



## **Beyond the Industry Advisory Board: Increasing the Role of Industry Engagement to Support Program Quality**

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Angela Acree Guggemos is an Associate Professor, Assistant Department Head and Undergraduate Program Coordinator of the Department of Construction Management at Colorado State University. She has Ph.D., M.S., and B.S. degrees in Civil and Environmental Engineering from the University of California, Berkeley. Her research focuses on the environmental and economic assessment of the built environment, modeling of life-cycle environmental and economic assessment, development of computer-aided environmental analysis and management tools, environmental performance measurement, international project management and education, and sustainable development. She has published peer-reviewed journal and conference papers on the life-cycle environmental implications and LCA of construction methods and materials, extended producer responsibility in the construction industry, environmental decision support tools, and integrating service-learning and sustainability in coursework. She has developed construction management curriculum for Egyptian, Palestinian, Tunisian, and US university students. Her research integrates concepts in economics, engineering, management, environmental science, and public policy. She has over five years of experience in the construction industry on tenant improvements, seismic retrofits, and historic renovations for commercial projects as well as sewer line maintenance and rehabilitation for a government agency. She has worked for contractors, owners, and construction managers.

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Dr. Khattab is a professor and head of Colorado State University's Department of Construction Management. He has more than 20 years of experience as a teacher, researcher, and consultant in construction project management. Dr. Khattab is a past president of the Associated Schools of Construction (ASC), an international educational organization that supports the advancement of construction education, serving more than one hundred fifteen schools across the United States. He has successfully led several international initiatives with department faculty and staff sponsored by the United States Agency for International Development (USAID) and the Education for Employment Foundation (EEF). Dr. Khattab's international effort in addressing challenges facing higher education and lack of employment in the Middle East was recognized by the Fulbright Commission. Dr. Khattab was named a Fulbright Specialist.

# **Beyond the Industry Advisory Board: Increasing the Role of Industry Engagement to Support Program Quality**

## **Abstract**

During the last number of years, States' support for higher education has declined significantly. Over the next decade, higher education will continue to face the challenges of state revenue funding constraints, changes in the public perception of higher education, and the effectiveness of higher education in preparing young men and women for a career after graduation.

With their natural connection to industry, engineering and construction education programs are poised to lead the way in a new model for the future of higher education. Construction management education by its nature is connected to the construction industry. In fact, construction management was created by the construction industry. As a result, today graduates from construction management programs across the U.S. enjoy almost 100% employment, higher salary than many other disciplines, and a great career. Construction management however does not truly fit the traditional model of higher education. Now, the traditional model of higher education is being challenged and this creates an opportunity for engineering and construction management education to introduce a model that connects the needs of the marketplace to the education provided to the students.

This paper examines one construction management program's approach to industry engagement throughout the program in order to increase the quality of education provided to the students. It highlights a cooperative partnership model between the academic program and the construction industry that goes beyond the limits of the traditional Industry Advisory Board of most engineering and construction programs. The results have been impressive for the program, the students, and the industry. The program has been able to stabilize its funding, improve the quality of the education for the students, and make a difference in the lives of those in need in the community. Students have received an excellent education with real-world applications not only on topics required by accreditation but in areas well beyond. Industry partners are hiring job-ready graduates who are poised to become the future leaders of the construction industry.

## **Introduction**

We are starting to see the questioning of the value of higher education<sup>1-3</sup>. Many students are graduating with significant debt and without well-paying jobs (or no jobs). Clearly there is a disconnect between academia and the marketplace. Higher education will continue to face the challenges of state revenue funding constraints, changes in the public perception of higher education, and the effectiveness of higher education in preparing young men and women for a career after graduation. With their natural connection to industry, often through industry advisory boards (IAB), engineering and construction education programs are poised to lead the way in a new model for the future of higher education.

Construction management education by its nature is connected to the construction industry. In fact, construction management as an undergraduate program of study was created by the construction industry. As a result of this strong tie to industry, today graduates from construction management programs across the U.S. enjoy nearly 100% employment, higher salary than many

other disciplines, and a great career. Construction management however does not truly fit the traditional, formal model of higher education. Now, the traditional model of higher education is being challenged and this creates an opportunity for engineering and construction management education to introduce a new education model that connects the needs of the marketplace to the education provided to the students through strong relationships with industry.

What is the construction industry is looking for from graduates? Much of what the construction industry desires of graduates is outlined in the technical and business topical content areas provided by the American Council for Construction Education (ACCE), the accrediting body for most construction management programs in the United States<sup>4</sup>. Table 1 lists the twenty Student Learning Outcomes (SLOs) for students graduating with a bachelor's degree from a construction education program.

*Table 1*

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***American Council for Construction Education student learning outcomes<sup>4</sup>***

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**Upon graduation from an accredited ACCE 4-year degree program, a graduate shall be able to:**

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1. Create written communications appropriate to the construction discipline.
2. Create oral presentations appropriate to the construction discipline.
3. Create a construction project safety plan.
4. Create construction project cost estimates.
5. Create construction project schedules.
6. Analyze professional decisions based on ethical principles.
7. Analyze construction documents for planning and management of construction processes.
8. Analyze methods, materials, and equipment used to construct projects.
9. Apply construction management skills as a member of a multi-disciplinary team.
10. Apply electronic-based technology to manage the construction process.
11. Apply basic surveying techniques for construction layout and control.
12. Understand different methods of project delivery and the roles and responsibilities of all constituencies involved in the design and construction process.
13. Understand construction risk management.
14. Understand construction accounting and cost control.
15. Understand construction quality assurance and control.
16. Understand construction project control processes.
17. Understand the legal implications of contract, common, and regulatory law to manage a construction project.
18. Understand the basic principles of sustainable construction.
19. Understand the basic principles of structural behavior.
20. Understand the basic principles of mechanical, electrical and piping systems.

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In 2012, the Construction Management (CM) program at Colorado State University, polled construction companies that recruit from the program. Table 2 summarizes the desired traits for graduates from the undergraduate program.

*Table 2: Construction industry desired traits for graduates of construction management undergraduate programs.*

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Communication and leadership  
Team work  
Time management  
Initiative  
Ethics and integrity  
Adaptation & relocation  
Career focus  
Emotional intelligence  
Listening

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Note that none of these traits are technical in nature. These are the soft skills that will enhance an individual's technical skills and propel them to continue growing in their careers.

Many universities struggle to update their programs to keep pace with the rapidly changing marketplace due to shrinking budgets that limit the ability to upgrade facilities or invest in new technology, or the long process of new curriculum approval (upwards of a year or more), as well as a lack of tenure-track faculty with industry experience. These same challenges are true for construction management programs across the country. This paper looks at how one construction management program addressed these challenges by increasing industry engagement to support program quality. It required a paradigm shift from considering industry as donors and recipients of our product to partners in the process to help produce quality graduates that can "hit the ground running."

### **Then: 2007 Challenges**

In 2007, our construction management program was at the center of a perfect storm. Our student numbers (over 1000) and student-to-faculty ratio (more than 90:1) were at all-time highs, while our budget had been repeatedly cut. Industry complained about the program quality. There was a real possibility of losing our program accreditation. Something needed to change. That is when the shift occurred. The department approached the industry with a proposal to be a partner in building a program of excellence. That opened the door for communication. It forced the department and industry to look at the program with a different lens. Industry, as recipients of our product (the graduates), decided to take a more active role in their development (beyond the IAB).

From meetings between the department and construction industry members, it was determined that to truly provide a quality education for our students, we needed to be strong in three areas: (1) faculty with industry experience, (2) state-of-the-art facilities, and (3) strong industry engagement in the program. See Figure 1.



*Figure 1:* A quality construction management (CM) education requires faculty with industry experience, state-of-the-art facilities, and strong industry engagement in the program.

By partnering with industry in all three areas, we have seen the quality of our graduates improve.

**Challenge: tenure-track faculty with limited industry experience**

Since our construction management program is at a Carnegie Very High Research Activity university, all tenure-track faculty are required to have doctoral degrees and maintain a sponsored research program in addition to their teaching duties. Although most of our tenure-track and tenured faculty have construction industry experience, few have more than 5 years of construction experience. We have found that the more industry experience a faculty member can bring into the classroom to supplement the core coursework, the better the students master the content. When students make the connection between course materials and real-life situations, they realize the importance of what they are learning. We have worked with industry on two fronts to increase the real-world content of our courses: (1) having tenure-track faculty participate in the Faculty Scholar Program, and (2) having industry members teach classes where our faculty have limited industry experience.

*Faculty Scholar Program*

The Faculty Scholar Program was introduced in 2010. It pairs a construction company with a tenure-track faculty member on a specific project over the course of a year. This provides a professional development opportunity for the faculty member to expand their industry experience and improve the department curriculum and construction practice. The industry sponsor receives assistance on a project that helps improve their construction or organizational processes. Not only has this program been mutually beneficial for the faculty member and the construction company, but the students have benefited from more current real-life examples and case studies in the classroom.

*Industry teaching courses*

In addition to enhancing our tenure-track faculty’s industry experience, we have also brought in industry experts to teach courses that our faculty have limited experience with the content areas. This has happened for two different types of content. In one case, we have a required undergraduate course on mechanical systems. We have struggled to find a tenure-track faculty

member who has mechanical industry experience. We have since partnered with the local Mechanical Contractors Association of America to have an industry expert teach the course. The department provides the syllabus for required content and a faculty member helps the industry member with any academic operational issues but the course is fully taught by the industry expert. These experts have brought current projects and real case studies into the classroom. This has improved students' understanding of current mechanical systems and the challenges they will face in coordinating these systems as part of a larger project.

Our curriculum focus has always been about the construction management basics. Due to rapidly changing technology and the associated costs with these systems, it has been a challenge for our faculty to remain "ahead of the curve" when it comes to technology in the construction management industry. For example, our scheduling course focuses on giving the students a strong understanding of the theory and application of scheduling for construction projects. Students are exposed to several scheduling tools but we do not promise them that they will be experts in any particular software. Time and budget also limit our faculty's ability to be experts in the current software programs in use. To give students exposure to state-of-the-art software, the department created targeted "boot camp" courses that are taught by industry experts. These courses are limited in size (less than 20 students) and are taught one night a week for five weeks. Industry provides the software and the case studies. Again, a faculty member is present to assist with any academic operational issues. Since these are not required courses in the program, they are not held to the typical curriculum approval process at the university which can take up to 1.5 years to approve. These short-term group study courses are dynamic and can easily change as the industry evolves. To date, we have held industry-led boot camps on the topics of building information modeling (BIM), scheduling, and estimating.

### **Challenge: state-of-the art facilities**

Budget remains to be a challenge at most universities. Funding facility upgrades often takes a back seat to covering salaries. The department has found unique ways to partner with industry to improve the quality of the program's facilities.

#### *Preconstruction Center*

One of the highest priorities of the department is to create and maintain an environment that will promote and sustain a first-rate educational experience for the students. In Fall 2009, the department celebrated the completed renovation of the old Industrial Sciences Building into the new Preconstruction Center. In addition to providing the faculty and students with a state-of-the-art learning facility, the Preconstruction Center demonstrates the enthusiasm and commitment of the industry partners to Colorado State University's CM department. The Preconstruction Center included the following additions to the program:

- Preconstruction laboratory
- Lecture hall
- Video conference classroom and lobby
- Classroom with state of the art technology access
- Technology laboratory,
- Preconstruction center

- Student study lounge
- Courtyard
- Conference room with video conference capability

The total cost of the facility renovation was about \$5 million. The project was the collective work of construction firms, industry organizations, and student groups that donated funds and in-kind support to refurbish the building. “It’s impressive that 170 companies and so many people saw a common need to preserve this space and make it beautiful and useful to our faculty and students once again,” said University President Tony Frank. “Their support and collaboration is more than just an investment in a building – it’s an investment in the long-term competitiveness of one of the nation’s top academic programs in construction management.”

### *BIM Lab*

In recent years, construction projects have increased in complexity, integrated project delivery has become more prevalent, and the use of technology has skyrocketed. The change in the marketplace creates a challenge and opportunity for construction education. In order to meet the industry’s needs for graduates with strong soft skills, leadership, and the ability to hit the ground running, partnership with the construction industry is not an option, it is essential.

In Fall 2013, following months of coordination, renovation, and technology and furniture selection, the new Mortenson Center for Virtual Design and Construction officially opened to students with a ribbon cutting ceremony on September 11. The new space provides interactive equipment that allows students to work more effectively with building information modeling technology. Currently, the CM Boot Camp courses are using the space to best facilitate collaboration on projects and assignments. The eventual goal is to have BIM integrated throughout the CM curriculum to allow students to stay current with trending processes and technologies utilized in the construction industry. “We are putting the world’s best technology into play at CSU so that students get to experience and interact with cutting edge tools that are going to define where our industry is going,” said Tom Gunkel, Mortenson CEO.

### *Upgrade Facilities*

Not only have our facilities been upgraded to facilitate learning, but it gives industry another venue to market to our students. It means a lot to students to see these construction companies actively investing in their education. Every single room in the department of Construction Management at Colorado State University is named after a CM industry partner. The industry takes pride, not only in what they build in our communities, but also how they represent their business to the future leaders in the industry in their classrooms through advertisement, messaging, furniture, and technology usage, all of which support and enhance the learning environment in the classroom. During 2014, almost every single classroom was upgraded and funded fully by each industry sponsor.

### **Challenge: industry engagement beyond writing a check**

In addition to their extensive efforts to increase industry experience in the classroom and update program facilities, our industry members have partnered with us in multiple ways to help increase the quality of the education our students receive. Similar to other construction management programs, we have an IAB that provides feedback on our program. The IAB is chaired by an industry member and twice a year the department faculty, staff, and students meet with them. There are three sub-committees under the IAB that are each chaired by an industry member and co-chaired by a department member: (1) Undergraduate Curriculum, (2) Recruitment and Diversity, and (3) Research and Outreach. In addition, an Executive Council for the IAB was created. This consists of a small group of prominent construction industry members and the department administration. They focus helping the department to achieve the program's mission, vision, and goals, particularly working at the levels of upper university administration.

#### *Competition team sponsor and mentors*

Like many CM programs across the nation, the CM program at Colorado State University supports and appreciates the learning that takes place during student competitions. The department, through the involvement of our industry partners, supports 14 different teams in regional and national competitions. The competition serves several educational and partnership purposes. From the educational aspect, competitions reinforce and expand on the teaching and learning that takes place in the classroom. It provides the students with the opportunity to engage in team building and experience the “real world” of the construction field. In addition, the competition provides the opportunity for the industry partners to interact directly with the students through the mentoring process that takes place prior to the competition. Such experience provides the opportunity for the industry members and students to learn about each other and expand the students' industry experience.

More importantly, industry partners' engagement with the student competitions opens the door for strengthening the relationship between the program as a whole and the industry. This happens through the discussions that take place at the industry advisory board meetings and with the department head on curriculum, communication skills, and any other topics to enhance the education provided to our students.

#### *Diversity Recruitment Coordinator*

The Department of Construction Management at Colorado State University has always prided itself on addressing the needs of our industry partners. One of these critical needs is a diverse workforce. The department asked members of the industry advisory board to fund a staff member recruitment and diversity position for the first two years with the department commitment to fully fund the position after the second year. Thanks to generous contributions from our industry partners, the department was able to secure the funds needed to create a position devoted to student recruitment and diversity. The new position focuses on marketing construction management education and a career in construction to underrepresented groups in high schools across the state of Colorado. One additional advantage of the new position is to address the lack of information available to high school graduates about construction management education. Over the past two years, the number of students in the CM program reporting as diverse has risen from 58 to 95, a 30% increase.

### *Sponsored speaker series*

In addition to guest speakers in classrooms, the program now has a sponsored speaker series to bring nationally-recognized construction leaders to campus to engage the students in discussions on the topics of leadership, construction trends, and current practice. This was the result from partnering with an alumni in 2013 to host industry speakers on campus and engage students in the possibilities of their future careers. “Colorado State University played an important role in my growth and education,” said the graduate. “I saw this speaker series as a way to support and deepen my connection with the University.” Students are responsible for identifying and nominating potential speakers, organizing the visit, marketing to students across multiple disciplines, and hosting the guest during their visit. In spring 2014, students brought two nationally-known construction leaders to campus including a vice president of Clark Construction and a senior executive of Fluor Construction. As a result of the success of the initial offerings, the sponsor decided to continue funding the speaker series. In addition, the department is currently working with industry to create an endowment to support the speaker series indefinitely.

### *CM Cares*

Industry has also partnered with the department to support our service learning initiatives. CM Cares, established in spring 2011, is a service learning program sponsored by the CM Department to infuse the traits of community service, leadership, team building and ethics throughout the culture of the CM program through construction-related community service projects. The program includes a Construction Leadership course involving guest lectures from industry leaders on the non-technical aspects of running a successful business, such as leadership, ethics, team building and creating company culture. Students from this course serve as leaders of the various CM Cares projects and work on identifying community members or agencies in need, fundraising, matching volunteers from specific CM classes to the projects’ needs, and mentoring and organizing the volunteers. Industry partners help throughout the process: planning, fundraising, obtaining building permits, and construction equipment and site volunteers. To date, CM Cares has completed 16 projects valued at over \$250,000<sup>5</sup>. As an example, in 2013, with the help of several construction companies, one of the CM Cares Leadership teams created a wheelchair-accessible, kid-friendly backyard space including a giant swing for James and Libby, twins who are both wheelchair-bound with cerebral palsy. This project was recognized by ABC national news for its impact<sup>6</sup>. Industry has recognized the impact that CM Cares has had on helping to create the future leaders of the construction industry by announcing a \$1 million endowment to support CM Cares.

### **Conclusion: Industry Transition from Donor to Partner**

These opportunities wouldn’t have been possible under the traditional one-way relationship of an IAB where their role is only advisory. The department changed the relationship with industry from a one-directional role of industry support to a mutually-beneficial industry-academy partnership. As a partner, industry members see the return on investment from upgrading classroom facilities, sponsoring faculty scholars and faculty internships, and engaging throughout the program, in the resulting higher quality of our graduates. Like the students, industry has gained a sense of pride and ownership in the quality of the program and the success

of the students. Our construction industry partners continue to rise to the challenge. They are fully committed to the success of our students.

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