

Colorado State University  
Department of Construction Management

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**Assessment Results  
and Action Plans**

Updated: Spring 2012

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## Senior Capstone Course - 2012

Each semester, students entering the Senior Capstone course (CON 465) are required to take a quiz at the beginning of the semester. The purpose of this quiz is to provide a quick assessment of their knowledge in various areas of construction. There are 30 questions covering eleven areas (Table 1). Students are given this quiz the second week of class as an unannounced quiz. It is also important to note that no reviews are given to prep students for this quiz. The percentage of students correctly answering each question is tracked and averaged across topical areas to determine the Average Percentage Correct (APC) score. Each topic area is assessed by 1 to 3 questions. APC scores above 75% are categorized as acceptable. APC scores below 60% are seen as deficient and APC score between 60% and 75% are considered marginal.

### Capstone Quiz Results

Table 1 provides the topic area included in the quiz, the number of questions used to assess each topic and the average percentage correct (APC) for each topic area. Of the 11 areas accessed, in four areas the APC was 75% or above. These were LEED (90%), Methods (87%), Safety (93%), and Scheduling (86%). These results indicate that students are retaining information related to these topics into their senior year. The two areas with an APC below 60% were: Codes (14%), Mechanical (33%), and Estimating (58%). Since the Mechanical and Electrical course is not required prior to taking the Capstone course, it is possible that the low APC for this area is directly tied to the number of students taking this course concurrently with the Capstone course. As a result, it is recommended that this question only be evaluated for those who have completed the Mechanical and Electrical course in the future. Codes had the lowest APC score of 14%. It is necessary to review which courses are addressing codes and to coordinate across these courses to ensure that students better understand building codes. The APC score for Estimating (58%) was just a few percentage points below the acceptable range. For the five other areas covered in the quiz, the APC was between 60% and 75%. Across all topic areas, APC was 66%.

**Table 1.** Structure of Capstone Quiz (CON 465).

<b>Topic</b>	<b>No. of Questions</b>	<b>Average Percentage Correct (APC) Across Questions Addressing Each Topic</b>
Administration	3	.69
Codes	1	.14
Contracts	7	.73
Estimating	3	.58
Finance	3	.62
LEED	1	.90
Math	5	.60
Mechanical	1	.33
Methods	1	.87
Safety	4	.93
Scheduling	1	.86
Average Across Topics	30	.66

### **Action Plans**

Following are the recommendations and actions resulting from the 2012 Capstone (CON 465) Quiz.

1. Course Revisions:

- a. Since codes are addressed in several courses, the Code questions will be discussed at the Fall 2012 faculty retreat to ensure that this topic is being addressed.
- b. Review the estimating questions and results with those instructors teaching the estimating courses prior to the Fall 2012 semester.

2. Capstone (CON 465) Survey Revisions:

- a. Review the topic areas included in the quiz and the number of questions related to each topical area with faculty.
- b. Each topic area should be accessed by a minimum of 2 questions.

## AIC Construction Fundamentals (CQE Level 1) Exam

Students in the CON 465 capstone course are strongly encouraged, but not required, to take the American Institute of Constructors (AIC) certification exam for its CQE Level 1 certification. This eight-hour exam gauges academic proficiency in 10 key areas of the CM profession. This paid exam provides students with the opportunity for individual CQE certification and its results are provided to the department by the AIC.

### Results

In March 2012, 63 CM students elected to take the AIC – CQE Level 1 Exam (Table 2). This was an increase of 19% from the previous semester, although the percentage passing the exam decreased. In November 2011, over 81% of CSU students taking the exam passed while only 70% passed in March 2012. For comparison, less than 60% passed the AIC – CQE Level 1 Exam.

**Table 2.** Number of students taking and passing the AIC – CQE Level 1 Exam.

	March 2012		November 2011	
	CSU	National	CSU	National
Number of Candidates Tested	63	1,271	53	728
Number of Candidates Passed	44	737	43	394
Percentage Passing	69.8%	57.9%	81.1%	54%

In all areas, the average score for CSU students taking the AIC – CQE Level 1 Exam was passing and above the national average. The average score for CSU candidates was in the top 25% percentile for several areas as denoted in Table 3. Project Administration is an area that CSU had scored in the top 25% in November 2011, but that dropped below that range in March 2012. There were three areas where scores were below the top 25% for both exams were. They are: (1) Communication Skills, (2) Materials, Methods, and Project Modeling and Visualization, and (3) Surveying and Project Layout.

**Table 3.** AIC – CQE Level 1 Exam scores.

Area Scores	March 2012			November 2011		
	CSU Average	National Average	Passing Score	CSU Average	National Average	Passing Score
Communication Skills	22.25	20.62	21	11.04	9.57	11
Engineering Concepts	22.35*	20.25	20	20.66*	18.81	19
Management Concepts	27.81*	25.83	25	9.64*	9.26	8
Materials, Methods, and Project Modeling and Visualization <sup>1</sup>	22.68	21.42	22	22.26	20.24	21
Bidding and Estimating	32.35*	29.86	30	39.06*	35.15	36
Budgeting, Costs, and Cost Control	20.63*	19.31	19	23.26*	22.26	22
Planning, Scheduling, and Schedule Control	36.75*	34.25	33	39.26*	35.94	35
Construction Safety	13.59*	13.05	13	16.04*	15.45	15
Construction Geomatics <sup>2</sup>	5.03	5.02	5	4.17	4.28	4
Project Administration	22.29	20.95	22	41.98*	39.30	39

<sup>1</sup> Previously referred to as Materials, Methods, and Plan Reading.

<sup>2</sup> Previously referred to as Surveying and Project Layout.

\* Average score was in the top 25%.

## Actions

The following recommendations and actions are based on the AIC – CQE Level 1 Exam Results

1. The results of the AIC – CQE Level 1 Exam have been shared with all faculty.
2. The combined results of the AIC – CQE Level 1 Exam will be reviewed at the Fall 2012 Faculty Retreat.
3. Breakout sessions will be held with instructors teaching courses related to the following areas to identify strategies for improving student performance in these areas:
  - a. Communication Skills
  - b. Materials, Methods, and Project Modeling and Visualization, and
  - c. Construction Geomatics.

## Alumni Survey - 2011

During the Spring 2011 semester, the Alumni survey was sent out to all program alumni that graduated in 2006 or earlier. A majority of the survey responses were from 2006 graduates, although there were responses from alumni as far back as 1977. A total of sixty-four surveys were completed from alumni working for 43 different companies and across 13 states. The majority of alumni reported being employed in project management positions, although alums held a variety of other construction related positions (Table 4).

**Table 4.** Self-Reported position held by CM Alumni (Alumni Survey Results, 2011.)

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Project Management (21)	Regional/Division Manager (3)
Estimating/Procurement (7)	Marketing/Business Development (1)
Business Owner/Self Employed (6)	Services (1)
Company Executive (5)	Other (10)
Field Supervision (5)	

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The majority of respondents (31%, n= 20) had salaries between \$90 – 120k. Twenty-three percent (n = 15) has a salary between \$70 – 89k and 21.8% (n = 14) had salaries over \$120k. The high percentage of salaries over \$120k in this response group is likely due to the broad range of alumni who responded to the survey.

### Survey Results

Questions 1 through 22 of the survey asked respondents to indicate:

- (a) if particular courses had been significant to their professional career (Q1 – 11) and
- (b) how well prepared they felt they were in each course area (Q12 – 22).

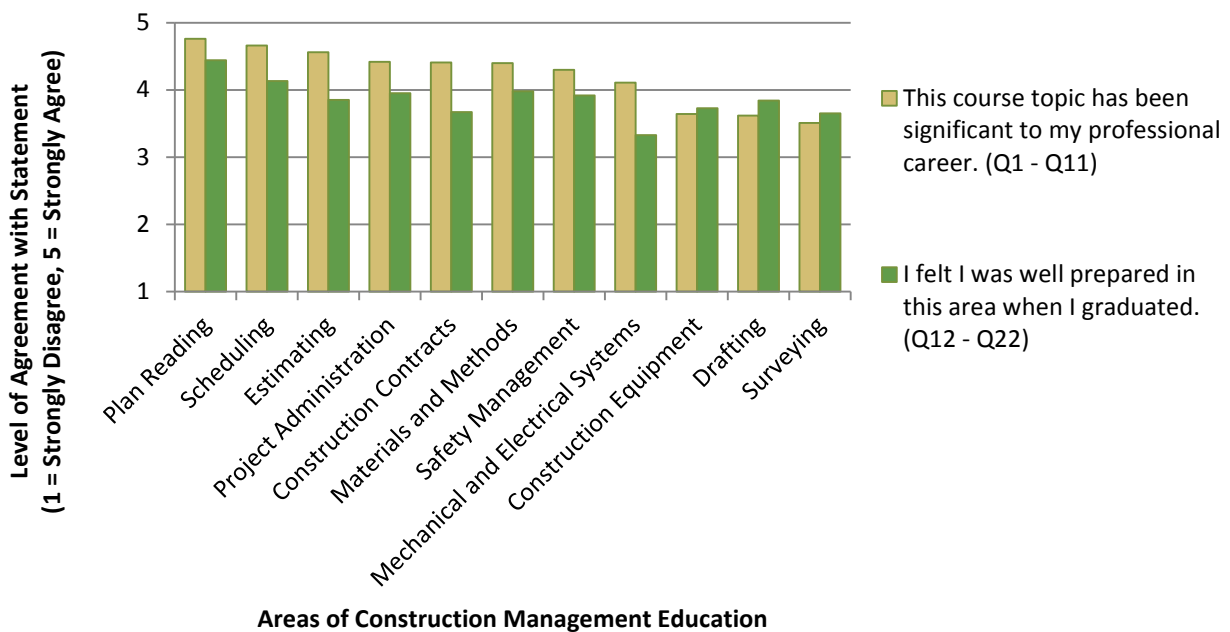
Responses used a 5-point Likert Scale ranging from ‘Strongly Disagree’ (1) to ‘Strongly Agree’ (5). Overall responses are shown in Figure 1 and in Table 5. For data analysis, respondents were grouped by year of graduation resulting in three groups:

- All Graduates: 1977 – 2006 Graduates,
- Group 1: 1977 – 2004 Graduates, and
- Group 2: 2005 and 2006 Graduates.

The responses in Figure 1 are organized by overall “perception of importance”. Many respondents indicated that they considered the majority of construction courses taught in the CM program to be significant to their professional career. The majority of scores ranged from ‘Agree’ to ‘Strongly Agree’ (Figure 1 and Table 5). Only three areas were slightly outside the

'Agree' to 'Strongly Agree' response range. These were Construction Equipment (M = 3.4), Drafting (M = 3.4), and Surveying (M = 3.3). The responses for Drafting were likely impacted by use of the term 'Drafting', which for many implies hand drafting and does not adequately reflect how this area has evolved to include CAD and 3-D modeling.

When asked about their level of preparation in the various areas of the CM program, the majority of responses were again in the 'Agree' to 'Strongly Agree' range, although the range was more heavily weighted toward 'Agree' (Figure 1 and Table 5). The areas with the lowest responses were Mechanical and Electrical Systems (M = 3.2), Construction Equipment (M = 3.4) and Surveying (M = 3.4). These were the same three areas that scored low in the area of significance as well.



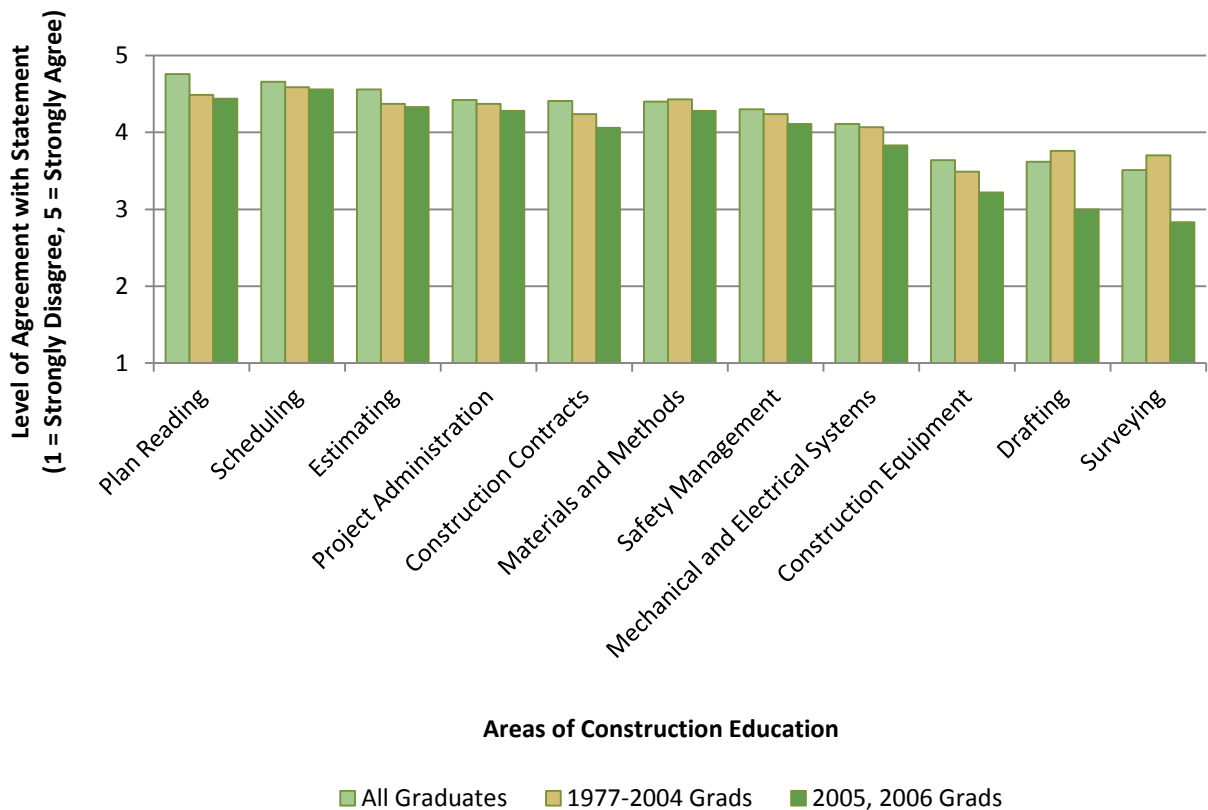
**Figure 1.** Responses to questions 1-22 of the 2011 CM Alumni Survey for all graduates.

When graduates were separated based on their year of graduation, there was an overall decline from the 1977 – 2004 Graduates to the 2005 and 2006 Graduates in the **significance rating** of each construction area to their professional career (Q1 – Q11). Although the difference between groups was small for the majority of educational areas, those who graduated in 2005 and 2006 tended to place less significance on each educational area than those alumni who graduated between 1977 and 2004 (Figure 2 and Table 6). The only statistically significant differences found were for Drafting and Surveying. The 1977 – 2004 Graduates tended to agree that Surveying was important to their careers (M = 3.7), while the 2005 and 2006 Graduates



slightly disagreed (M = 2.8). Two possible reasons for this result are (1) equipment used and (2) structure of labs. The surveying equipment used to teach the surveying class had not been upgraded in several years. As a result, the equipment used to teach students was not the same type of equipment being used in industry. Additionally, the lab activities are not tied to building projects. This may make it difficult for students to translate what they are learning in this course to what they experience on a construction site.

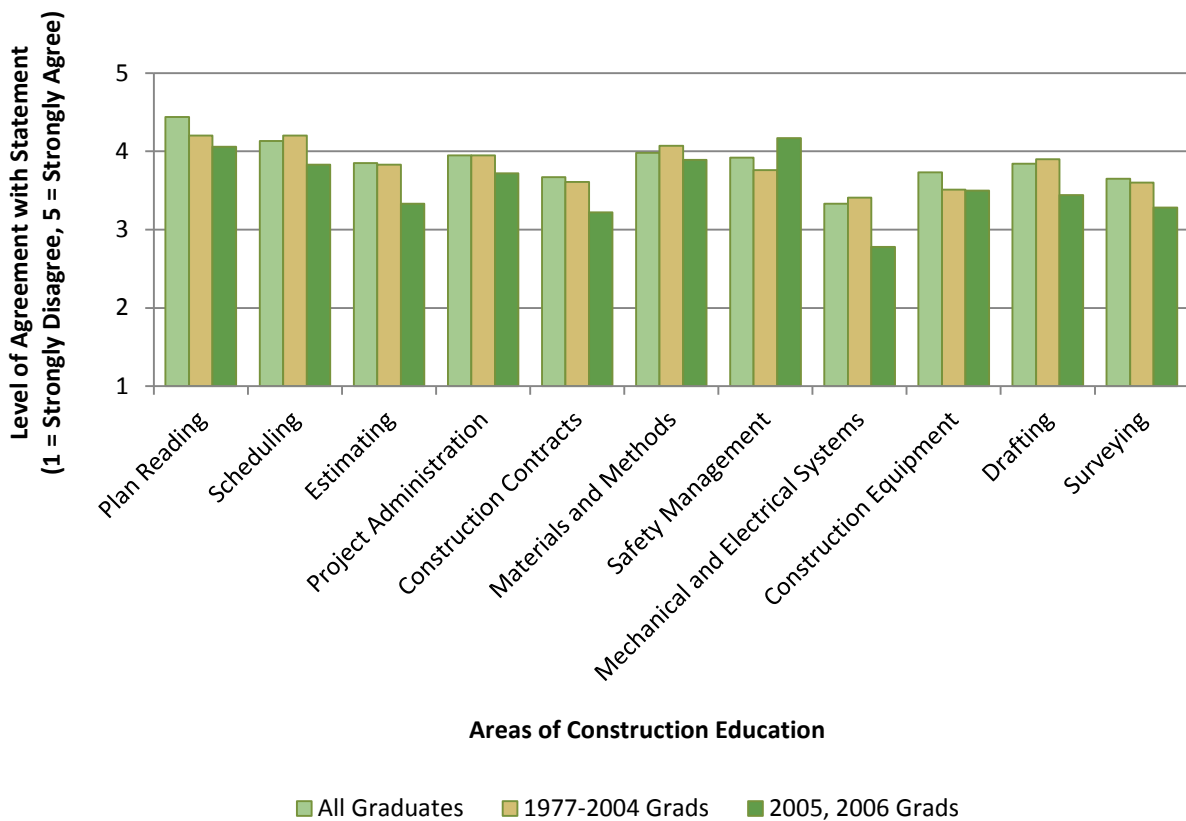
A similar difference was also found in Drafting. Those who graduated between 1977 and 2005 tended to agree that Drafting was significant to their professional careers (M = 3.8). While those who graduated in 2005 and 2006 were neutral about the importance of Drafting (M = 3.0). One possible reason for the decline in Drafting could be the category wording. It is likely that many respondents interrupted this term as only referencing hand drafting. Other areas that also declined were Construction Equipment and Mechanical and Electrical Systems, although these differences were not found to be statistically significant.



**Figure 2.** Alumni ranking of the significance of each construction management education area to their professional career (Q1 – Q11) grouped by graduation year.

When asked about how well-prepared they were in each of the construction education areas, the 2005 and 2006 Graduates again tended to give a lower rating than the 1977 – 2004 Graduates (Figure 3 and Table 6). Two exceptions were Safety Management, which increased and Construction Equipment, which stayed the same. While both groups of graduates agreed that they were well prepared in the area of Safety Management, those who graduated in 2005 and 2006 gave a much higher rating for this area (M = 4.2) than those who graduated between 1977 and 2004 (M = 3.8) signifying that this course is doing a better job of preparing students for Safety Management.

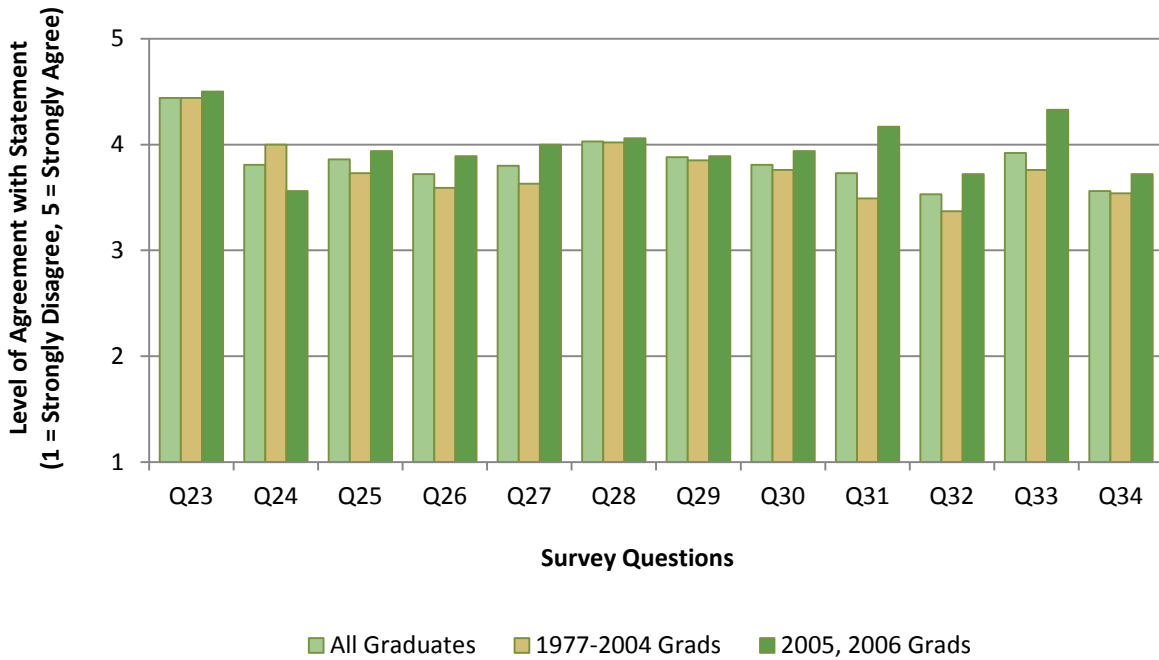
In all other areas, the 1977 – 2004 Graduates rated their preparation higher than the 2005 and 2006 Graduates; however, the only statistically significant differences found were for Mechanical and Electrical Systems, and Drafting (Figure 3 and Table 6). Those who graduated between 1977 and 2004 agreed that they were well prepared in the area of Mechanical and Electrical (M = 3.4), while the 2005 and 2006 graduates slightly disagreed (M = 2.8). Similarly, the 1977 – 2004 Graduates agreed (M = 3.9) that they were well prepared in the area of Drafting, while the 2005 and 2006 Graduates tended to be more neutral (M = 3.4).



**Figure 3.** Alumni ranking of how well they were prepared in each area when they graduated (Q11 – Q22)

grouped by graduation year.

Survey questions 23 through 34 addressed various elements of graduates' educational experience while they were a student in the CM Department at CSU. The purpose of these questions is to address the quality of graduates' educational experience across the board. A list of the questions is provided in Table 7. Overall, the 2005 and 2006 graduates tended to respond with a higher rating to each question than those who graduated between 1977 and 2004 (Figure 4 and Table 7). The one exception is Q24, which addresses the academic rigor of the construction courses. The 1977 – 2004 graduates agreed (M = 4.0) that the academic rigor of CM courses was appropriate. While the 2005 and 2006 graduates still agreed with this statement, their mean response was lower (M = 3.6). Due to the question wording, however, it is not possible to discern if they felt the rigor was too high or too low.



**Figure 4.** Responses to Question 23 – Question 34 grouped by graduation year.

Overall graduates felt that faculty members for construction courses were very knowledgeable about their course material (Q23). Areas of significant change between graduate groups were related to placement assistance (Q31) and leadership opportunities available to students (Q33). In both Q31 and Q33, there was a statistically significant increase in graduates' level of agreement with these questions from the 1977 – 2004 graduates to the 2005 and 2006 graduates. This indicates a significant increase in the quality of placement assistance provided to students and a significant increase in the number of leadership opportunities available to

students. Interestingly, the percentage of graduate reporting club involvement stayed flat between the two groups. This can be interpreted as an indication that the overall percentage of the students involved in clubs remained constant as the total number of students within the program was increasing.

## **Action Plans**

Following are the recommendations and actions resulting from the 2011 Alumni Survey.

1. Revisions to incorporate into the next survey:
  - a. Survey questions related to Drafting need to be revised to better reflect current practices. The term drafting conveys that the work is done by hand and does not accurately reflect the incorporation of CAD, 3-D and BIM technologies. As a result, the survey results related to Drafting are inconclusive.
  - b. Revise Q24 about rigor to allow respondents to indicate if the rigor was too low or too high.
  - c. Re-administer the survey annually to graduates who have reached the 5-year mark.
2. Course Revisions:
  - a. Based on the survey responses, the following courses will be evaluated to make them more reflective of the skills and knowledge needed by graduates to be successful and to ensure that they are well prepared in these areas.
    - i. Construction Equipment: This course curriculum will be reviewed by the PADB Curriculum Review Committee in Fall 2012.
    - ii. Drafting: The department has been working with industry to educate students about the advances in drafting. These include 3-D modeling, CAD, and integration of BIM technologies. Additionally, students have the opportunity to learn more about the application of these technologies through workshops organized by department faculty and industry experts that are specific for CM students.
    - iii. Mechanical and Electrical: This course was revised and a new curriculum implemented in 2006. It was also reviewed by the PADB Curriculum Committee in Fall 2011.
    - iv. Survey: New total stations were purchased and incorporated into this course in 2011. The course activities will be revised in Fall 2012 to better reflect surveying activities graduates will encounter on a construction site.

## Supporting Tables

**Table 5.** Responses to Survey Questions 1-11 by year of graduation (Alumni Survey, 2011).

	ALL Grads			2005 and 2006 Grads			1977 – 2004 Grads		
	N	M	SD	N	M	SD	N	M	SD
<b>This course topic has been significant to my professional career: 1 = Strongly Disagree, 5 = Strongly Agree</b>									
Q1. Construction Contracts	64	4.2	1.3	18	4.1	1.4	41	4.2	1.3
Q2. Construction Equipment	64	3.4	1.5	18	3.2	1.6	41	3.5	1.4
Q3. Drafting	64	3.4	1.4	18	3.0	1.6	41	3.8	1.2
Q4. Estimating	64	4.3	1.2	18	4.3	1.2	41	4.4	1.2
Q5. Materials and Methods	64	4.3	0.9	18	4.3	0.8	41	4.4	0.7
Q6. Mechanical and Electrical	64	3.9	1.3	18	3.8	1.5	41	4.1	1.1
Q7. Plan Reading	64	4.4	1.4	18	4.4	1.5	41	4.5	1.3
Q8. Project Administration	64	4.3	1.2	18	4.3	1.0	41	4.4	1.1
Q9. Safety Management	64	4.1	1.2	18	4.1	1.2	41	4.2	1.1
Q10. Scheduling	64	4.5	1.0	18	4.6	0.6	41	4.6	0.9
Q11. Surveying	64	3.3	1.5	18	2.8	1.5	41	3.7	1.4

**Table 6.** Responses to Survey Questions 12-22 by year of graduation (Alumni Survey, 2011).

	ALL Grads			2005 and 2006 Grads			1977 – 2004 Grads		
	N	M	SD	N	M	SD	N	M	SD
<b>I feel I was well prepared in this area when I graduated: 1 = Strongly Disagree, 5 = Strongly Agree</b>									
Q12. Construction Contracts	64	3.5	1.3	18	3.2	1.5	41	3.6	1.2
Q13. Construction Equipment	64	3.4	1.2	18	3.5	1.2	41	3.5	1.2
Q14. Drafting	64	3.7	1.3	18	3.4	1.2	41	3.9	1.1
Q15. Estimating	64	3.7	1.4	18	3.3	1.5	41	3.8	1.3
Q16. Materials and Methods	64	3.9	1.0	18	3.9	0.9	41	4.1	0.8
Q17. Mechanical and Electrical	64	3.2	1.3	18	2.8	1.2	41	3.4	1.2
Q18. Plan Reading	64	4.1	1.4	18	4.1	1.4	41	4.2	1.3
Q19. Project Administration	64	3.8	1.1	18	3.7	0.9	41	4.0	1.0
Q20. Safety Management	64	3.8	1.2	18	4.2	1.2	41	3.8	1.1
Q21. Scheduling	64	4.0	1.1	18	3.8	0.9	41	4.2	1.0
Q22. Surveying	64	3.4	1.3	18	3.3	1.2	41	3.6	1.2

**Table 7.** Responses to Survey Questions 23 – 34 by year of graduation (Alumni Survey, 2011).

	All Grads			1977-2004 Grads			2005 and 2006 Grads		
	N	M	SD	N	M	SD	N	M	SD
<b>Please indicate your level of agreement with the following statements: 1 = Strongly Disagree, 5 = Strongly Agree</b>									
Q23. Faculty members for construction courses were very knowledgeable about their course material.	64	4.4	0.7	18	4.5	0.7	41	4.4	0.6
Q24. Academic rigor of construction courses was appropriate.	64	3.8	1.0	18	3.6	1.3	41	4.0	0.8
Q25. There were ample opportunities for "hands-on" experience in construction courses.	64	3.9	0.9	18	3.9	0.7	41	3.7	0.9
Q26. Overall quality of building facilities was high.	64	3.7	1.0	18	3.9	1.0	41	3.6	1.0
Q27. I had ample access to computing resources.	64	3.8	0.9	18	4.0	1.0	41	3.6	0.9
Q28. My construction courses utilized current software.	64	4.0	0.9	18	4.1	0.9	41	4.0	0.9
Q29. The level of technology utilized in construction courses was appropriate.	64	3.9	0.9	18	3.9	1.1	41	3.9	0.9
Q30. I received excellent academic advising.	64	3.8	1.0	18	3.9	0.9	41	3.8	1.0
Q31. I received excellent placement assistance.	64	3.7	1.2	18	4.2	0.9	41	3.5	1.2
Q32. I had ample opportunities for exploration of individual construction interest areas.	64	3.5	1.1	18	3.7	1.1	41	3.4	1.2
Q33. There were ample leadership opportunities for students in student clubs and competitions.	64	3.9	0.9	18	4.3	0.8	41	3.8	0.9
Q34. Students' opinions were solicited and valued by the department.	64	3.6	0.9	18	3.7	1.0	41	3.5	0.8

## **Open Forum**

The department head conducts an open forum each semester, consisting of a brief presentation of the department's status followed by a question and answer session. This forum is between the department head and the students. Faculty are specifically excluded to allow students to speak freely about courses. Student attendance at this event has fluctuated significantly over the last few semesters. In order to increase participation, the CM Board of Directors (BOD), which represents the 11 CM clubs within the Department, has been given more responsibility for organizing and advertising this event with support from the department. The topics discussed include department updates, strengths and weaknesses of courses, feedback on department direction, etc. The questions, concerns and praise are discussed in subsequent faculty meetings.