

Adding a Land Surveying Specialization to a Construction Management Program

Part II: Implementation

Dianne Kay Slattery, Ph.D., PE, CPC and Carla Lopez, MS, CCC
Southern Illinois University Edwardsville
Edwardsville, Illinois

The Department of Construction at Southern Illinois University Edwardsville (SIUE) has added a specialization in land surveying to its Bachelor of Science in Construction Management (CM). This change gives graduates the educational requirements to be admitted to the Land Surveyor-in-Training (LSIT) licensure exam in Illinois. This option, combined with the necessary work experience, would provide the CM student with the potential for future licensing as a Professional Land Surveyor (PLS). The paper will address the process for implementation of this specialization, the necessary program changes required for adopting this specialization, staffing issues and accreditation considerations.

Keywords: surveying education, construction education, accreditation, professional licensure

Introduction

In June 2007, a proposed Bachelor of Science in Construction Management (CM) with a land surveying specialization developed by the Department of Construction at Southern Illinois University Edwardsville (SIUE) received approval of the Land Surveyor Licensing Board of the Illinois Department of Financial and Professional Regulation (IDPFR). In June 2008, the land surveying specialization received the approval of the President of the Southern Illinois University System. This program change gives CM graduates the educational requirements to sit for the Land Surveyor-in-Training (LSIT) licensure exam in Illinois, leading to future licensing as a Professional Land Surveyor (PLS). The specialization, which requires an additional 11 credit hours beyond the 128-hour Bachelor of Science in Construction Management, gives CM graduates new career paths in such areas as land development or construction surveying and mapping, and the opportunity to obtain a professional license.

Overview

While land surveying has traditionally been allied with the civil engineering profession, and many civil engineers obtained dual licensure as professional engineers and land surveyors, state statutes governing professional licensure have changed. The increased educational requirements for land surveyors reflects the fact that land surveying has become a professional discipline in its own right, requiring college-level study in mathematics, the sciences, communications, law, and computer applications in addition to developing technical skills. Nationwide, there are currently 21 programs leading to a baccalaureate degree accredited by ABET, the Accreditation Board for Engineering and Technology (ABET, 2008): 5 by the Engineering Accreditation Commission (EAC), 11 by the Applied Sciences Accreditation Commission, ASAC (formerly the Related Accreditation Commission, RAC), and 5 by the Technology Accreditation Commission (TAC), a net increase of six programs in the past five years (Table 1).

Table 1 ABET-Accredited Land Surveying Programs

Engineering Accreditation Commission (ABET-EAC)	Applied Science Accreditation Commission (ABET-ASAC, formerly ABET-RAC)	Technology Accreditation Commission (ABET-TAC)
California State Polytechnic University, Pomona (1994)	University of Alaska, Anchorage (1995)	University of Akron—Summit College (2003)

California State University, Fresno (1979)	East Tennessee State University (1994)	Alfred State College (1994)
Ferris State University (1991)	University of Florida (1986)	Idaho State University (2006)
<i>University of Maine (1981)</i>	Metropolitan State College of Denver (2004)	<i>University of Maine (2007)</i>
New Mexico State University (2001)	Michigan Technological University (1987)	New Jersey Institute of Technology (1994)
Pennsylvania State University at Wilkes-Barre (2006)	New Mexico State University (1993)	
<i>Purdue University (1984)</i>	<i>Ohio State University (1988)</i>	
	Oregon Institute of Technology (1985)	
	<i>Pennsylvania State University, Wilkes-Barre (1999)</i>	
	Polytechnic University of Puerto Rico (2008)	
	Southern Polytechnic State University (2006)	
	St. Cloud State University (2006)	
	Texas A&M at Corpus Christi (2001)	

Legend: Since 2003 program was *Deleted*; **Added**; *Moved from ABET-EAC to TAC*

Problem Statement

The Illinois Professional Land Surveyor Act of 1989 (225 ILCS 330) tightened the requirements for licensure as a professional land surveyor by increasing the educational requirements. Per Title 68, Chapter VII, Section 1270.5: *Application for Licensure as a Professional Land Surveyor in Training by Examination*, an applicant for licensure as a Professional Land Surveyor in Training must provide a certificate of education for a baccalaureate degree in land surveying from an accredited college or university; or a baccalaureate degree from an accredited college or university in a *related science* [emphasis added], as defined in Section 1270.15, including 24 semester hours of land surveying courses.

Section 1270.15 defines a *related science* as a program that includes core courses in at least the following subjects, or their equivalents, with the minimum semester hours shown. The subjects all may be completed prior to, concurrent with, or subsequent to receiving the baccalaureate degree:

- Mathematics (College Algebra and beyond) – **15 semester hours**
- Basic Sciences (Physics and/or Chemistry) – **8 semester hours**
- Additional Basic Sciences (including, but not limited to: geology, geography, dendrology, astronomy, biology, soil mechanics, and engineering sciences) – **20 semester hours**
- Land Surveying courses (including, but not limited to: fundamentals of land surveying, boundary surveying, route surveying, topographic surveying, descriptions, legal aspects, subdivision design, data computations and adjustments, map projections and geometric geodesy and photogrammetry) – **24 semester hours**

These statutory changes included a *grandfather* period to allow persons who qualified under the previous statute to obtain professional licensure under the old rules. After the grandfather period ended in 1998, the number of land surveyor candidates meeting the educational requirements for licensure in Illinois decreased, leading to shortages in the number of skilled professionals. This shortage was in part due to the lack of land surveying programs at institutions of higher education in the state. Ten years after the grandfather period ended, the Illinois Professional Land Surveyors' Association (IPLSA, 2008) www.iplsa.org/students.html, accessed October 15, 2008 reports that there are no programs in the state offering a baccalaureate degree in land surveying, only two programs in the state that lead to a B.S. in a *related science* with a specialization in land surveying, and 8 programs that offer an associate of science degree with an emphasis in land surveying (Table 2). IPLSA notes that additional programs are available in the neighboring states of Indiana and Wisconsin, and through other colleges and universities through distance education.

Table 2 Illinois Land Surveying Programs

Institution Name	Degree Program Name
Lakeland College	Associate of Applied Science, Civil Engineering Technology
Triton College	Associate of Applied Science, Surveying
College of Lake County	Surveying and Civil Technology Certificate
Rend Lake College	Associate of Applied Science in Surveying Technology
Illinois Central College	Associate of Applied Science
Parkland College	Associate of Applied Science, Construction Design and Management: Surveying Technology
Morrison Institute of Technology	Associate of Applied Science, Highway and Building Construction Technology
John A. Logan College	Associate of Applied Science in Construction Management Technology
Southern Illinois University Carbondale	Bachelor of Science in Civil Engineering, specialization in Land Surveying
Southern Illinois University Edwardsville	Bachelor of Science in Construction Management, specialization in Land Surveying

Industry Involvement

In response to the shortage of programs producing future land surveyors, in the spring of 2001, the president of a local surveying and engineering consulting firm contacted the SIUE School of Engineering with a request to study the addition of surveying courses to the present curriculum of either Civil Engineering or Construction Management. Without additional faculty resources, neither department was able to consider adding the land surveying specialization at that time. However, the Department of Construction continued to study the idea (Kay, 2003), and in 2006, formed an advisory group of local land surveying professionals and educators to work with SIUE faculty to develop the necessary curriculum of surveying coursework (Table 3).

Table 3 Survey Advisory Group

Name	Affiliation
Norman Brown, PLS	St. Louis Community College Florissant Valley
Bob Church, PLS	Illinois Professional Land Surveyors Association
Mark Grinter, PLS	The Korte Company
Aaron Hutson, PLS	Hutson Engineering and Surveying
James P. Peterson II, P.E., PLS	Sanborn Map Company
Matt Schrader, PLS	Woolpert, Inc.
David Sherrill, PLS	Sherrill Associates

The chair of the Construction Department headed the initiative to study the addition of a land surveying specialization, and to make such an addition compatible with the programs accreditation through the American Council for Construction Education (ACCE) and acceptable to the Land Surveying Licensing Board of the Illinois Department of Financial and Professional Regulation. In consultation with the Assistant Provost, the department chair first worked to secure approval of the curriculum by the Licensing Board, and then began the internal process of modifying the CM program to add the land surveying specialization.

Licensing Board Approval

The department chair determined that SIUE Construction Management program meets or exceeds the requirements to qualify as a related science under Section 1270.15. The SIUE Construction Management program:

- Leads to a baccalaureate degree accredited by the American Council for Construction Education.
- Contains 17 semester hours of mathematics beyond college algebra (15 required)
- Contains 9 semester hours of chemistry and physics (8 required)
- Contains 27 semester hours of construction science courses, including methods, materials, statics, mechanics of solids, mechanical and electrical systems, structural systems, plans and specifications, and soils (20 required)
- Has been modified to provide the required 24 semester hours of land surveying courses.

The advisory group assisted the department chair in developing course syllabi, textbooks, equipment needs, and funding possibilities. The required 24 semester hours would consist of a core curriculum that included one existing course and four new ones for a total of 18 credit hours, and 6 credit hours of electives. The core consists of:

- Construction Surveying (existing, 4 credit hour)
- Legal Aspects of Land Surveying (3 credit hour)
- Boundary Surveying (3 credit hour)
- Advanced Survey Systems (4 credit hour)
- Survey Computations and Applications (capstone, 4 credit hour)

Beginning in Fall 2006, the four new courses were rolled on incrementally, one new course per semester, using a combination of adjunct faculty from the Survey Advisory Board (*italics*) and faculty from the CM program (Table 4). The existing Construction Surveying course, formerly offered only in Fall semester, was offered twice per year using adjunct faculty, in response to both the new program and enrollment growth in the CM program. In 2008, the Construction Surveying course was offered in summer semester for the first time.

Table 4 Addition of New Land Surveying Courses Fall 2006 through Spring 2009

Fall 2006	Spring 2007	Summer 2007	Fall 2007	Spring 2008	Summer 2008	Fall 2008	Spring 2009
Construction Surveying <i>(Sherrill)</i>	Construction Surveying <i>(Sherrill)</i>	none	Construction Surveying <i>(Sherrill)</i>	Construction Surveying <i>(Sherrill)</i>	Construction Surveying <i>(Sherrill)</i>	Construction Surveying <i>(Sherrill)</i>	Construction Surveying <i>(Sherrill)</i>
Legal Aspects of Surveying <i>(Peterson)</i>	Boundary Surveying <i>(Peterson)</i>		Legal Aspects of Surveying <i>(D. Slattery)</i>	Boundary Surveying <i>(Sherrill)</i>		Legal Aspects of Land Surveying <i>(Sherrill)</i>	
			Advanced Survey Systems <i>(Peterson)</i>	Survey Computations and Applications <i>(Peterson)</i>		Advanced Survey Systems <i>(Peterson)</i>	Survey Computations and Applications <i>(Peterson)</i>

The remaining 6 credits would come from two electives, to be selected from an approved list of four courses. One of these is an existing elective offered through the Department of Construction. Three courses were selected from the Department of Geography:

- Land Development (CNST 415, 3 credit hours)
- Geographic Information Systems (GEOG 418, 3 credit hours)
- Remote Sensing (GEOG 422, 3 credit hours)
- Computer Mapping (GEOG 423, 3 credit hours)

Table 5 Offering of Land Surveying Electives Fall 2006 through Spring 2009

Fall 2006	Spring 2007	Summer 2007	Fall 2007	Spring 2008	Summer 2008	Fall 2008	Spring 2009
Geographic Information Systems	Geographic Information Systems	Geographic Information Systems	Geographic Information Systems	Geographic Information Systems	Geographic Information Systems	Geographic Information Systems	Geographic Information Systems
Remote Sensing	Computer Mapping		Remote Sensing	Computer Mapping		Remote Sensing	Land Development

Impacts on Accreditation

The SIUE Department of Construction, housed in the School of Engineering, is an ACCE-accredited program offering a Bachelor of Science degree in Construction Management with a minor in Business. Students take a 2-year core of science and general education requirements similar to other programs in the School of Engineering. The 128 semester-hour program includes 60 hours of Construction courses (including 29 hours of construction science), 24 hours of Business, 23 hours of Natural Science and Mathematics, and 21 hours of other general education courses.

One scheme for adding an additional 20 hours of credit to the existing CM program would have been to substitute a land surveying minor for the existing business minor for those students wishing to pursue the land surveying specialization. The Survey Advisory Board urged that the minor in Business Administration be retained because it provides a strong background in the fundamentals of running a business, an essential skill that most land surveyors need. Removing the minor in business also would have impacted the program's ACCE accreditation, which requires 18 credit hours of business topics.

Once the decision to retain all elements of the current B.S. in Construction Management was made, the department chair worked to find a way to minimize the impact of adding 20 credit hours of land surveying courses to the curriculum. One possibility was to gain 12 of the 20 credits by require that the three technical electives and the internship be surveying courses, resulting in a net gain of 8 credit hours, and pushing the total credit hours required for graduation to 136. This curriculum proposal was submitted to the IDFPR Land Surveying Division in November 2006. The Land Surveyor Licensing Board made a site visit to SIUE in May 2007, and rejected the use of the 3 credit hours of internship as part of the required 24 hours of land surveying. The proposal was revised and resubmitted with a total of 139 credit hours for graduation with a B.S. in Construction Management, Land Surveying Specialization. The Licensing Board approved this curriculum in June 2007 (Table 6).

The approved curriculum requires students pursuing the land surveying specialization to trade three technical electives for three required land surveying courses, and take an additional 11 credit hours of coursework. The internship may involve work in a land surveying firm, but the credit hours for internship do not count toward the required 24 hours of land surveying coursework.

Table 6 Curriculum for B.S. in Construction Management, Land Surveying Specialization

FALL—1 st Year		SPRING—1 st Year	
CNST 120 Introduction to Construction	3	ENG 101 English Composition	3
CHEM 120a General Chemistry	3	MATH 152 Calculus II	5
CHEM 124a Chemistry Lab	1	PHYS 211a	4
ENG 101 English Composition I	3	PHYS 212a	1
MATH 150 Calculus I	5	ECON 112 Microeconomics	3
ECON 111 Macroeconomics	3		
	18		16
FALL—2 nd Year		SPRING—2 nd Year	
CNST 210 Materials & Methods	3	CNST 264 Construction Surveying	4
ACCT 200 Financial Accounting	3	ACCT 210 Managerial Accounting	3
CNST 241 Statics & Mechanics of Solids	4	PHIL 106 Critical Thinking	3
STAT 244 Statistics	4	FINE ARTS OR SOC. SCI. Introductory	3
FINE ARTS/HUM. Introductory	3	SPC 103 Interpersonal Communication	3
	17		16
FALL—3 rd Year		SPRING—3 rd Year	
CNST 332 Mechanical Systems	3	CNST 321 Electrical Systems	3
CNST 351 Structures	4	CNST 341 Plans & Specifications	3
CNST 320 Finance	3	CNST 353 Computer Applications	3
CNST 310 Legal Aspects of Land Surv	3	CNST 364 Boundary Surveying	3
FINE ARTS/HUM. Distribution Course	3	CNST 301 Soils	4
	16		16
		SUMMER—3 rd Year	
		IS 401 Business & Society	3
		CNST 470 Internship	3
FALL—4 th Year		SPRING—4 th Year	
CNST 403 Planning & Scheduling	4	CNST 411 Construction Contracts	3
CNST 451 Estimating & Bidding	4	CNST 452 Construction Management	4
ECON 331 Labor Economics	3	MGMT 340 Principles of Management	3
CNST 482 Advanced Survey Systems	4	CNST 484 Survey Applications & Comps	4
Surveying Elective	3	Surveying Elective	3
	18		17
Land Surveying Courses indicated in bold type			
TOTAL 139 credit hours B.S. in Construction Management, Land Surveying Specialization			

University Approval

Upon receiving the approval of the Illinois Department of Financial and Professional Regulation, the department chair began the process of obtaining internal approval of the program. A formal process for modifying an existing program was followed, in consultation with the office of the Provost. The request for a Reasonable and Moderate Extension (RME) of the existing program was written and submitted in Fall 2007. The RME included letters of support from area engineering and surveying firms, as well as the Illinois Professional Land Surveyors' Association. The RME was approved by the University President in June 2008. A new budget line for a half-time instructor was approved by the Provost in Spring 2008, and the position was filled in August 2008 by a member of the Survey Advisory Group who was serving as adjunct faculty. Other courses have been taught using existing resources, including adjunct faculty and faculty from the Departments of Construction and Geography. Students completing

the land surveying specialization now will have that designation noted on their transcripts, and will be accepted as eligible to sit for the Illinois Land Surveyor in Training (LSIT) examination.

Student Demand

The availability of new land surveying courses, beginning in Fall 2006, prompted immediate reaction among current SIUE School of Engineering students. Construction students have opted to take land surveying courses as part of their three technical electives, and six have opted to take the entire suite of courses in order to be qualified to sit for the LSIT exam. Current Civil Engineering (CE) students and CE alumni working in the metropolitan St. Louis area have also shown great interest in the specialization. In November 2007, the local chapter of IPLSA held its monthly meeting on the SIUE campus, met the students and faculty, examined the available equipment, and offered assistance. In February 2008, the Department of Construction had an exhibition booth at the IPLSA annual convention in Springfield, Illinois and marketed the land surveying specialization. In Fall 2008, a student chapter of the IPLSA was formed, offering students the opportunity to learn more about the career opportunities in land surveying and construction.

The market for the specialization has been strong. Twenty-six students took the first new course, Legal Aspects of Land Surveying, in Fall 2006 and seven took Boundary Surveying in Spring 2007. In Fall 2007, nine working professionals and seven undergraduates took Advanced Survey Systems and Survey Computations and Applications. In summer 2008, seven students took the first summer offering of Construction Surveying, and seven are enrolled in both surveying electives in Fall 2008. Fifteen students have enrolled for the Spring 2009 offering of Land Development. It is anticipated that over the long term, the combined demand from undergraduates and working professionals will yield average enrollments of 15 students per class.

On the employer side of the demand equation, the Illinois Professional Land Surveyors Association website is currently posting 15 pages of classified ads for licensed surveying personnel. A number of area construction firms, including The Korte Company, Keller Construction, and Fred Weber, Inc., have added land surveying divisions to handle increasingly complex construction layout and surveying technologies. The Construction Department has been contacted with requests for resumes of graduates to fill surveying positions as far away as Chicago. It appears that demand significantly exceeds the supply, a fact that has driven surveyors' salaries to levels that are competitive with other professionals. The SIUE program is convenient for working professionals in the St. Louis metropolitan area, and is meeting the needs for undergraduate CM students who desire the combination of construction and surveying.

Conclusion

The Department of Construction at Southern Illinois University Edwardsville has added a specialization in land surveying, at the request of local industry. The SIUE Construction degree, a Bachelor of Science in Construction, Minor in Business, met the criteria for acceptance as a *related science* as defined in the 1989 Illinois Professional Land Surveyors Act (225 ICS 330). The addition of the specialization did not negatively affect the program's current accreditation with ACCE. The Land Surveying specialization in Construction Management is meeting the needs of undergraduate students and working professionals who wish to obtain professional licensure.

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