students think beams and columns are just thin lines on a computer screen, illustrating that not much has changed in structural steel education besides the medium. Yet designers need to understand fabrication and erection, and it is the educator's responsibility to prepare young designers for the profession.

One of the most effective and prolific ways of teaching students about fabrication and erection has been AISC's Steel Sculpture, a 35-piece, 1.4-ton structural sculpture that contains almost every imaginable connection in one compact location. The sculpture has been assembled on more than 135 campuses around the U.S. with the help of many generous donations from fabricators.

At Lafayette College in Easton, Pa., the students take the lesson a step further by *dis*assembling the sculpture three times each year. In the required junior-level course "Fundamentals of Structural Engineering," each of the three lab groups undergoes a hands-on activity in which they must re-assemble 15 pieces of the sculpture in about 45 minutes. When the exercise begins, the students are faced with a partially disassembled sculpture and the challenge of having to reassemble the puzzle. They are armed with a set of erection/shop drawings and an impact wrench.

Hands-on engineering education is strongly emphasized in the Lafayette College Civil Engineering program, which requires eight courses that contain three-hour labs. In Fundamentals of Structural Engineering, students devote roughly half of their laboratory time to fabricating structural steel. The overriding philosophy is that students cannot become creative designers if they have never created anything. Hence, every student in the program is expected to become proficient at welding, drilling, cutting, and fitting up structural steel. The unifying theme in the course is a term project in which teams of eight students compete against one another in a steel bridge competition that's modeled after ASCE/AISC's National Student Steel Bridge Competition (NSSBC). Devoting much of their lab time during the semester to designing and fabricating a 15-ft-long steel bridge from size-limited parts and loading it with 2,500 lb of weight, students combine all of their knowledge of structural analysis, steel design, detailing, and fabrication.

Steve Kurtz is an assistant professor at Lafayette College. Lafayette College is grateful to Slatington Fabricators (AISC Member) of Slatington, Pa. for donating the steel sculpture.

Why should students erect steel in class? One reason is that students enjoy the change of pace from their usual analytical work. But the main reason is that the process of erecting steel is valuable education for would-be engineers. It teaches students that erecting steel is a tough job that is only possible with precise fabrication. More technically, it trains students to read shop drawings in a much more serious and immediate way than could be simulated in a classroom, because they are presented with a serious and immediate job to perform. More subtly, they become aware of erection clearances, the problems of double-sided connections, and the myriad of connection types.

Mostly, they benefit in ways that are not obvious or necessarily testable. The experience of having aligned holes with a spud wrench, torqued bolts with an impact wrench, and made physical connections between the thin lines drawn on paper may not help them on their next exam. But, they gain the kind of understanding that can only come from having physically done something. MSC

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