

A Study of ASC Construction Management Programs' Curricula Content as of December 2011

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Universities with Construction related Bachelor degree programs may be members of the Associated Schools of Construction (ASC). This organization is a gathering of like programs in terms of content. Comparison of similar programs can be helpful when seeking support for curricular changes of a program, justification for number of credit hours in a program, or to evaluate whether there might be a need for a specialty focus. Data on the percentage of programs offering similar courses were gathered using ACCE grouping. ACCE has the most detailed requirements in terms of content for course groupings by type. This was used due to the study findings that there were 69% of the programs accredited, or will be getting ACCE accreditation while 70% went with ABET, and 17% ATMAE aligned. Additionally, the average number of credit hours to obtain a degree was 126.2 hours; only 18% of the programs in the study required the minimum of 120 credit hours for a degree. Some results of this study correlated with past published papers, but others did not. More study needs to be done to determine core courses and commonality in Construction Management programs since this study only gathered data on courses offered in programs.

Key Words: Construction Management; Curricula; Associate Schools of Construction

Introduction

Curricular content in construction programs change due to many reasons including industry trends, state policies, institutional initiatives, and program faculty. This study was conducted to determine typical Construction Management program content per listed members of the Associated Schools of Construction (ASC) located in the United States using the website www.ascweb.org. The ASC Construction Management member programs used in the study were reviewed for total program hours, accrediting organization, and content hours covering various common subject areas. Programs not included in the study were those that were not located in the United States, Associates Degree programs, those that did not have a comprehensive major in Construction Management, or were engineering programs. Thus, 116 of the 131 listed ASC programs as of December 2011 were included and summarized by curricular content. A list of the university programs included in this 2011 study is available in the Appendix.

This paper summarizes the 116 ASC Construction Management member programs' curricula, by courses within the major content areas. It also summarizes the accrediting groups and their representative percentage among the Construction Management programs included in the study, the correlation (if any) between the accrediting groups and program credit hours, the percentage of programs with certain areas of course content, and the hours of content coverage in some of the major topic areas. This data will be compared to data reported in previous ASC articles about specific areas of content or course topics. The data for this study was collected by utilizing the ASC member program websites, their corresponding department websites, and university course catalogs.

Literature Review

A search for published journal articles or books published on ASC four year Construction Management programs' overall curricular content turned up no results. Thus, the author searched the ASC Archives for any past articles on member programs' content and found that they were several published proceedings papers; however, these were focused on specific course topics or topic areas and not overall program content. Previously published papers on

ASC program content include works by: Burt, R., Hatipkarasulu, R., & Nobe, M. (2008); Chini, S. A. (1995); Clarke, S. (2003); Gehrig, G. B. (2005; Hein, M., & Williams, S. (1990); Jackson, B. (2003); Johnson, B., & Gunderson, D. (2009); Lew, J., & Achor, D. P. (1994); Rounds, J. (1992); and, Senior, B., & Hauck, A. (2000). These published articles are referred to in the Results section below where appropriate.

Methodology

The study was conducted using the ASCweb.org site to determine ASC members as of December 2011. Program content of member organizations was determined by their department, or program websites, as well as utilizing individual online university course catalogs. Only Construction Management focus programs were included, irrespective of program title. Accreditation was determined by program websites, departmental websites, university course catalogs, accreditation group websites (as listed in the References), or by contacting the appropriate ASC program faculty member, identified by the ASC website.

Limitations

The author of this paper does not guarantee the accuracy of the information gathered from the member program websites, as many were difficult to navigate. Additionally, these websites may not have been well maintained over time, and may not have had current program information. While many programs have similar course content, the course titles may vary, so to counter this dilemma the author attempted to group courses by content similarities, not just course titles. Actual course content may not be reflected in course titles or descriptions listed for each program; thus, courses were grouped according to published information. Not all elective courses were listed within the program content, such as Ethics or Humanities, which made it difficult to compare program similarities outside the major Construction Management courses included in each program. For reference, both Accreditation Board for Engineering and Technology (ABET) and American Council for Construction Education (ACCE) require coverage of professional Ethics either through a single course, or through a minimum number of content hours spread across many courses. The Ethics courses are not accounted for in the Construction courses area of study in this paper, but rather, were accounted for in the General Education courses data collected for each program. It was not differentiated between whether the curricular courses were specifically required by the program or whether they were electives.

Results

Accreditation

Of the 131 identified four-year institutional members of the ASC as of December 201, the author included 116 programs for data collection in this study. Fifteen programs were rejected due to: being an International program; all appropriate program data was not available; the program was not being a comprehensive Bachelor of Science degree; or the program was not Construction Management, but rather was Engineering. However, Engineering Technology programs were included in the study. As a comparison, Johnson & Gunderson (2009) reported 126 ASC Schools, Gehrig (2005) reported 111 accredited programs members of ASC per 2003 data, and Jackson (2003) reported 88 four-year schools as members issuing Bachelor degrees.

The breakdown of the number of programs included in the study from the seven ASC regions can be found in Table 1 below, along with the accreditation data for each respective region. Of the 116 Construction Management programs included in this study, the Total column shows that 81 programs (70%) have, are in the process of, or intend to get, ABET accreditation; and 80 programs (69%) have, are in the process of obtaining, or intend to get ACCE accreditation. Only 17 % of the programs included in the study had the Association of Technology, Management and Applied Engineering (ATMAE formerly NAIT) accreditation. The programs for which data was not found concerning accreditation were sent emails directed to the ASC listed program administrator that requested the information. Those remaining programs reported they were either not accredited (2%), or did not respond (4), and thus were not included in the percentage calculations for this portion of the study. Johnson and Gunderson (2009) found that of their 43 survey responders from 126 ASC programs, 65.1% were ACCE, 14% were ABET, and

16.3% were non accredited. In comparison to the data collected for this study and Johnson & Gunderson's (2009) results, Gehrig (2005) reported that of the 111 ASC programs in his study, 50.5% were ACCE accredited, 42.3% were ABET, and 7.2% were NAIT (currently ATMAE) accredited, per 2003 data.

Table 1. ASC program Accreditation Breakdown as of December 2011.

ASC By Region	**Northeast**		**Southeast**		**Great Lakes**		**North Central**		**South Central**		**Rocky Mountain**		**Far West**		**Total**
# Programs	19		16		22		14		15		17		13		116
ABET	7	37%	13	81%	15	68%	9	64%	13	87%	12	71%	12	92%	70%
ACCE	16	84%	13	81%	17	77%	7	50%	8	53%	10	59%	9	69%	69%
ATMAE	1	5%	2	13%	7	32%	7	50%	0	0%	1	6%	2	15%	17%
Dual	6	32%	10	63%	11	50%	8	57%	6	40%	7	41%	9	69%	49%
None	1	5%	0	0%	0	0%	0	0%	0	0%	0	0%	1	8%	2%

This December, 2011 study also found that 49% of the programs were dual accredited, most of them being ABET/ACCE, but many also having ABET/ATMAE, and ACCE/ATMAE dual accreditations.
Johnson & Gunderson (2009) reported that 4.7% of the 43 programs in their study were dually accredited by ACCE and ABET.

Since the majority of academic programs included in this study were accredited by either the ABET or ACCE, and because neither ABET nor ATMAE accreditation requires minimum content coverage for any specific topic for their accreditation, categories according to ACCE groupings, as listed in the website www.acce-hq.org, were used to report program areas of content in the following sections of this paper.

Construction Science Courses

Construction Science courses, per ACCE, include those that fit in general groups of Fundamental Design Theory, Analysis and Design of Construction Systems, Construction Design, Construction Materials and Equipment, Graphics, and Surveying. This group of courses must total a minimum of 20 semester hours or 30 quarter hours. This is down from 24 semester hours (36 quarter) required by ACCE as of 1989 standards (Hein & Williams, 1990).

Fundamental Design Theory courses which include, but are not limited to statics, strength of materials, dynamics, thermodynamics, soil mechanics, hydraulics, and hydrology are limited to a 3 credit hour minimum coverage in ACCE programs. This study results include:

- 9% of programs include a Construction Problem Solving course
- 27% of programs have a combined Statics and Strength of Materials course, while 28% have a separate Statics course, 20% have a separate Strength of Materials course
- Only 13% of programs report a Temporary Structures course
- 54% require some sort of Soils/Foundations course
- 16% require a Site Analysis course

Per Chini's 1995 paper there were 61 member programs in ASC. Of those: 93.4% had Statics, 88.5% Strength of Materials, 47.5% had Structural Design, and 24.6% included a Temporary Structures course. In Clarke's (2003) study of 52 ACCE accredited programs 85% had Statics and Strength of Materials, while Temporary Structures were only taught in 15% of the programs. See the Appendix for the ASC member programs included in this 2011 study along with those reported in Chini's (1995) and Clarke's (2003) studies.

Examples of courses, per ACCE that fit in the remaining *Construction Science* areas include Structural, HVAC, Plumbing, Mechanical, Electrical, Roadways, Drainage, Utilities, Temporary Facilities, Rigging, Formwork, Scaffolding, Foundations, Construction Surveying, Construction Graphics, Construction Materials, Assembly Techniques, Equipment Selection, Components and Materials Testing, Project Development, Feasibility Studies, Value Analysis, Site Planning, Building Codes, Inspection, Basic Elements of Building and Site Design, and Architectural or Engineering electives. Per this December 2011 study:

Analysis & Design of Construction Courses:

- 54% of programs had Structural Analysis and Design courses
- 38% of programs included Concrete and Aggregates courses
- Combination Electrical & Mechanical systems were in 40% of programs, while 28% have separate Electrical systems, 31% Mechanical systems, and 29% Environmental systems courses
- 33% of programs had a Construction Information Technology course
- Sustainable Construction courses were in 17% of programs

Construction Materials and Methods Courses:

- 85% of programs had courses on Materials and Methods, 30% had Construction Equipment courses, and 18% included Building Systems courses

Construction Surveying

- 83% of programs included surveying courses, at an average of 3.2 semester hours (ACCE requires a minimum of 1 semester coverage in this topic).

Construction Graphics:

- 24% of programs included a course on Building Codes, 73% Architectural Drafting, 6% Residential Architecture, 3% Commercial Architecture, and 28% offered Building Information Modeling (BIM) for an average of 3.9 semester hours

Johnson and Gunderson (2009) reported the results of their survey sent to 126 ASC program Administrators in which they received 43 responses. They found that as of that time only 17 programs of those responding offered stand-alone courses on sustainable materials and methods. Additionally, it was reported that 12 or 27.9% of the responding programs had sole focus courses on Building Information Modeling (BIM); however, 22 programs had courses with partial focus on BIM.

Rounds (1992) expounded upon the overwhelming need for major specialty courses in Construction Management programs of the 1990's and beyond. Lew and Achor (1994) sent out 90 surveys to U.S. colleges and universities and had a 61% response rate concerning their program content coverage of mechanical or electrical systems. The survey responses indicated that 71% of programs offered one or both Mechanical and Electrical systems courses, while 14.77% offered 3 or more courses, and 8.8% had no courses on these specialty areas.

Construction Courses

Courses concerning Estimating, Planning and Scheduling, Construction Accounting and Finance, Construction law, Safety, Project Management are grouped into the ACCE category of *Construction Courses* with a minimum of 20 semester hours (30 quarter) content. Course titles in these categories include Quantity Surveying, Pricing Manpower Estimates, Bid Compilation, Bidding Strategy, Scheduling, Purchasing, Expediting, Project Budgeting, Cost Control, Cash Flow, Construction Safety or OSHA, Work Analysis, Field Records, Quality Control and Assurance, Job Supervision, Productivity, Orientation, Drawings and Specifications, Contract Documents, Computer Applications in Construction, Specialty Construction such as Mechanical, Electrical, Process Plant Construction, Roadways, Construction Work Experience, and Construction electives.

Data collected from the 116 ASC member Construction Management programs as of December, 2011 found:

- 55% of programs had courses on Drawings and Specifications
- 47% had Contract Documents courses
- 27% had Heavy/Highway specialty courses
- 16% had Commercial construction courses
- 7% had Industrial Construction courses
- 13% had courses in Real Estate analysis
- 28% had courses in Cost Management, 21% Finance in Construction, and 24% Economics of Construction
- 3% listed courses in Entrepreneurship
- 75% of programs listed Safety courses (ACCE requires at least one semester course)
- Only 9% of programs reported courses in Quality
- 6% of programs had Risk or Insurance courses
- 49% offered courses in Construction Law topics

- 52% offered Construction Management, 25% Construction Administration, and 48% offered Project Management content courses
- Project Controls courses were offered by 51% of programs (average of 4.7 hours of content) and 82% of programs offered Scheduling and Planning courses (3.1 averaged hours of content)
- 90% of programs offered Estimating, with the average estimating content coverage of 4.7 semester hours

In addition to courses noted above, this study found that 42% of the 116 programs reviewed offered Technical Writing or Writing in Construction courses; 13% offered some type of Professional Development or Senior Seminar course, and 18% included courses in Construction Leadership. Accreditation requirements may also require a capstone course. Of the 116 programs 31% listed a Capstone course (average 3.2 hours), and 24% a Senior Project requirement (average 3.6 semester hours). Lastly, many programs still have room in their programs for Major Electives (44% with average 9.2 semester hours), Special Studies in Construction courses (15% with average 5.9 semester hours), and Special Topics in Research (1% for 6.6 average hours). Internships were included in 34% of the 116 programs with an average of 3.2 semester credit hours.

Program Hours

Many Construction Management programs in the last decade have been asked to reduce program hours down to the minimum accepted by their state or accreditation group, typically 120 credit hours, in order to remain competitive with similar programs in their regions. The programs at Colorado State University did this in 2000 (Senior & Hauck, 2000) and Texas A&M University in 2007 (Burt, Hatipkarasulu & Nobe, 2008). The authors of this study found that as of December 2011, only 21 of 116 programs required the minimum of 120 semester credits (180 quarter units) for a degree. This is also the minimum number of credits required by both ACCE and ATMAE accredited programs for a Bachelor of Science degree. Six of those particular programs were located in the ASC Rocky Mountain region, while five were in the ASC Great Lakes region. The others were spread amongst the remaining ASC regions. No correlation was observed between the number of program credits and the accreditation that program received. The average ASC program total semester credit hours was found to be 126.2, as seen in Table 2 below along with the average number of credit hours in each respective ASC region.

Table 2. Average ASC member BS program credit hours as of December 2011.

ASC Region	**Northeast**	**Southeast**	**Great Lakes**	**North Central**	**South Central**	**Rocky Mountain**	**Far West**	**Total ASC**
Ave. # Program Credit Hrs. (semesters)	129.7	125.4	124.3	127.2	123.8	125.7	128.3 Sm Hrs./ 189.2 Qtr. Hrs.	126.2
Regional Ave. per # Programs with Semesters	18	16	19	14, One 5 yr. program	15	15	8; 5 w/ Qtrs.	105 w/ Sem. (5 Qtr. not in Total Ave.)

Conclusions

This paper is limited to the information available on program websites and in online course catalogs at the time of data collection. Actual course content may not be reflected in published course titles or descriptions listed for each program; thus, courses were grouped according to published information. Also, course offerings were noted, not whether they were required core courses or elective courses. ACCE course groupings per subject matter were used since they were the most stringent guidelines and reflect 69% of programs' structure in the study.

One observation of this study compared to past research as noted previous published papers, is that membership in the Associated Schools of Construction is growing. Membership programs include Engineering, Engineering

Technology, Building Science, Building Construction and Construction Management titles. The majority of programs are still ACCE or ABET accredited, but the percentage of accredited programs have grown. Dual accreditation as well as the number of ATMAE accredited construction programs have increased according to available data. The total credits required for graduation, at over 126 semester hours, is more than the 120 hours that some programs have been pushed to reduce their content down to meet. In fact, only 18% of the 116 programs in the study on required 120 semester credit hours for a degree.

Construction Management program course titles varied significantly, and because of this variability determining a content category name was important to ensure that similar courses would be grouped together as often as possible. The course content groupings selected can be observed in the lists on previous pages, but were grouped according to ACCE examples of courses per category. Because course content descriptions were often vague, or nonexistent in catalogs or program websites, the author had to make judgment calls when selecting what courses belonged in which category. It was not noted whether the courses were required within the program or were electives, but programs including "Major" electives, or Special Areas of Study credits were noted. Capstone courses and Senior Project courses were also noted because some of these courses were accreditation requirements.

Construction Management program inclusion of the Majority Specialty courses in Mechanical and Electrical Systems have increased with 40% of the 116 programs having combined courses, 28 % separate Electrical and 31% separate Mechanical courses. In addition, 29% of programs offered Environmental Systems courses. The increase in course offerings on these specialty areas does seem to confirm Rounds' (1992) conclusion that these are necessary and important courses and should be included in Construction Management programs.

Another conclusion that can be made from the review of the data is that there was no core set of courses for Construction Management programs per all 116 ASC member programs reviewed. Whether this is driven by faculty limitations or belief of what courses topics are important can't be determined by this study. Previous papers in ASC conferences have emphasized the need to cover Temporary Structures, Building Information Management, Sustainable Construction etc., yet not all programs have added or maintained content in these areas.

A suggestion for further research is what should the minimum content coverage and absolute areas of knowledge that is needed by all graduates of Construction Management programs? Perhaps the minimum core courses and content coverage guideline that should be included in all Construction Management programs is worthy of a Delphi study of ASC members.

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Appendix

List of ASC Members in 2011, 2003 & 1995 studies.

ASC Program Name in 2011 Study	In ASC Chini (1995)	In Clarke (2003)	ASC Program Name in 2011 Study	In ASC Chini (1995)	In Clarke (2003)
Alfred State College	No	No	Oklahoma State University	Yes	No
Appalachian State University	No	No	Oregon State University	Yes	Yes
Arizona State University	Yes	Yes	Pennsylvania College of Technology	No	No
Auburn University	Yes	Yes	Philadelphia University	No	No
Ball State University	No	No	Pittsburg State University	Yes	No
Boise State University	Yes	Yes	Polytechnic Institute of New York University	No	No
Bowling Green State University	Yes	Yes	Purdue University - BCM	Yes	Yes
Bradley University	Yes	Yes	Rochester Institute of Technology	No	No
Brigham Young University	No	Yes	Roger Williams University	No	Yes
Brigham Young University - Idaho	No	No	San Diego State University	No	No
California Polytechnic State University - San Luis Obispo	Yes	Yes?	South Dakota State University	No	No
California State Polytechnic University - Pomona	No	Yes?	Southeast Missouri State University	No	No
California State University - Chico	Yes	Yes	Southern Illinois University Edwardsville	No	Yes
California State University - Fresno	Yes	Yes	Southern Polytechnic State University	No	Yes
California State University - Long Beach	No	No	Southern Utah University	No	No
California State University - Northridge	No	No	State University of New York/ESF	Yes	No
California State University - Sacramento	Yes	Yes	SUNY Delhi	No	No
Central Connecticut State University	No	No	Texas A&M University	Yes	Yes
Central Washington University	Yes	Yes	Texas A&M University - Commerce	No	No
Cincinnati State Technical and Community College	No	No	Texas State University	Yes	No
Clemson University	Yes	Yes	Texas Tech University	No	No
Colorado Mesa University	No	No	The Ohio State University	No	No
Colorado State University	Yes	Yes	The Pratt Institute	Yes	No
Drexel University	No	No	The University of Kansas	No	No
East Carolina University	Yes	Yes	The University of Southern Mississippi	Yes	No
Eastern Kentucky University	Yes	Yes	The University of Texas at San Antonio	No	No
Eastern Michigan University	No	Yes	The University of West Florida	No	No
Ferris State University	Yes	Yes	University of Alaska Anchorage	No	No
Georgia Institute of Technology	Yes	Yes	University of New Mexico	Yes	No
Georgia Southern University	No	Yes	University of Arkansas - Little Rock	No	Yes
Illinois State University	No	No	University of Central Missouri	Yes	Yes
Indiana State University	Yes	Yes	University of Cincinnati	Yes	Yes
Iowa State University	No	No	University of Colorado at Boulder	No	No
ITT Technical Institute - Tempe Campus	No	No	University of Denver	No	No
John Brown University	No	Yes	University of Florida	Yes	Yes

Kansas State University	Yes	Yes	University of Houston	Yes	No
Lamar University	No	No	University of Louisiana at Monroe	No	Yes
Louisiana State University	No	Yes	University of Maine	Yes	No
Louisiana Tech University	Yes	No	University of Maryland Eastern Shore	Yes	Yes
Marquette University	No	No	University of Massachusetts, ECO	Yes	No
Michigan State University	No	Yes	University of Nebraska - Kearney	Yes	Yes
Michigan Technological University	No	No	University of Nebraska - Lincoln	Yes	No
Middle Tennessee State University	No	No	University of Nevada - Las Vegas	Yes	Yes
Milwaukee School of Engineering	No	Yes	University of North Carolina at Charlotte	No	No
Minnesota State University - Mankato	No	No	University of North Florida	No	Yes
Minnesota State University - Moorhead	No	Yes	University of North Texas	No	No
Mississippi State University	No	No	University of Northern Iowa	No	No
Missouri State University	No	No	University of Oklahoma	Yes	Yes
Montana State University	No	No	University of Washington	Yes	Yes
Morgan State University	No	No	University of Wisconsin - Platteville or Madison	Yes	No
New Jersey Institute of Technology (CMT)	Yes	No	University of Wisconsin - Stout	Yes	Yes
New Mexico State University	No	No	Utica College	Yes	No
New School of Architecture and Design	No	No	Virginia Tech	Yes	Yes
North Dakota State University	Yes	Yes	Washington State University	Yes	Yes
Northern Arizona University	Yes	Yes	Weber State University	Yes	No
Northern Kentucky University	No	Yes	Wentworth Institute of Technology	Yes	Yes
Northern Michigan University	No	No	Western Carolina University	No	No
Norwich University	No	No	Western Illinois University	No	No