

Capstone Course: Involving an Industry Sponsor

Dr. James C. Smith, P.E., NAC
Texas A&M University
College Station, TX

Most programs of construction higher education offer a senior capstone course designed to require students to integrate previous coursework into a comprehensive, team-based course to better prepare them for initial employment. Capstone courses typically have some industry involvement to promote realism and to insure that contemporary construction issues are introduced. This paper is a case study of the capstone courses taught at the author's university with emphasis on the extent of industry integration. Specific topics to be presented are suggested. The benefits to the industry sponsor and to the students are postulated.

Key Words: Capstone Course, Industry Sponsor

Introduction

Most programs of construction higher education offer a senior capstone course, designed to integrate previous coursework into a comprehensive, team-based course to better prepare students for initial employment. As implied by the name "capstone", these courses are usually rigorous, all-encompassing, and focused on real, contemporary construction issues. At the author's university, capstone courses are offered in multiple industry sectors—residential, interdisciplinary, commercial, heavy-highway and industrial. Students can select their desired capstone course depending on the sector of the industry they intend to enter. The focus of this paper is on the commercial capstone course, but the principles of industry sponsorship can be applied to the other sector capstone courses as well.

Literature Review

The literature is replete with publications discussing the use of industry in capstone courses; however, nothing in the literature search reveals the use of an industry sponsor to the extent suggested in this paper. Arthur Kney and his colleagues at Lafayette College discuss the process of developing a set of defined goals and objectives of a capstone course and how those goals may be achieved (Kney, 2003). Others have suggested that capstone courses should be team-taught with appropriate faculty expertise focusing on different learning objectives (Jones, et al, 2007). The cadets at West Point, who are senior CE majors, work on real projects furnished by the construction and engineering industries (Welch, et al, 2005). An excellent discussion of the methods and techniques to evaluate student capstone work and a means for course assessment are provided by Charles McIntyre from North Dakota State University (McIntyre, 2003). The **References** page contains some of the best resources found by the author.

Course Background and Objectives

The commercial capstone course is designed for students intending to seek employment in the commercial construction sector. The instructor has chosen to use the construction management at risk [CMR] project delivery system as the course vehicle. The CMR project delivery system is becoming a dominant delivery system for the commercial construction sector with both public and private owners and the delivery process lends itself to team-based assignments. The CMR delivery process also lends itself to the introduction of contemporary issues such as:

- Leadership in Energy and Environmental Design [LEED]
- Historically Underutilized Businesses and Minority/Women-owned Business Enterprises [HUBs and M/WBE]
- Storm Water Pollution Prevention Plan [SWPPP]
- Building Information Modeling [BIM]
- Web cameras
- Internet-based PM systems
- Conceptual estimating
- Preconstruction services

Industry Sponsor: Case Study

Selection

Given that the course overall objective is centered around the use of a CMR contract, the industry sponsor should be familiar with the CMR delivery process and have a successful track record for winning and executing CMR contracts. There are usually a large number of companies that fit this description in proximity to the university. The companies may be large international companies or smaller, regionally-based companies. The author will typically approach a company at a fairly high level within their organization, give them a synopsis of the role of the industry sponsor [See APPENDIX A], and ask them if they are willing to serve in that capacity. To date, the author has never been turned down when requesting a company to act as industry sponsor.

Tasks

There are three fundamental tasks requested of the industry sponsor. The key is to keep these tasks flexible and work with the industry sponsor to modify them as the sponsor desires.

The RFQ/RFP.

The sponsor is requested to provide a contemporary Request for Qualifications [RFQ] and the associated Request For Proposal [RFP] for a CMR project and, if required, to

seek clearance from the owner to use the documents as a teaching tool. Since most such documents are published in open forum, owner approval is typically not required. The author asks the sponsor to select a building project in the \$20-50 million range which is large enough to involve all aspects of building construction and yet not so large and complex that it loses some of its realism. The project may be one that the sponsor has competed for and won [or even one which the sponsor lost], one that the sponsor did not pursue, or one which they are currently pursuing.

Working with the sponsor, the RFQ/RFP can be modified as necessary to insure coverage of all teaching objectives and contemporary issues. For instance, if the RFQ/RFP does not have a LEED requirement, an appropriate LEED requirement can be drafted and inserted in the RFQ/RFP. This is usually done by the instructor with the advice and concurrence of the sponsor.

Guest Speakers.

The industry sponsor is invited to have company ‘experts’ present guest lectures to the class. The Appendix is the current guest speaker topic list that is initially given to the sponsor. Working with the sponsor, this list will be modified or consolidated depending on the availability of the sponsor ‘experts’. Some topics may be combined or other guest speaker topics may be developed. For topics which the sponsor cannot provide a guest speaker for, the instructor must present the material to be covered. The author has found most industry sponsors to be very responsive to the guest speaker opportunities.

Industry speakers are a welcome diversion to the students and have added credibility by virtue of their current positions. A seasoned superintendent talking about site logistics, or a chief estimator explaining conceptual estimating, or a marketing coordinator discussing written and oral proposals captures the student’s interest and enhances their learning. It has been the author’s experience that the industry sponsor guest speakers are committed to making excellent presentations and are diligent in their preparation, often using high quality visuals with extensive handouts or “leave-behinds”.

Proposal Review.

Student teams are required to create a hypothetical company and to respond to the RFQ and RFP on behalf of their company. The industry sponsors are asked to play the role of the owner in evaluating the written proposals and the oral presentations.

The written responses to the RFQ are usually graded by the instructor, and the student teams receive a grade based on content, format and grammar. Since all student teams will receive the RFP, there is no need to create a shortlist based on RFQ responses, but they are graded and teams are shown their strengths and weaknesses.

The industry sponsors, usually 3-4 members, receive the written proposals and evaluate them just as an owner would. Scoring criteria may or may not be made available to the

teams as desired by the industry sponsor. The industry sponsor is asked to force rank the proposals, from best to least best, and this ranking may be used in assigning grades.

The student teams are then required to make a formal, oral presentation of their proposal before a panel of industry sponsors, acting in the role of owner's representatives. The presentations are usually done in the industry sponsor's office. Presentations are formal—coat and tie for men and comparable business attire for women—and are strictly timed with allowance for a question and answer session. The industry sponsors are again asked to force rank the oral presentations and this ranking may be used in assigning grades. Student teams may sit in on other team presentations only after their team has presented.

Finally, the industry sponsor is asked to critique all team's proposals, written and oral, and to pick an overall winner and announce their selection. The critique is an important part of the student learning and should be allotted sufficient time for comprehensive coverage.

Benefits

To the Students.

Maintaining student interest and focus in their last semester is a challenge. Students are typically concerned with final job interviews, selecting an employer, finding an apartment for their first job, and shopping for their new pickup. Academics often are low priority. Active involvement of an industry sponsor serves to heighten the students' interest and brings 'credibility' to the learning objectives and the learning process. Students can relate to practicing professionals, particularly if they can relate the coursework to the tasks that they will face early in their careers. Involving the industry sponsor in the evaluation process also instills a sense of competition among the student teams, which causes them to seek excellence in their required coursework.

To the Industry Sponsor.

Why should a construction company be willing to undertake the industry sponsor role, committing significant time and resources to support the course? While some benefits are fairly obvious, others are more subtle:

- Company name recognition. Companies are continuing to compete for new entry-level construction managers and the visibility inherent in sponsorship is attractive to companies. This visibility can be enhanced with internet and hard copy postings that feature the company's role.
- Professional pride/industry service. Participating companies view this sponsorship role as a laudable service contribution by the company to the university and the program. Most companies pride themselves in supporting their communities with visible service activities, and course sponsorship certainly contributes to that goal.

- Guest speaker skills enhancement. Most companies promote continuing education for its employees, to include the enhancement of presentation skills for key employees who represent to company in owner presentations and other public forums. Companies can use the guest speaker opportunities to improve the guest speaker's presentation skills; an informal speaker evaluation form may be used to let the students evaluate the speaker's visuals and presentation. In one instance, a sponsoring company instituted a 'competition' among its guest speakers, using the student evaluations to rank guest speakers.

To the Instructor/Program.

Using an industry sponsor complicates the course delivery for the instructor. The instructor must be flexible and be prepared for schedule changes and amendments, as the industry sponsor participants will have priority conflicts that are unavoidable. Murphy's Law will apply and the instructor must be prepared. If a guest speaker cancels at the last minute, the instructor must be prepared to deliver the material or have a substitute topic. If key company participants change, new participants must be found and prepared. Given these inevitable complications, participation by an industry sponsor ensures that:

- Student engagement. Anyone who has taught a senior capstone course has faced the challenge of motivating students with one foot out the door. Many may have accepted a job and know who they are going to work for, some have marriage planning in progress, and they are ready to move on with their lives. Introducing the industry sponsor, who will have some influence on their grade, helps engage the students. Creating student teams and the competition provided by industry reviews of their teamwork, gets students competitive juices flowing and keeps them focused throughout the semester.
- Currency. Using an industry sponsor and a current project RFQ/RFP, which can be tailored for teaching purposes, ensures that the students *and the instructor* are focused on current issues, practices and procedures.
- Relevance. The course becomes relevant as the students experience the 'real world' which awaits them as they join the industry. The students experience roles that they will be expected to play shortly following graduation.
- Program visibility. In all likelihood, the sponsoring company will be a member of the program's industry advisory council. The company will gain new insight and respect for the program's goals and objectives and what is involved in preparing students to enter the industry. Sponsoring companies will become even stronger program advocates and will be even more willing to support the program with time and resources.

Summary

The use of an industry sponsor in senior capstone courses clearly enhances the learning process for students about to enter the industry. It does require more instructional flexibility, but the benefits are extensive. Will we evolve to the point where capstone courses are taught exclusively by industry?

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APPENDIX --Construction Science Senior Capstone Course

Construction Industry Sponsor

Participation Opportunities

1. General. Seniors in the Construction Science program at Texas A&M are required to take a “Capstone” course in their last semester which is designed to integrate all previous coursework and expose the students to a “real world” scenario. The course is designed to require the students to work in a team environment and respond, orally and in writing, to a contemporary construction opportunity. Class sizes are less than 20 students, and are usually broken into teams of 3-4 students for the purpose of responding to a real RFQ/RFP.
2. Industry sponsor. To facilitate the learning process, it is very desirable to involve an industry sponsor and expose the students to industry “experts” to provide rigor and realism. Opportunities for sponsor participation include:
 - a. Provide a contemporary CM at Risk RFQ and RFP. Cost range should be \$20-50 million; may be public or private owner. The RFP may be modified by the instructor in concert with the industry sponsor to insure that the project covers all the desired teaching topics. For example, if the RFP did not include any LEED requirements, the instructor might add provisions to the RFQ/RFP requiring the student teams to do some LEEDs analysis.
 - b. Provide guest speakers on current topics. See Attachment for a listing of guest speaker topics.
 - c. Review and rank student team written Qualifications submittals and written Proposals in response to the RFQ/RFP.
 - d. Acting as owner reps, hear the student team oral presentations. Critique and rank student presentations. [This may be done in the industry sponsor’s home office.]

ATTACHMENT

COSC xxx—Senior Capstone Course

Guest Speaker Topics

GENERAL. This listing and suggested subtopics is intended to provide a starting point for guest speakers and is NOT intended to suggest any limitations as to topic content or delivery method. The use of examples is encouraged and any references concerning the topic are welcomed.

TOPICS:

1. Site Logistics and SWPPP.
 - a. How does the PM/Superintendent approach the issue of site logistics? Is there a checklist? What are the important considerations?
 - b. Security. What are the site security considerations? How are they addressed? Fencing, lighting, access control, cameras, guards, etc.
 - c. Transportation. Access to and from the site. Vehicle parking.
 - d. Laydown areas—how many, size, location, pave or not.
 - e. Crane placement. What size crane will be required? Access and placement. Scheduling. Cost implications.
 - f. Office placement. Size and number, location, scheduling, cost implications. Health and safety considerations.
 - g. Other. Porta-cans, how many and where. Dumpsters, how many and where. First aid station. Union considerations.
 - h. SWPPP. What is it? Where does the requirement come from? What is required in the Plan? What is required on the site? Who enforces and how? Sanctions for violations.
2. Conceptual Estimating
 - a. What is conceptual estimating and when is it used?
 - b. How do you accomplish estimating when you do NOT have complete plans and specs?
 - c. Where do you get conceptual cost information?
 - d. How do you attack a specific project; what are the steps to take?
 - e. How do you handle contingency?
 - f. How do you estimate the cost of preconstruction services?
 - g. How do you estimate the cost of General Conditions?
 - h. How do you estimate the cost of bonding and insurance?
 - i. What is GMP and how is it managed?
3. Preconstruction Services and VE.
 - a. What services are included in preconstruction services?
 - b. How do you determine the staffing requirements to deliver preconstruction services?
 - c. How do you interface with the designer and the owner to deliver preconstruction services?

- d. What is Value Engineering and how is it used? What is a CVS? Who does Value Engineering? How is Value Engineering applied in a Construction Management at Risk [CMR] project?
- 4. Safety and Risk Management
 - a. Who has safety responsibility on a project site?
 - b. When is a full time safety engineer required?
 - c. What is in a project Safety Plan? Who writes it, who implements it?
 - d. What is included in a Project Safety Plan?
 - e. What are the normal routine safety activities that occur on a job?
 - f. What is EMR and why is it important? [Discuss the impact that it has on your insurance rates]
 - g. What are safety incentive plans?
 - h. How do you enforce safety on a job site?
 - i. What do you do when OSHA visits?
 - j. How do you create and maintain a positive safety environment on your job?
- 5. Scheduling
 - a. How can you do a detailed schedule without complete plans and specifications?
 - b. How do you accomplish schedule updates as design proceeds?
 - c. What are the important schedule milestones in a CMR project?
- 6. Project Management Technology
 - a. What technology is available to the project team today and how is it used? [Samples and demos would enhance the presentation]
 - i. Document Control systems
 - ii. PM systems [Constructw@re, etc.]
 - iii. Web cameras
 - iv. BIM models
 - v. PDAs
- 7. Project Staffing
 - a. How do you determine the staffing needs for a project?
 - b. How do you schedule and cost the project staff?
 - c. How can you build the esprit of the project team?
 - d. How can you train the project staff?
 - e. How do you manage a change in the project team?
 - f. How do you handle the young buck [recent COSC grad] versus the old guard situation?
 - g. How do you bring subs into the project team?
 - h. How do you bring the owner and designer into the project team?
- 8. Subcontracting, HUBs
 - a. How do you decide on the subcontract packages required?
 - b. How do you 'buy out' the job? How do you set the schedule?
 - c. What is the subcontractor procurement process?
 - i. RFP/RFQ. Who do you send to? What form does it take?
 - ii. Selection. Which sub is selected? How is this determination made?

- d. How do you handle the “Bid Shopping” ethical issue?
 - e. What is a HUB and why is it important?
 - f. How is HUB participation handled?
 - g. What do you do when a sub does not perform?
9. CMR contract provisions
- a. What are the standard forms of CMR contracts [AIA, DBIA, AGC, etc.] and which are preferred and why?
 - b. What are the contract provisions peculiar to the CMR process and what is their impact on the project?
 - i. Shared savings
 - ii. GMP requirements
 - iii. Open book requirements
 - iv. Preconstruction services
10. Professional written proposals and oral presentations.
- a. Organizing the team—who is included?
 - b. Avoiding the last minute crunch
 - c. Management approvals
 - d. Proposals:
 - i. Content
 - ii. Format
 - iii. Avoiding grammar errors
 - iv. Graphics and pictures
 - e. Presentations:
 - i. Power point vs boards, models
 - ii. Power point do’s and don’t’s
 - iii. Presentation content, and who presents?
 - iv. Room layout
 - v. Handling Q&A
 - vi. Handling Murphy’s Law
 - vii. Rehearsals
 - viii. Dress, name tags, leave behinds
 - ix. Asking for the order
11. QA/QC
- a. What is QA? QC?
 - b. Who is responsible for QA/QC?
 - c. What is a QA/QC plan? Who is responsible for writing it? Who is responsible for implementing it?
 - d. What QA/QC testing is normally required on a project? Who does the testing? Why do the contractor and the owner sometimes have duplicate tests?