

AC 2007-401: DEVELOPING A NEW CONSTRUCTION MANAGEMENT PROGRAM

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Developing a New Construction Management Program

In Southeast Texas and throughout the globe there is an increasing demand for construction managers. Specifically, in the golden triangle area, plans for enlarging various petro-chemical plants and the establishment of a number of liquid gas terminals will require the hiring of many new construction managers. In fact, currently in Southeast Texas, \$13.00 out of every \$100 earned is done so in the construction industry.

In order to meet this anticipated demand for construction managers, Lamar University has decided to introduce a B.S. in Construction Management Program into the curriculum. It's general mission will be to provide a quality program for preparing nationally competitive undergraduate students for a successful career in construction.

The paper will describe the administrative details of developing the program. The Dean of Engineering, a chemical engineer, originally recommended the course requirements developed by a theoretical structural engineer. This program was found unsuitable by the University Curriculum Committee after consultation with individuals involved with construction. After considerable revision, a final program was sent to the Texas State Coordinating Board for approval. It is hoped that the B.S. in Construction Management Degree will provide educational, research and outreach opportunities that serve both the needs of students and those of the construction industry.

Introduction

During the year 2005-2006 the provost of Lamar University recommended that the Civil Engineering Department consider establishing a construction management program. This was due, in part, because his previous institution had a successful construction curriculum. In June 2006 it was believed that a number of local contractors were in a position to fund the program. The Dean of Engineering, therefore, decided to quickly develop a program and obtain approval of the Texas State University Board of Regents. The Chair of the Department of Civil Engineering was authorized to determine the courses that were to be offered and develop a degree plan for the curriculum. Unfortunately, the Chair is a theoretical structural engineer and is not familiar with construction engineering.

Texas State University Board of Regents Certification

For a program to be approved by the Commissioner for Academic Affairs and Research, the Board of Regents must certify that the new program meets eight criteria.^{4,5} The criteria stipulate that the program shall:

- (1) Be within the institution's current Table of Programs;

- (2) Have a curriculum, faculty, resources, support services, and other components of a degree program that are comparable to those of high quality programs in the same or similar disciplines at other institutions;
- (3) Have sufficient clinical or in-service sites, if applicable, to support the program;
- (4) Be consistent with the standards of the Commission of Colleges of the Southern Association of Colleges and Schools and, if applicable, with the standards of discipline-specific accrediting agencies and licensing agencies;
- (5) Attract students on a long-term basis and produce graduates who would have opportunities for employment; or the program is appropriate for the development of a well-rounded array of basic baccalaureate degree programs at the institution;
- (6) Not unnecessarily duplicate existing programs at other institutions;
- (7) Not be dependent on future Special Item funding
- (8) Have new five-year costs that would not exceed \$2 million.

Anticipated Market for Construction Personnel

Due to the forecasted industrial growth in Southeast Texas there are several large construction projects in the planning stage. In fact, the Southeast Texas Workforce Board and Leadership Summit is looking into the workforce in the Golden Triangle area and are anticipating a large need for construction engineers. The governing bodies of the region are also willing to merge academia and industry in a way to promote the program to meet the overwhelming needs of the community. In addition, the Southeast Texas Interfaith Organization for Disaster Relief anticipates thousands of volunteers are needed to help complete repair on over 1000 homes damaged due to hurricanes. These organizations work closely with the construction industry and will continue to do so and maintain a steady market for new construction and major renovation personnel.

Board of Regents Requirements

In order to satisfy Texas State University requirements, a study of projected enrollment was conducted. The anticipated enrollment in the Construction Management program is shown in Table 1. These figures are based, in part, on the regional demand for programs that are related to engineering but do not include a rigorous science and mathematics requirement.

Table 1. Enrollment Projection

YEAR	1	2	3	4
Headcount	20	40	60	80
FTSE	20	40	60	80

Faculty must also be hired to staff the program. The Lamar University Administration, at this time, limited the number of new faculty to three. The department has been assured that additional faculty will be allocated to the program as the demand warrants. Table 2 illustrates the number and type of faculty to be hired.

Table 2. Proposed Faculty

Name of Core Faculty and Faculty Rank	Highest Degree and Awarding Institution	Courses Assigned in Program	% Time Assigned To Program
One new faculty will be hired in the 1 st year	One Ph.D. in Construction Management	Construction Management	75-100
One new faculty will be hired in the 2 nd year	One Ph.D. in Construction Engineering Systems	Construction Engineering Systems	75-100
One new faculty will be hired in the 3 rd year	One Ph.D. in Construction Management	Construction Management	75-100

Monetary resources are important for numerous endeavors. An investigation of the costs and funding involved with the Construction program is illustrated in Table 3. It is interesting to note that at this time the anticipated funds generated from state assistance and tuition/fees is greater than the costs of the program. This distribution may, of course, change in future years.

Table 3. Costs and Funding

Five-Year Costs		Five-Year Funding	
Personnel (faculty/staff)	\$965,000	Reallocated Funds	\$0
Facilities and Equipment (computers for faculty/staff, etc.)	\$34,000	Anticipated New Formula Funding (for 3-5 years)	\$688,800
Library, Supplies, and Materials	\$46,000	Special Item Funding	\$0
Other (faculty travel)	\$24,000	Other (5-yr designated tuition and fees)	\$1,047,120
Total Costs	\$1,069,000	Total Funding	\$1,735,920

There are numerous other resources required for academic programs such as an adequate library and audio/visual (A/V) classroom equipment. For example, the library at Lamar University is centrally located on campus.² “Its collection exceeds 1 million volume equivalents, including microforms and state and federal documents. The library subscribes to almost 2,000 current periodicals and provides access to many full-text databases covering more than 3,000 periodicals.

Students, faculty and staff of Lamar University can use PCs to locate electronic books in the online catalog, access indexes and journals electronically, and locate selected information through the Internet. A service-oriented library staff provides assistance in the use of reference

materials, documents, special collections, reserve materials and instructional media. The ID card serves as an individual's library card.

The library provides rooms for group study, and the fifth floor is a designated quiet study floor. Coin-operated copy machine for both print and microforms are available. An open-access PC lab is located on the library's seventh floor in the Media Services department. Assistance in using the PCs, software and the Internet is available from a trained staff. Additionally, students have access to the collections of 51 other publicly funded colleges and universities through the TexShare program.”

In addition to the above, the Civil Engineering department enjoys adequate facilities for undergraduate academic programs. Most of the courses are taught in classroom settings using traditional and modern A/V systems. Most all instructors use supplemental visual-aid tools, such as overhead, slide, or computer projectors. The civil engineering classrooms are equipped with a PC computer connected to a LCD projector installed on the ceiling for power-point presentations as well as for demonstrating software used in the course. The modern multimedia technology used by the instructors in the classroom has enhanced their teaching skills and lecture presentations.

Degree Plan

The degree plan that was originally developed for the program is shown in Figure 1. It is not known if any local construction personnel were asked to provide input to the document. However, two department chairs, electrical and industrial, questioned the use of the word “engineering” in the title since it was clearly not an engineering program. The Dean reportedly checked this out with the Texas Board of Professional Engineers and this group apparently does not concern itself with the use of the word “engineering.”

In violation with rules and regulations of Lamar University, the proposal was submitted to and approved by the Texas State Board of Regents before being submitted to the Undergraduate Curriculum Council (UCC) for approval.^{2,6} The Associate Provost subsequently requested the UCC to review the proposal before it was to be forwarded to the Texas Higher Education Coordinating Board for approval at the highest level. Afterward, the Provost of Lamar University (to which the UCC reports) sincerely apologized for this problem and clearly stated it should not have happened.

University Curriculum Council

The University Curriculum Council revised the degree plan associated with the construction proposal. It determined there were numerous problems with the document and refused to approve the plan until recommended changes were considered. For example, it was found that prerequisites were not being followed and students were scheduled to enroll in courses for which they did not have the required mathematics background.³ Therefore, a subcommittee of the UCC was given the task to revise the program so that it may be academically acceptable. The following is a list of changes recommended by the subcommittee:

LAMAR UNIVERSITY
Construction Engineering Management Program
Department of Civil Engineering

NAME: _____

LU I.D.#: _____

FALL

SPRING

FIRST YEAR

ENGL 1301 - Composition I	3
MATH 2312 - Pre-Calculus/Elementary Functions	3
ELEN 1301 - Introduction to Computers	3
PHIL 1370 - Philosophy of Knowledge	3
CEMT 1310 - Prin of Building Construction Mgmt	3
PEGA	1
TOTAL	16

ENGL 1302 - Composition II	3
MATH 2376 - Calculus I	3
CEMT 1340 - Residential Construction Matl and Methods	3
PHYS 1407 - Physics	4
COMM 1315 - Public Speaking	3
TOTAL	16

SECOND YEAR

ACCT 1301 - Principles of Accounting	3
HIST 1301 - U.S. History I	3
ENGL 2326 - American Literature	3
ECON 1301 - Introduction to Economics	3
CEMT 2340 - Commercial Construction Matl & Methods	3
TOTAL	15

HIST 1302 - U.S. History II	3
POLS 2301 - American Government I	3
Fine Arts Elective	3
FINC 3310 - Principles of Finance	3
CEMT 2310 - Statics and Mechanics of Solids	3
TOTAL	15

THIRD YEAR

CEMT 3310 - Utility System	3
CEMT 3320 - Site Construction and Management	3
INEN 3320 - Probability and Statistics	3
CEMT 3311 - Structural System I	3
POLS 2302 - American Government II	3
TOTAL	15

CEMT 3330 - Construction Presentation Graphics	3
CEMT 3340 - Land Development & Real Estate Principles	3
MISY 3310 - Principles of Management Information Systems	3
CEMT 3312 - Structural System II	3
GEOL 1403 - Physical Geology	4
TOTAL	16

FOURTH YEAR

CEMT 4320 - Construction Project Scheduling	3
CEMT 4330 - Cost Estimating and Analysis	3
MGMT 3310 - Organization Behavior and Management	3
CEMT 3350 - Construction Document and Contract	3
CEMT 4350 - Construction Project Management	3
TOTAL	15

CEMT 4360 - Residential/Commerical Building Projects	3
CEMT 4370 - Legal Aspects of Engineering Practice	3
MKTG 3310 - Principles of Marketing	3
CEMT 4310 - Construction Safety Management	3
CEMT 4000 - Independent Study	0
TOTAL	12

Note (120 total hours)

Figure 1. Original Degree Plan

- Revise program title from Construction Engineering Management to Construction Management
- Fall of first year – change Math 2312 (Pre-Calculus) to Math 1314 (College Algebra)
- Fall of first year – change ELEN 1301 (Introduction to Computers) to MISY (Introduction to Business Technology)
- Spring of first year – change PHYS 1407 (Physics) to PHYS 1405 (Conceptual Physics)
- Spring of first year – change MATH 2376 (Calculus I) to MATH 1325 (Elements of Analysis for Business Applications)
- Fall of third year – change INEN 3320 (Probability and Statistics) to MATH 1342 (Elementary Statistics)
- Spring of second year – change CEMT 2310 (Statics and Mechanics of Solids) to CMET 2310 (Fundamental Mechanics and Surveying)
- Spring of fourth year – change CEMT 4000 (Independent Study) to CEMT 4300 (Internship or Independent Study)

The subcommittee forwarded their report to the full UCC for their consideration. After further deliberations the report was accepted. However, the UCC was concerned that there were not enough electives associated with the university core requirements. Therefore the following changes were recommended:

- Fall of second year – change ENGL 2326 to Literature elective
- Fall and spring of second year – change HIST 1301 and 1302 to History electives
- Spring of third year – change GEOL 1403 to Science elective
- Spring of first year – change COMM1315 to Communications elective

In addition to the above, various construction electives were specified as shown in Figure 2. This degree plan was submitted to the upper administration (Provost) to be forwarded to the appropriate Texas State agency.

General Business – Industrial Engineering

Numerous faculty believed that the Construction program should be housed in the College of Business. Here, the General Business major allows students to concentrate their coursework in one of the following areas: Advertising Communication, Entrepreneurship, Industrial Engineering, and Retail Merchandising.³

Specifically, “the General Business-Industrial Engineering concentration is an interdisciplinary program between the College of Business and the Department of Industrial Engineering. This concentration combines a solid knowledge of business with the technical expertise of engineering. This combined education enables a graduate to make decisions concerning products to manufacture or services to provide, layout of the production facilities, materials used in manufacturing a product, production procedure, quality control, and inventory control as well as methods of motivating and rewarding employees. Because their skills and knowledge can be used to improve operating efficiency in almost any type of company,

FINAL DRAFT DEGREE PLAN

NAME: _____

LU I.D.#: _____

FALL

SPRING

FIRST YEAR

ENGL 1301 - Composition I	3
MATH 1314 - College Algebra	3
MISY 1373 – Introductory Business Technology	3
PHIL 1370 - Philosophy of Knowledge	3
CMTP 1310 - Prin of Building Construction Mgmt	3
PEGA	1
TOTAL	16

ENGL 1302 - Composition II	3
MATH 1325 – Elem. of Anal. for Bus. Appl.	3
CMTP 1340 - Residential Construction Matl and Methods	3
PHYS 1405 – Conceptual Physics	4
Communications Elective	3
TOTAL	16

SECOND YEAR

ACCT 1301 – Principles of Accounting	3
History Elective	3
Literature Elective	3
ECON 1301 – Introduction to Economics	3
CMTP 2340 – Commercial Construction Matl & Methods	3
TOTAL	15

History Elective	3
POLS 2301 – American Government I	3
Fine Arts Elective	3
FINC 3310 – Principles of Finance	3
CMTP 2310 – Fundamental Mechanics	3
TOTAL	15

THIRD YEAR

CMTP - Elective	3
CMTP 3320 – Site Construction and Management	3
MATH 1342 – Elementary Statistics	3
CMTP 3311 – Structural System I	3
POLS 2302 – American Government II	3
TOTAL	15

CMTP 3330 – Construction Presentation Graphics	3
CMTP - Elective	3
MISY 3310 – Principles of Management Information Systems	3
CMTP 3312 – Structural System II	3
Science Elective	4
TOTAL	16

FOURTH YEAR

CMTP 4320 – Construction Project Scheduling	3
CMTP 4330 – Cost Estimating and Analysis	3
MGMT 3310 – Organization Behavior and Management	3
Construction Elective	3
CMTP 4350 – Construction Project Management	3
TOTAL	15

CMTP 4360 – Residential/Commercial Building Projects	3
CMTP 4370 – Legal Aspects of Engineering Practice	3
MKTG 3310 – Principles of Marketing	3
Construction Elective	3
CMTP 4300 – Internship/Independent Study	3
TOTAL	15

Note (123 total hours)

- CMTP Electives are: CMTP 3310 (Utility Systems), CMPT 3340 (Land Development and Real Estate Principles), CMTP 3350 (Construction Documents and Contracts), CMTP 4310, CMTP 4370 (Legal Aspects), CVEN 2320 , CVEN 3310
- Science Electives are: GEOL 1403, BIOL 1406, CHEM 1411

Figure 2. Revised Degree Plan

graduates from this concentration can be employed by insurance companies, banks, construction firms, public utilities, hospitals, retail organizations, manufacturing companies, and other large business firms, as well as by government agencies.”

Unfortunately, in this type of program, as shown in Figure 3, only fifteen credits are allocated to a major such as construction. This was deemed unacceptable and a stand-alone curriculum was considered necessary to satisfy the construction industry.

General Business – Industrial Engineering Concentration

Third Year – 30 hours	Fourth Year – 30 hours
BCOM 3350 Business Communications.....3	ECON 3340 Macro Economics or
BUAL 3310, 3320 Business Analysis.....6	ECON 3390 Economics of Firm.....3
BULW 3310 Business Law.....3	*INEN 3320 Engineering Economy or
FINC 3310 Principles of Finance.....3	INEN 3322 Engineering Materials
*INEN 3300 Industrial Engineering -	and Processes.....3
An Introduction.....3	*INEN 3380 Work Design.....3
MGMT 3310 Principles of Organizational	*INEN 4316 Industrial Product Safety or
Behavior and Management.....3	INEN 4369 Engineering Management.....3
MGMT 3320 Production Management.....3	*INEN 4374 Human Factors Engineering,
MISY 3310 Management Information Systems..3	or INEN 4376 Occupational Ergonomics
MKTG 3310 Principles of Marketing.....3	or INEN 4379 Facilities Design.....3
	MGMT 4370 Strategic Analysis.....3
	Electives (College of Business
	3000-4000 level).....9
30	30

*possible construction courses

Figure 3. Construction Concentration

Preliminary Exploration at Chadron State College

Numerous other institutions are considering establishing a Construction Management program. For example, Chadron State College in Nebraska is in the preliminary stage of exploring an addition of a B.S. in Construction Management. The program, if adopted, would be housed in the Department of Applied Sciences – Industrial Technology program. Currently, Chadron State College offers a B.S. in Industrial Management. This program has produced an average of 9 graduates for the five year period ending July 31, 2006.¹ Chadron State College is exploring the potential student & industry demand for a B.S. in Construction Management. In addition, Chadron State College is assessing its faculty resources to support a construction program.

Summary and Conclusion

Over the years numerous institutions have developed a curriculum in construction engineering and/or management. Some of these programs are housed in engineering, architecture, or other colleges. They also may be offered at either the B.S. or M.S. level. A

Ph.D. is also available

The proposed B.S. in Construction Management Program at Lamar University will be administered by the Civil Engineering Department. The level of mathematics required will be that of students enrolled in the College of Business at the institution. The original construction program approved by the Lamar administration and forwarded to and approved by the regents of the Texas State University system contained numerous errors and was internally inconsistent. Fortunately, the checks of balances in operation at the University in form of the UCC were able to recommend corrections to the program. It is hoped that the Texas Higher Education Coordinating Board will approve the proposal and that it attracts students who will benefit from the curriculum.

As of this date (end of February 2007), word has been received that the construction management program has been approved by the state. However, The Coordinating Board has established a requirement that the three new faculty must be hired at the start of the program rather than during the first three years. The Lamar University Administration has not, as of this date, responded to this requirement.

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