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Preparing Cost Engineers for Today's Construction Industry Challenges

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Education Spotlight

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In the last 20 years, the US design and construction industry has changed the way it is doing business. This has caused the industry to reassess its traditional roles, revise business practices, and look for ways to add value to the process without adding cost. The increased use of alternative project delivery systems such as design-build (DB) and construction management (CM) is one of the major results of these changes in the industry [1]. The increase in popularity of alternative project delivery methods has significantly revised the set of professional skills and knowledge that the cost engineer must have to be successful in this business. Alternative project delivery methods require the construction contractor to establish a lump sum amount for a facility for which design is not complete. Thus, the cost engineer must be able to base the cost estimate on something other than a detailed quantity survey. He or she must also be able to communicate time, cost, and constructability constraints to the designer during the design phase of the project in a manner that enhances the value of the final project, without compromising the professional integrity of the design-build team. Additionally, today's cost engineer must be comfortable working in the world of performance criteria rather than yesterday's legalistic prescriptive specifications. This requires a better understanding of the owner's requirements and a more responsive business approach. While these skills are certainly being acquired on the job by today's practicing cost engineers, it is incumbent upon university construction education programs to adjust the curriculum and ensure that entry-level cost engineers are entering the industry with the educational background to quickly assimilate into this new, faster-paced environment. Thus, the purpose of this article is to describe how the University of Oklahoma's Construction Science program has adapted its curriculum to fulfill this need.

Background

There are three construction specific bodies of knowledge that have been impacted by the industry's shift in project delivery methods: estimating, scheduling, and contract administration. Additionally, the shift has created a requirement for construction professionals to be more fluent in their writing, and more polished in their public speaking/presentation skills. They must also have an excellent business background that will help them integrate all of the above.

The traditional construction estimating curriculum is based on the preparation of bids for fully designed projects. As a result, the emphasis is on quantity surveying and pricing for competitive

	CURRENT COURSES SUBJECT						
DELIVERY METHOD	INTRO TO CONSTRUCTION	COST ESTIMATING 1	COST ESTIMATING 2	SCHEDULING	CONTRACT ADMIN	CONSTRUCTION LAW	CAPSTONE
DBB	X	X		X	X	X	
CM	X		X		X	X	
DB	X			X		X	X
TOPIC							
Conceptual Estimating			X				X
Conceptual Scheduling				X			X
Value Engineering					X		X
Alternative Contract Admin					X	X	X
Constructability				X			X
Partnering					X	X	X
Proposal/ Presentation Preparation	X	X	X	X	X	X	X

Table 1— Integrating Alternative Project Delivery Topics into the Undergraduate Curriculum

bidding where the submission of the low bid is the object. Similarly, scheduling focuses on developing detailed schedules from which the actual construction can be managed after the award of the contract. Finally, the emphasis in construction administration is on learning the intricacies of the contract between the owner and the construction contractor. While these are certainly essential elements of the required body of knowledge, they are focused on the design-bid-build (DBB) project delivery method.

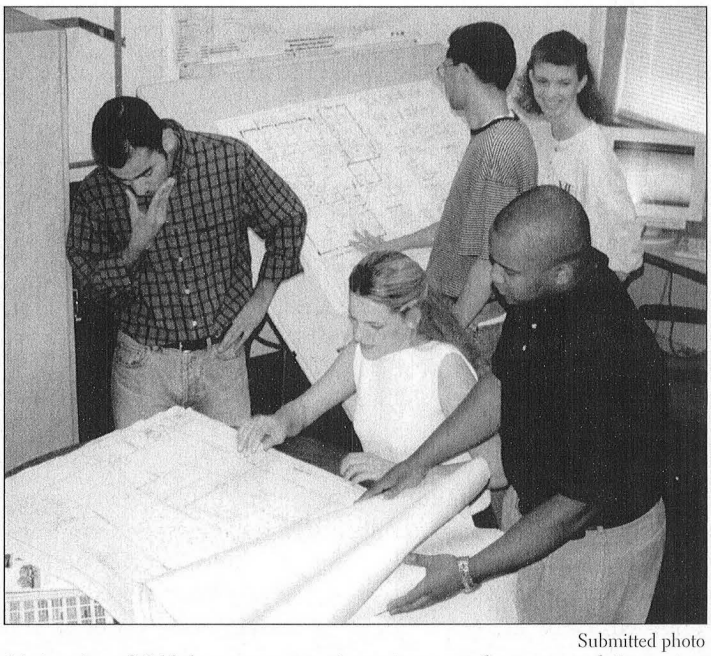
Adjusting the Curriculum to Fit the Market

Alternative project delivery methods require the construction industry to be able to establish a firm, fixed-price at a much earlier point in design development. This means that both cost and time estimates must be made based on performance criteria, rather than completed design. Then after contract award, construction professionals now must make input into the details of design in terms of value engineering and constructability to ensure that the final product meets both cost and schedule constraints. To do this, a new set of relationships must be established with both the design professional and the owner. In the case of DB, often the design professional no longer has a contract with the owner, but rather will have some contractual relationship with the construction professional. Finally, as both CM and DB contracts are competitively negotiated, the ability to both prepare a responsive proposal and then present it to the owner is critical.

The obvious change that must be made in the current construction curriculum is to shift the focus from the low bid mentality to one that recognizes that the future construction professional must operate in an environment with a greater amount of technical uncertainty and much more input into the process of design development. To do so, seven elements must be included in the construction management curriculum:

- conceptual estimating;
- conceptual scheduling;
- value engineering;
- alternative contract administration;
- constructability;
- partnering; and
- proposal preparation and presentation techniques

The University of Oklahoma's Construction Science Division's basic approach was to take the two cost estimating courses and the construction capstone course and use them in a building block fashion to cover the quantitative skills necessary for the three project delivery methods. Thus, cost estimating 1 students focused on design-bid-build and completed a hard bid project, cost estimating 2 students completed a construction manager at risk project, and the capstone project involved design-build project delivery. Scheduling and planning was inserted between estimating 1 and estimating 2, so that students could learn the basic concepts of scheduling. The integration of the estimate and the schedule takes place in estimating II and the capstone project. Table 1 shows how these seven elements have been incorporated into existing courses. The other courses were viewed as opportunities to reinforce those bodies of knowledge, as well as the place where the project management skills necessary in alternative project delivery were taught. Additionally, both



Submitted photo

University of Oklahoma construction science students at work in project management laboratory. Shown above in the front from left to right are Eulises Chacon, Susan Beck, and George Knuckles. In the back are Brandon Barrett and Crystal Conner.

written and oral presentation skills were taught and exercised in all the courses to maximize communications skills. When combined with the 21 hours of business classes required by the construction science degree, future cost engineers are receiving a very timely and relevant education that prepares them to fully address the changing construction market.

Realization that the above changes needed to be made was a product of both the faculties' consulting work and input from the OU construction industry advisory board. Goal setting sessions determined the need for addressing alternative project delivery methods and developed the means and methods for accomplishing the previously discussed alterations to the construction curriculum. The integration of the estimate and schedule in these classes, along with the written and oral presentation skills and the business classes already required in the construction science curriculum, is better preparing future cost engineers to practice in the construction industry.

An interesting situation existed in the OU graduate program. Most of the students had undergraduate degrees in architecture or engineering rather than construction science or construction management. Thus, as the student body basically consisted of graduate design professionals who were studying to become construction professionals, it was decided to revise the graduate curriculum to create an emphasis on design-build. To do so, four new courses were created:

- facilities acquisition planning;
- design-build contracting;
- project management and controls; and
- construction contracts and finance

These were added to two existing courses in construction quality management and construction information technology to form the core of the 32-hour master of construction administration degree. Most students are required to take the cost estimat-

ing 1, scheduling, and contract administration undergraduate classes as leveling courses. Thus, the graduate students receive exposure to all three project delivery methods as well. The graduate program requires all of its students to take and pass the Interim Cost Consultant examination at the conclusion of their studies and uses the results of that examination to assess the accomplishment of cost engineering educational objectives.

The design and construction marketplace has changed its mode of doing business, and this has created a requirement for academia to adjust its curriculum as well. As the construction industry is probably most affected by the move to alternative project delivery methods, the University of Oklahoma's Construction Science program is better preparing future cost engineers through program revisions. This fundamental shift in the way the nation delivers its facility projects must also be recognized by architectural and engineering programs as well. While the facility design will not change in and of itself, the concept of integrating both cost and constructability input from the construction community during design development is virtually unrecognized in the architecture and engineering curricula. To prepare the next generation of cost engineering professionals, all three disciplines must graduate with both a knowledge and an understanding of how alternative project delivery impacts the various components of planning, design, and construction. ◆

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