

ADDING CONSTRUCTION TO THE ACADEMIC SAFETY CURRICULUM

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Anyone who has recently been involved in adding a new wing to a plant or building a new home knows that the boom in construction is so widespread that project delays and shortages in material and labor are common.

This incredible growth has brought many inexperienced workers into the field, which has further contributed to its standing as a high-hazard industry. As Figure 1 shows, one in six fatal occupational injuries occur in construction. In addition, the construction industry has the third-leading rate of injuries among all workers—and the highest rate among industries regulated by OSHA (National Safety Council 48-50).

These statistics, coupled with the industry's dramatic growth, has prompted many contractors to seek safety personnel with knowledge of key construction safety issues. However, in many cases, university-based academic safety programs have been slow to meet the challenge of preparing students to enter this field. This may be due to low faculty interest or established departmental priorities; it may also be related to the challenge of arranging hands-on demonstrations of construction situations. For example, it is difficult to illustrate the need for a full-body harness rather than a body belt on a blackboard or with a video.

In response to input from various sources, the safety and environmental faculty at West Virginia University (WVU)

developed a construction safety course that has been integrated into the program's mission. This course focuses on technical and compliance aspects of construction safety and utilizes a pool of local talent to meet specialized technical needs.

Ideally, when students complete this course, they will know whether the ignition source for a cutting torch is in compliance because they will have struck a torch with a legal ignition device and used it under careful supervision during the course. They will have erected scaffold and wired sample electrical outlets.

Such practical lessons are more likely to be retained because the course's compliance content has been consciously linked to real-world learning activities. When students can strap themselves into a full-body harness and compare it to a body belt by suspending themselves briefly above the floor, they *experience and remember* the difference between the two devices instead of merely taking notes during a lecture.

THE NEED FOR THE PROGRAM

Five factors prompted WVU's faculty to consider construction safety as a special elective.

- **Around 1995, alumni began asking the department to consider such a course.** These graduates reported that their jobs demanded greater knowledge of 29 CFR 1926 (OSHA's construction safety standards). In addition, alumni employed in the mining, chemical and steel industries expressed interest.

- **The safety management profession**

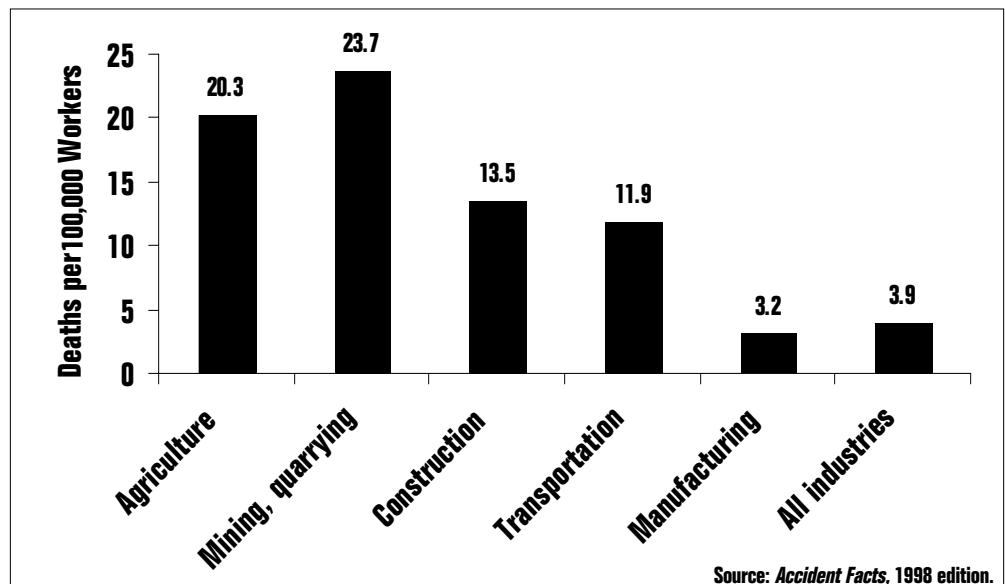
as a whole expressed the desire to recognize individuals with specialties in various safety areas through rigorous certification procedures. In addition to high-level designations such as the CSP and CIH, it was believed that lower-level certifications might help recognize graduates as having special abilities. Subsequently, the university began to offer an OSHA 10-hour construction card, which requires instructor certification and careful adherence to an OSHA-specified curriculum.

- **The construction industry began to seek safety personnel with practical exposure to 29 CFR 1926.** Groups such as Associated General Contractors and National Home Builders Assn., with which the faculty have regular contact, had expressed the need for new safety personnel to "hit the ground running" due to their knowledge of construction regulations.

- **A survey of job placement descriptions in *Professional Safety* and *The Synergist* found that firms often identify construction safety as a desirable background for prospective candidates** (Frederick, et al 27+). As mentioned, the boom in the industry has significantly increased its hiring activity.

- **The Related Accrediting Commission of Accreditation Board for Engineering and Technology (RAC/ABET), which accredits the university's safety degree program, indicated that the program needed additional technical coursework.** The department believes it has partially addressed this weakness with the construction safety course.

FIGURE 1 Fatality Rate By Industry



•Faculty members believe it is important to offer safety management coursework as electives to engineering students. Civil or chemical engineering students have an obvious need for such information, yet no courses at WVU covered compliance with construction regulations or highway workzone configuration. It was also believed that exposure to safety management strategies would help students learn effective techniques for minimizing losses, as well as the basic principles of safety program development.

VALUE-ADDED PARTNERING

Those involved felt that one way to ensure success was to partner with groups which could add value due to special expertise or qualifications. This was achieved on two fronts.

WVU faculty tapped into the expertise and facilities of the school's Safety and Health Extension (S&HE) group. One of this group's major programs involves teaching OSHA-based construction safety to practicing contractors in West Virginia and the surrounding region. Regional contractors do not take such courses for college credit, however, and the department was careful to prevent any conflicts with S&HE's goals.

The extension also provides curriculum resources, guest lecturers and specialized equipment, as well as information on its ongoing intervention research project in fall prevention. The most critical contribution is making available its demonstration area, which is equipped with a full range of fall protection equipment (e.g., personal fall arrests, shock absorbing lanyards), and demo roof, which simulates a low-slope roof on one side and steep-slope on the other. S&HE also provides scaffolds and planking that students use to erect and disassemble scaffolds so they will know how to best work with a scaffold-competent person as defined in Subpart L.

WVU's campus safety group, Environmental Safety and Health, is another key partner. This group demonstrates its excavation equipment, including aluminum-hydraulic and laminated-veneer shoring. In addition, for classes with a heavy contingent of civil engineering students, a local certified HazMat instructor provides an eight-hour HazMat awareness certification course and card. Faculty also work with the university's Technology Transfer

Center to demonstrate how to create Dept.-of-Transportation-compliant highway construction zones, complete with table-top mockups of barrels, barricades and compliant signage.

THE CURRICULUM: A BLEND OF MANAGEMENT & TECHNICAL CONTENT

Course content is divided into three modules, which can be selected and used as the composition of the class dictates. The introductory module covers safety management practice; the second covers technical content; the third addresses technical-support content.

Module I

Since the course attracts civil engineering students and those pursuing other degrees, the course opens with a description of the industry and a discussion of how construction safety management differs from fixed-site safety management.

Students learn to calculate various incidence rates for comparing experience among and between industries. They learn basic principles of controlling variable costs and use experience modification rates to calculate workers' compensation rates. In addition, students undertake what may be their first—and, in the case of engineers, perhaps only—exposure to OSHA: They learn about worker and employer rights and responsibilities, as well as about inspections and OSHA's hierarchy of violations. Basic management theory and program evaluation methods are also reviewed to better integrate the course into the curriculum.

Module II

By 1994, OSHA had determined that existing enforcement approaches—which focused on numbers of violations rather than on types of injuries experienced—had largely failed in the construction

industry. As a result, the agency redirected its efforts to focus on major injury areas. These areas, known as "focused priorities," include four major categories: falls from heights; struck-by injuries; caught in/caught between injuries; and injuries related to electrical hazards.

These areas correspond to the major content areas of the WVU construction course. Each student receives an unabridged copy of 29 CFR 1926 and must write a three-page abstract on each area as it is discussed in class. The goal of this exercise is to help each student compile a reference file. Critical content areas are:

FALLS FROM HEIGHTS (FEATURING SUBPART M, FALL PROTECTION)

- Top five OSHA violations of Subpart M.
- Conventional fall protection.
- Specialized systems of fall protection.
- Practical demonstration of fall protection equipment.
- Top five OSHA violations of Subpart L.
- End-frame/tube-and-coupler scaffold.
- Lab activity during which students must erect, inspect and disassemble two types of scaffold.

STRUCK-BY INJURIES (SUBPART I, HAND AND POWER TOOLS) AND SAFETY ZONES

- Top five violations of Subpart I.
- Lab on cutting safety that features welding torch demonstration.
- Lab on highway safety zones modeling.

CAUGHT IN/CAUGHT BETWEEN INJURIES (SUBPART P, EXCAVATION)

- Top five violations of Subpart P.
- Trenches and excavations.
- Sloping and shoring techniques.
- Lab on soil typing using manual methods and instruments.

ELECTROCUTION (SUBPART K, ELECTRICAL)

- Top five violations of Subpart K.
- Basic calculations, with an emphasis on resistance.
- Using basic instruments and diagnosing faulty circuits.
- Lab that features "temporary service" wiring activity.
- Lab on ground fault circuit interrupter and load center.



Photo 1 (above):
A WVU student erects scaffold as part of a practical learning exercise in the construction safety course.



Photo 2 (above, right):
A student wires a temporary service load center. This activity is part of the Module II content.



Photo 3 (right):
Students erect scaffold. Through this exercise, they learn how to best work with a scaffold-competent person as defined in Subpart L.

Module III

The supporting components of critical content include discussion of compliance activities associated with OSHA violations. However, the content of this module is typically customized based on class composition. Support areas that may be selected include:

- Common construction tools (Subpart H); includes lab on identifying unserviceable hand tools.
- Torch and welding safety (Subpart I, Welding and Cutting); includes lab on using a torch and identifying glass shade gradients.
- Cement and concrete hazards (Subpart Q, Concrete); includes activity on identifying special respiratory and fall hazards.
- Highway construction zones (DOT and state regulations); includes activity to create model workzones to specification.
- HazMat transportation; includes an activity on using CHEMTREC handbooks to identify placards.

RESULTS & REVIEWS

The class was offered experimentally in spring 1998 to 36 students, one-third of whom were studying civil engineering.

(The typical graduate-level safety and environmental management class has 22 to 25 students.) The student reviews were positive, as were the comments from alumni and construction industry contacts.

The course now has an official university number and has been logged into the WVU catalog (as SEM 270). An informal survey showed that students who have completed the course are more

likely to be hired at a firm with job descriptions requiring construction knowledge.

MEETING STATED NEEDS WITH THE RIGHT BALANCE

Academic curricula are influenced by several factors, including criteria established by the academic program's accrediting body and the demands of the job market. A truly successful curriculum must also meet the demands of its customers—the students. The desire to have a customer-driven curriculum is what led to development of WVU's environmental area of emphasis and its three related courses (see Whaley and Della-Giustina 18+) and to the course detailed here.

Department faculty also believe that technical learning must be meaningful and must feature hands-on activities that closely represent real-world situations because such learning will be retained longer. In addition, partnering with qualified professionals enhances the program's credibility.

Based on feedback to date, the course is a success. Of course, long-term measurements must be taken to gauge learning outcomes over time. In addition, the RAC/ABET has not reviewed the program since the course was added, so it is

not yet known whether the course answers its "need for more technical coursework" recommendation. However, the faculty are encouraged by the positive reception on so many fronts. Due to the response, the university

plans to develop a similar course covering 29 CFR 1910, OSHA's general industry standards, as well. ■

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