

PROPOSAL 32-04

BS PROGRAM IN ENGINEERING TECHNOLOGY, CONCENTRATION IN CONSTRUCTION MANAGEMENT TECHNOLOGY

A. Proposed Degree Concentration

The School of Technology, in collaboration with the School of Business and Economics, proposes the introduction of a new degree concentration: Construction Management Technology (CMT). This program will be a third concentration available under the Bachelor of Science in Engineering Technology degree currently available in the School of Technology. The existing BSET degree has concentrations in Electrical Engineering Technology (EET) and Mechanical Engineering Technology (MET). Initially, the curriculum for this new concentration would be structured as a 2+2 program, with the first two years being the existing associate degree program in Civil Engineering Technology (CET), followed by an additional two years of primarily business and management coursework along with upper-level CET courses (or two existing ECE courses depending on capacity). The concentration has been structured to meet the accreditation requirements of the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET). ABET accreditation will be pursued as part of the implementation of this new degree concentration.

B. Background

The current Associate in Applied Science degree program in Civil Engineering Technology was established at Michigan Tech in 1968. The program is accredited by the Technology Accreditation Commission (TAC) of the Accreditation Board for Engineering and Technology (ABET). It is the only such accredited civil engineering technology program offered in the State of Michigan. Graduates of the program typically work as civil engineering technicians. The AAS degree program prepares our students for "hands-on" applications and immediate value-added performance in the workplace. For this reason, our graduates are in high demand and there is ample opportunity for them to pursue a fulfilling career in the construction field.

The Civil Engineering Technology program, however, can also be an effective first degree for students interested in either broadening or focusing their interests. For example, students have gone on to degrees in business and civil engineering following the successful completion of the CET program. Most of these students have worked through rather informal agreements at Michigan Tech and other universities. While these informal agreements have served student needs, they do not allow us to aggressively market the program to attract new students to Michigan Tech.

To better serve our students and build enrollment, we want to promote the linkages of the current Civil Engineering Technology program to bachelor's level degree programs, preferably on the Michigan Tech campus. This has recently been done with the Department of Civil and Environmental Engineering; we now want to make this linkage with our own BSET program. From conversations with students, parents, employers and admissions staff, we feel that this can be done effectively by establishing the Construction Management Technology concentration in the existing BSET degree program, and marketing it to prospective students.

Students have expressed interest in this program, and we have alumni who have successfully completed programs of their own design and choosing that emphasize business and management. Our experience has been that most students who are enrolled in the two-year program would like to earn a four-year degree. The historical experience at MTU and other institutions is that approximately 85% of the existing students stay for the four-year degree when it is available. However, one obstacle for these students in obtaining a four-year degree at Michigan Tech is that they may not be interested in continuing in a baccalaureate engineering degree program. These students may choose other programs on campus, or continue their studies at another university. Currently, students interested in Construction Management Technology have few well-defined options available at Michigan Tech.

This program would be attractive to parents of future students, a group that is very influential in helping students make college decisions. To most parents, attending college means pursuing a baccalaureate degree program. However, most students, parents, and even high school counselors are unaware of associate degree programs and the career opportunities available; worse yet, they often confuse them with *technical* offerings common at community colleges and for-profit institutions. The availability of a clearly defined path to a BSET degree through CET would reassure parents of the program value.

According to members of our Industrial Advisory Board, there are significant opportunities for graduates of a four-year technology program in the construction management field, and this is supported by information from the Bureau of Labor Statistics⁽¹⁾. An employee with a four-year degree in Construction Management Technology will have enhanced earning potential and additional opportunities for advancement compared to one with a two-year CET degree. The program described in this proposal is of special interest because it has a strong technical content (i.e., the AAS degree in Civil Engineering Technology) in addition to a strong business and management emphasis.

C. CET Linkages

The AAS-CET program is important to Michigan Tech and is already linked to other programs. This is the second programmatic initiative aimed at building on the CET program to enhance University enrollment and revenue. The School of Technology has recently formalized a 2+3 articulation agreement between the CET and Civil Engineering programs. Students can also pursue a baccalaureate degree in Surveying within the School of Technology. Many CET graduates have stayed at MTU to continue in the Surveying program. Some surveying students elect to take a few extra classes to obtain the associate degree in CET along with the BS in Surveying. There will likely be some changes in the CET-TLS linkage as the Surveying program is moving toward EAC accreditation. As a result, the CET-TLS linkage will then be a 2+3 concentration.

The Construction Management Technology concentration, with the cooperation of the School of Business and Economics, will primarily appeal to students interested in construction management. Other possible linkages that may be pursued over time are with Social Sciences for restoration construction, and with Fine Arts for technical theater offerings. Networking with both established and new four-year degree programs should place the CET and BSET programs in the mainstream of campus life, while promoting student retention and enrollment growth.

Additional linkages can be established with Canadian and Wisconsin accredited AAS Civil Engineering Technology programs or other community college programs throughout the Midwest (e.g., Alpena Community College) to act as feeders for the CMT program.

D. Program Administration

The concentration in Construction Management Technology will be administered by the School of Technology as part of the existing Bachelor of Science degree in Engineering Technology. The area coordinator for CET will coordinate the delivery of courses in the CMT concentration. The Dean of the School of Technology and the Dean of the School of Business will coordinate activities to promote the program.

E. Reasons for this Degree Concentration

Construction Management requires that people have broad skills and interests. Successful managers must work effectively with licensed professional engineers and architects, skilled tradesmen, licensed surveyors and vendors of building materials and fabricated components. They also work with technical information on a broad array of subjects including building specifications, structural and material testing information, environmental regulations, and legal and contractual requirements.

With this spectrum of activities, there is demand for a person with combined strong technical and business skills. Michigan Tech has the capability to provide just this type of education. The Construction Management Technology degree concentration will appeal to both students and employers. Some areas where graduates with the BSET-CMT degree could work include:

- project manager/superintendent
- construction management
- construction equipment sales
- construction materials sales
- construction estimator
- management of (or own) a contracting business
- contract administration/architect's representative

The U.S. Bureau of Labor statistics predict excellent employment opportunities for Construction Managers through 2010, and showed as many as 100 Bachelor level degree programs in 2000⁽²⁾. However, there are only seven ABET-accredited Construction Management type programs nationwide. Of these, three are accredited engineering programs by EAC/ABET, and four are accredited engineering technology programs by TAC/ABET. The engineering technology "CMT" programs are in Maine, New York (2), and Oklahoma. University of Maine statistics indicate five job offers per student for their most recent graduating class, with an average starting salary of \$42,200 per year. The most common starting jobs are project engineer, project supervisor, estimator, scheduler, and construction manager. Michigan Tech has an opportunity to provide this type of education for the upper Midwest region.

F. Why a Concentration Under the BSET Degree?

The BSET degree is an established degree within the School of Technology with concentrations established in Mechanical Engineering Technology and Electrical Engineering Technology. Creating the concentration in Construction Management Technology under the existing degree program will capitalize on the experience of the faculty and existing resources. It will facilitate program start-up at minimum cost.

It is important that this degree concentration be identified and marketed as a four-year Bachelor of Science degree, rather than a 2+2 degree in CET and Business. This will enable us to effectively serve the needs of employers, better serve the interests of our existing students, and market the concentration to attract new students to Michigan Tech. The program will provide options to students that are not readily available within the state since it has the already accredited AAS in Civil Engineering Technology embedded in the first two years of study.

G. Accreditation

The programs in engineering, technology, and related programs (Surveying) at Michigan Tech are all nationally accredited by the Accreditation Board for Engineering and Technology (ABET). The existing associate program in CET is accredited by ABET. It seems appropriate to use the same accrediting board for this program. To do this under the existing BSET degree, the word "technology" should appear in the name, hence the name Construction Management Technology. Accreditation of this degree concentration will then be pursued under the ABET guidelines specified for baccalaureate degree programs in "Construction Engineering Technology" or "similarly named programs." The degree name and curriculum content is similar to existing accredited programs at other universities.

H. Resources and Institutional Impact

1. Enrollment Predictions:

Years 1 and 2: We anticipate that 20 students will be added to the program in the first year including current students who would choose to stay at MTU for the additional two years, internal transfers, and new admits. This would be in addition to the normal enrollment of 12-15 in the AAS-CET program that would now be enrolled in the BSET-CMT program⁽³⁾. In year two, we conservatively project an incoming class size of 20 from internal transfers and new admits.

End of Year 2: Enrollment of 50-55

Years 3 to 5: As marketing materials are developed and distributed, website upgrades are completed, and direct mail and high school visitations are organized, we conservatively project that 10 or more additional students would be added each year (net of graduation).

End of Year 5: Enrollment of 70-75

Beyond Year Five: At steady state, we project that enrollment would be approximately 75 students. This will include those students who may have enrolled in CET or Business at MTU, along with the majority being "new market" students who would likely have enrolled elsewhere. We do not expect to have a long-term impact on existing programs in engineering as this degree program will be much different than those in engineering, and will attract a different type of student. It will improve retention by providing another degree option for students looking for alternatives to their original chosen curriculum.

2. Faculty:

Program start-up can occur with no additional faculty. We propose to use two existing ECE courses (see Class Listing) as upper level CET courses in this curriculum. Adjunct funding for one course would be needed in Spring 2005. If it is not possible to expand the capacity of two existing CE courses, we would develop two new CET courses that would use existing School funding to support an adjunct faculty member in the first two years (\$5,000 in 2004, \$15,000 in 2005). These funds would come from shifting priorities in the School to grow this new program. If successful in meeting the 2006 enrollment projections, we would evaluate capacity in both Schools at that time, and request that as many as three to four total positions be added to the base budgets of the Schools. The allocation of these would depend on the capacity and success of other initiatives in the Schools.

Similarly, we acknowledge that there may be an increased enrollment in the College of Science and Arts for General Education courses. The impact of this increase will depend upon the enrollment of other University programs and therefore is hard to predict at this point. The phased start-up, and the use of existing expertise in the two Schools, allows Michigan Tech the opportunity to add faculty only if the program is successful in meeting its goals.

3. Lab/Classroom Space:

Existing laboratory and classroom space will be used for this program.

I. Implementation Schedule

If approved in the Spring of 2004, students could begin taking classes in the concentration immediately, with our first students graduating in Spring 2006. With two years of marketing and recruiting efforts, we expect our first significant graduating class in 2008.

J. Marketing

On approval of the Construction Management Technology concentration, we will begin the preparation of new printed materials for this program as well as all of the programs in the School (e.g., individual materials, composite "viewbooks"). We are currently working on a web page that will be ready to post to our web site when the program is approved.

K. Curriculum Structure

The first two years would be the existing AAS-CET curriculum (Appendix A). A summary of the curriculum requirements is shown on the next page.

Curriculum Plan for Construction Management Technology Degree Concentration

Year #1 & Year #2: Civil Engineering Technology Program 64 credits

(See Appendix A)

Year #3 Fall Semester

BA2300 Accounting Principles I 3 credits

CE3332 Fund. of Construction Engineering 3 credits

MAT2215 Applied Integral Calculus for Technology 3 credits

SU2220 Route and Construction Surveying 3 credits

Gen. Ed. Distribution 3 credits

Gen. Ed. Distribution 3 credits

1 unit Co-curricular (PE)

18 credits

Spring Semester

BA2500 Business Law I 3 credits

BA2700 Business Problem Solving 3 credits

CET3250 Structural Analysis and Design 3 credits

MA2720 Introduction to Statistical Analysis 4 credits

MAT3225 Integration & Differential Equations for Tech. 3 credits 1 unit Co-curricular (PE)

16 credits

Year #4 Fall Semester

BA3400 Managerial Finance 3 credits

BA3620 Project Management 3 credits

BA4760 Strategic Leadership (Gen. Ed. Distribution) 3 credits

CE4333 Est., Planning, & Control of Const. Projects 3 credits

Gen. Ed. Distribution 3 credits

1 unit Co-curricular (PE)

15 credits

Spring Semester

BA3780 Entrepreneurship 3 credits

BA3800 Principles of Marketing 3 credits

CET4200 Building Systems 3 credits

SU4260 Professional Practice 3 credits

Gen. Ed. Distribution 3 credits

----- 15 credits

Total credits for BSET in Construction Management Technology = 128 credits

APPENDIX A - Civil Engineering Technology (AAS Degree Program)

Year #1 Fall Semester

CET1000 Public Speaking and Group Leadership 1 credit

CET1100 Introduction to Computing and Technical Drawing 3 credits

MAT1115 College Algebra & Trigonometry for Technology 5 credits

PE3985 Community First Aid and CPR 1 credit

SU1100 Introduction to Surveying and Mapping 2 credits

UN1001 Perspectives on Inquiry 3 credits

15 credits

Spring Semester

CET1141 Fundamentals of Cemented Aggregate Mixtures 4 credits

CET2100 Civil/Surveying Software 3 credits

MAT1125 Applied Derivatives for Technology 5 credits

PH1100 Physics by Inquiry I 1 credit

UN1002 World Cultures 4 credits

17 credits

Year #2 Fall Semester

MET2120 Statics and Strength of Materials 4 credits

PH1110 College Physics I 3 credits

PH1200 Physics by Inquiry II 1 credit

SU2100 Surveying Fundamentals 3 credits

SU2110 Surveying Fundamentals Laboratory 2 credits

UN2001 Revisions 3 credits

16 credits

Spring Semester

CET2251 Soils in Construction 4 credits

CET2265 Construction Planning and Estimating 3 credits

CETxxxx Elective (**UN2002 if continue in BSET-CMT**) 3 credits

CETxxxx Elective 3 credits

PH1210 College Physics II 3 credits

16 credits

Electives

CET3141 Cemented Aggregate Mix Design 3 credits

CET3250 Structural Analysis and Design 3 credits

CET3252 Water and Wastewater Technology 3 credits

CET3270 Special Projects in Civil Engineering Technology 3 credits

SU2220 Route and Construction Surveying 3 credits

UN3002 Cooperative Laboratory 4 credits

Total Credits Required for Graduation = 64 credits

New Course Descriptions

***CET3265 Project Scheduling and Estimating (3 credits, 0-3-0)**

A continuation of topics introduced in CET2265 relating to cost estimating, project scheduling, and other project management issues. Incorporates computer usage in preparing cost estimates and evaluating project schedules.

Semester offered: Fall

***CET4100 Construction Methods and Equipment (3 credits, 0-3-0)**

A discussion of construction methods and equipment considerations on a variety of construction projects. Includes construction safety, cash flow, equipment ownership, and other items related to construction costs.

Semester offered: Fall

CET4200 Building Systems (3 credits, 0-3-0)

An introduction to the major systems and components in the construction, operation, and maintenance of a building. Includes the study of the drawings and specifications for the civil, mechanical, and electrical systems of a building.

Semester offered: Spring

*Note: The proposed curriculum shown on page 9 includes the use of two Civil Engineering courses: CE3332 and CE4333. If unacceptable, then the above courses would be used. CET3265 would replace CE3332, and CET4100 would replace CE4333.

1. Bureau of Labor Statistics, Occupational Outlook Handbook for Construction Management http://search.netscape.com/ns/boomframe.jsp?query=us+government&page=1&offset=0&result_url=redir%3Fsrc%3Dwebsearch%26amp%3BrequestId%3D24509dbf7b6beae5%26amp%3BclickedItr%26amp%3BfromPage%3DNSCPIndex&remove_url=http%3A%2F%2Fwww.firstgov.gov%2F

2. Bureau of Labor Statistics, Occupational Outlook Handbook for Construction Management http://search.netscape.com/ns/boomframe.jsp?query=us+government&page=1&offset=0&result_url=redir%3Fsrc%3Dwebsearch%26amp%3BrequestId%3D24509dbf7b6beae5%26amp%3BclickedItr%26amp%3BfromPage%3DNSCPIndex&remove_url=http%3A%2F%2Fwww.firstgov.gov%2F

3. Note that the CET degree was considered for elimination in last year's budget reduction plans, and this was announced to students in Spring 2003. The program was not eliminated, and students were contacted to encourage them to attend Michigan Tech. However, in the end, some chose to attend other schools which depressed this year's enrollment.

Adopted by Senate: 7 April 2004

Approved by President: 22 April 2004