Surveying Engineering Department

COLLEGE OF
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Ferris State University
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ACADEMIC PROGRAM REVIEW REPORT

Baccalaureate Program in

Surveying Engineering & AAS in Surveying Technology

August 2000

Ferris State University
College of Technology
Surveying Engineering Department

ACADEMIC PROGRAM REVIEW REPORT

Program Review Panel

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August 2000

ACADEMIC PROGRAM REVIEW REPORT
Surveying Engineering and Surveying Technology

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SECTION 1

OVERVIEW

A Brief History of the Department

Ferris State University has offered surveying education for over forty- three years. The Associate in Applied Science (AAS) degree in Surveying Technology was started in 1957. The Bachelor of Science Degree in Surveying was established in 1973 in response to the requirement passed by the Michigan Legislature that a four-year degree be required in order to be licensed as a professional surveyor in the state. Michigan was the first state in the U.S. to require a degree for professional licensure in surveying. The department was first accredited in 1984 by the Related Accreditation Commission (RAC) of the Accreditation Board for Engineering and Technology (ABET) and was reaccredited in 1987 by ABET under the same commission. The surveying science degree was changed to a surveying engineering degree and was accredited by the Engineering Accreditation Commission (EAC) of ABET in 1991. A surveying engineering graduate from our department is eligible to be licensed as both a professional surveyor and a professional engineer provided he/she acquired the necessary experience and passes the licensing examinations in both areas.

The department had one full-time program director until 1996. During the restructuring of the College of Technology, that position was changed to program coordinator. Prof. Sayed Hashimi served as program director until 1996 and as program coordinator until August 1998. In the fall of 1998, Dr. Khagendra Thapa was appointed program coordinator. In the new restructured College of Technology, the Surveying Engineering program has become the Surveying Engineering Department. Dr. Thapa serves as the chair of the new department.

At the recommendation of the department faculty, the following individuals, who have played significant roles in the field of surveying and mapping, have been honored by the university with honorary doctoral degrees:

Dr. Jack Dangermond, Founder and President of the Environmental Systems Research Institute (ESRI) of Redlands, California, 1994.

Dr. Charles Trimble, Founder and President of Trimble Navigation Ltd. of Sunnyvale, California, 1995.

Dr. Larry Ayers, Vice President of Intergraph Corporation, Huntsville, Alabama, 1996.

Dr. Mary Feindt, a veteran surveyor and owner of Charlevoix Geomatics, Charlevoix, Michigan, 1999.

The Department

The Bachelor of Science Degree in Surveying Engineering is designed to incorporate the Professional Surveyor licensing requirements of the State of Michigan, the professional engineering and design requirements of the ABET, and the cultural enrichment and social awareness requirements of Ferris State University. Key to successful integration is a focus on balance; balance of the theoretical with the practical, balance of the sciences with the arts, balance of the individual with the whole. Graduation from this department requires 137 semester hours with a minimum 2.0/4.0 grade point average. The course of study is long, rigorous and challenging and gives graduates a sense of pride and accomplishment along with the confidence and self-assurance that they will make their marks on the world. The following are some of the highlights of the department:

Nearly forty-three years of educating surveyors for the State of Michigan and the nation.

The largest undergraduate Surveying Engineering department in the Midwest, and one of the largest in the U.S.

Accredited (B.S. Surveying Engineering) by EAC/ABET.

Approved by the Michigan State Board of Licensing and Regulation (Surveying Engineering).

Excellent job opportunities in the field or office, 1999 Surveying Engineering graduates' average entry-level salary was $37,735 per year.

Employment demands far exceed Surveying Engineering department graduates. In 1999 there were ten to twelve positions available for every graduate. The department has experienced 100% placement record every year.

Diversity in employment shows FSU graduates are in demand nationwide by large and small private surveying and mapping firms; federal, state, and local governmental agencies.

Practical hands-on surveying engineering courses are integrated throughout the curriculum. There are eighteen courses which require laboratory work.

Computer applications and interactive graphics are heavily integrated into the curriculum.

State-of-the-art surveying equipment including the "Field to Finish" computerized total stations systems, Global Positioning System (GPS) receivers, and expensive mapping equipment.

Comprehensive curriculum include courses in survey law, field surveying, Global Positioning System, Geographic Information Systems (GIS), photogrammetry, geodesy, cartography, hydrology & hydraulics, soil mechanics, and other related courses.

Graduate School opportunities are available for the Surveying Engineering graduates to continue further studies in surveying and mapping related fields in other institutions.

Over $14,000 in annual scholarships.

Faculty

The department faculty are dedicated and more than qualified to teach within the curriculum. To date there are four full-time, tenured faculty (the Department Chair is given no more than a 25% teaching load). One tenure-track position will be filled this year as replacement for Professor Jens O. Rick who retired in December, 1999. Two Surveying Engineering courses (SURE 321 and SURE 421) are taught by Construction Technology and Management faculty who are licensed professional engineers. The faculty also teach CONM 122, *Construction Surveying and Layout,* which requires a half-time faculty load because three sections are necessary for both fall and winter semesters. In addition, SURE/HUMN 331 Ethics and Professionalism in Engineering and Technology is open to all students in the campus.

For the last seven years, the department has been using one additional adjunct faculty member to meet all of the demands of the courses within the curriculum. While department demands are being met through the use of adjunct faculty, the authorization for a full-time tenure-track position would enhance the quality of instruction and remove the need to hire an adjunct faculty on a semester-to-semester basis. A request for this position has been made as part of the Unit Action Plan process. All of the full-time faculty have at least a Master's degree in the surveying engineering area. In addition, three of these members, along with the adjunct, are licensed as Professional Surveyors and one is a certified photogrammetrist. There is also an important thread through the faculty that maintaining professional competency is critical to the viability of the Surveying Engineering department.

The following is the list of faculty along with their professional involvement:

Khagendra Thapa, Ph.D.

- **Academic Rank**: Professor and Department Chair

Education:

- B.SC. (Honors) CNAA in Land Surveying Sciences, University of East London, UK
- B.SC. in Mathematics, Statistics, and Physics, Tribhuvan University, Nepal
- M.SC.E. in Surveying Engineering, University of New Brunswick, Canada
- M.S. in Geodetic Science and Surveying, The Ohio State University
- Ph.D. in Geodetic Science and Surveying, The Ohio State University

- **Teaching Experience**: 22 years
- **Field Experience**: 2 Years

Professor Thapa has been involved in the following activities:

- Chair of the Surveying Engineering Department
- Member of the American Congress on Surveying and Mapping (ACSM) Curriculum Accreditation and Registration (CAR) Committee
- Member of the (ACSM) Education Committee
- Reviewer for the ACSM Journal Surveying and Land Information System and ASCE Journal of Surveying Engineering
- Attended the ACSM Fall Conference at Grand Rapids, October, 1999
- Attended the annual MSPS Conference at Sault Ste. Marie in Feb., 2000.
- Elected to the Academic Senate of Ferris State University for next two years.
- Evaluator for the Accreditation Board for Engineering and Technology (ABET).
- Grant evaluator for the National Science Foundation
- Responsible for soliciting donations from Trimble Navigation, Environmental System Research Institute, Topcon Corporation, and Intergraph Corp., all of which are Phoenix Society Members.
- Responsible for soliciting a number of scholarships for the department.
- Received Certificate of Commendation from National Society of Professional Surveyors in 1994 and 1995.
- Published and presented several articles and papers in national and international peer-reviewed journals.
- Received the 1996 Michigan Association of Governing Boards Award.
- Received the Provost's Award for Excellence in 1997.
- Received a Certificate of Commendation from Ferris State University Board of Trustees for contributions to the university in 1995 and again in 1998.

Robert C. Burtch, PS

- **Academic Rank**: Professor
- **Education**:
  - B.S. in Surveying, Ferris State University
  - M.S. in Geodetic Science, The Ohio State University
- **Teaching Experience**: 20 years
- **Field Experience**: 8 years
- **Professional Licenses**: Professional Surveyor, Certified Photogrammetrist

Prof. Burtch has been involved in the following activities:

- Editor of the Journal of Surveying Engineering, American Society of Civil Engineers
- Treasurer of the Board of the Michigan Society of Professional Surveyors (MSPS)
- Member of the Board of Directors of the American Society for Photogrammetry and Remote Sensing (ASPRS)
- Member of the Task Force on the National Council of Examiners on Engineering and Surveying (NCEES) Model Law for Surveying
- Member of the ASPRS Certified Photogrammetrist Committee
- Member of the American Congress on Surveying and Mapping (ACSM) Scholarship Committee
- Member of the MSPS Geodetic Control/GIS Committee
- Member of the MSPS Scholarship Committee
- Reviewer for the ACSM journal *Surveying and Land Information Systems*
- Attended the ACSM Fall Conference at Grand Rapids, October, 19999
- Attended the annual MSPS Conference at Sault Ste. Marie in Feb., 2000
- Co-author of the MDOT Surveying Manual (with Carl Shangraw)
- Attended ASPRS Annual Conference (May, 2000)
- Attended workshop on airborne GPS (May, 2000)
- Attended workshop on softcopy photogrammetry (May, 2000)
- Attended IMAGIN Forum (May, 2000)

Sayed R. Hashimi, PS

- **Academic Rank**: Professor

- **Education**:
  - B.S. in Civil Technology – Surveying Option, Oregon Institute of Technology
  - B.S. in Computer Information Systems, Ferris State University
  - M.S. in Geodesy, Purdue University

- **Teaching Experience**: 21 years
- **Field Experience**: 7 years
- **Professional License**: Professional Surveyor

Prof. Sayed R. Hashimi has been involved in the following activities:

- Chair of the Licensing Board for Professional Surveyors
- Member of the NCEES Examination Committee
- Attended the ACSM Annual Convention in Little Rock – Attended a one day work shop on GPS Orthometric Height determinations
- Recipient of the ACSM Fellow award
- Member of ACSM, National Society of Professional Surveyors (NSPS), MSPS, American Society of Engineering Education (ASEE)

Carl F. Shangraw, PS

- **Academic Rank:** Assistant Professor
- **Education:**
  - B.A. Aquinas College
  - M.S. in Surveying, Purdue University
- **Teaching Experience:** 5 years
- **Field Experience:** 21 years
- **Professional License:** Professional Surveyor

Prof. Shangraw has been involved in the following activities:

- MDOT Survey Manual - Burtch and Shangraw are completing the writing of the new MDOT Survey Manual. The manual will be on the Internet this summer and serve as a guide for those performing design surveys for the Michigan Department of Transportation.

- First Order Level Network - Formed a consortium among MDOT, the National Geodetic Survey (NGS), Leica Geosystems, Inc. and the Surveying Engineering Department at Ferris State University to survey a First Order, Class II, vertical control network from Reed City, MI to Jackson, MI. The portion from Reed City to Portland was completed in the summer of 1999; the remainder is scheduled for completion during the summer of 2000.

- GPS Training - Provided training for a two-week period to the Survey Section, U.S. Army Corps of Engineers, Buffalo, NY District in high order GPS surveying techniques to support hydrographic surveying operations.

- Attended the fall conference of the American Congress on Surveying and Mapping held in Grand Rapids, MI during October of 1999.

- Attended winter conference of the Michigan Society of Professional Surveyors held in Sault Saint Marie, MI during February 2000.

- Attended GIS 2000 Symposium at St. Louis, Missouri, May, 2000.

- Member of ACSM, MSPS, Society of American Military Engineers.

Members of the Advisory Committee

The Surveying Engineering Department has a very active advisory committee consisting of leaders of the profession, alumni, and representatives from the Michigan Society of Professional Surveyors, the Michigan Society of Professional Engineers, and the Michigan Licensing Board for Professional Surveyors. The committee meets at least once a year. The input from the committee is seriously considered when the department upgrades and revises the curriculum. The following are the members of the committee:

Gary C. Bilow, PS
Michigan Dept. of Natural Resources

Mary C. Feindt, PS
Advanced Geomatics
Division of Charlevoix Abstract &
Engineering

John R. Fenn, PS
John Fenn & Associates

John G. Kamer, PS
Wightman and Associates

Paul B. Lapham, PS
Lapham and Associates

Gary D. Martin, PS
Martin Survey Assoc., Inc.

John D. Matonich, PS
Rowe, Incorporated

John I. Nelson, PS
Retired Surveyor

Zoran Novak
MSPE President

Jan S. Fokens, PS
MSPS President

Roland Self
MSPS Executive Director

Students

The department has attracted an academically strong, dedicated, interested, and hard working student body because of its tradition of success. The students have handled academic responsibility well, graduated with strong credentials, assumed responsible roles in the profession, and created an influential base of loyal alumni. They have continuously demonstrated a high degree of personal integrity, concern and respect for department facilities and equipment along with loyalty to the department and the university. In the fall semester 1999, the department had a total of 101 students.

Within the department there exists two nationally recognized student organizations: the Burt and Mullett Student Chapter of MSPS/ACSM and the Lambda Sigma National Surveying Honor Society. Both organizations are very active on campus, in the community and with the profession.

Students in the Surveying Engineering Department were recipients of six different national scholarships which were awarded by American Congress on Surveying and Mapping (ACSM) in March 2000. The following are the scholarships and the recipients:

Recipient	Scholarship	Amount
Amy Feindt-Zeitler	Mary Feindt Forum for Women in Surveying	$1,000
Jason M. Juras	Bernstein International Scholarship	$1,500
Jason M. Juras	NSPS Board of Governors Scholarship	$1,000
Scott A. Hendges	Allen Shelf Memorial Scholarship	$1,500
David Proctor	National Society for Professional Surveyors	$1,000
David Proctor	AAGS Joseph F. Dracup	$2,000

Students in the Surveying Engineering Department also received the following state-level scholarships in winter semester 2000:

Recipient	Scholarship	Amount
David Proctor	Michigan Society for Professional Surveyors	$1,000
Jason M. Juras	Richard Lomax Memorial Scholarship	$1,000
Michael Nelson	BMJ Scholarship	$500

Surveying Engineering Department Scholarship Recipients

The following students were awarded the scholarships for academic year 1999/2000:

Student	Scholarship	Year Established	Amount
Amy C. Feindt-Zeitler	Vijay Mahida Surveying Scholarship	1987	$400
Michael D. Nelson	The Urban Land Consultants Surveying Scholarship	1989	$1,000
Gilbert M. Barish	Fenn & Associates Surveying Scholarship	1993	$2,000
Brenda L. Gray	Lewis & Lewis Professional Surveying Scholarship	1993	$600
Carolyn A. Kieft	Mary C. Feindt Surveying Scholarship	1994	$500
Karl F. Brandys	Bishop Surveying Scholarship	1997	$500

Glenda M. Bromm	Khagendra Thapa Surveying Scholarship	1998	$500
Anthony D. Thelen	Robert C. Burtch Geodetic Surveying Scholarship	1998	$500
Scott Hendges	Moore & Bruggink, Inc. Scholarship	1999	$2,500
Jason M. Juras	Rowe, Inc. Scholarship	1999	$1,000
Nathan A. VanRaemdonck	Richard L. Rought Surveying Scholarship	1999	$500
David W. Proctor	David R. Greer Surveying Engineering Scholarship	1999	$500
David W. Proctor	Tingley & Associates Scholarship	2000	$500

Other scholarships that were awarded the Surveying Engineering Students during the last year:

Student	Scholarship	Year Established	Amount
Anthony D. Thelen	Robert Creswell Scholarship		$1,000
David Proctor	Donna M. Warfield Scholarship		Tuition
Carolyn Kieft	West Central Chapter of MSPS Scholarship	1988	$500
Scott Hopkins	Central Chapter of MSPS Scholarship		$500

Emeritus Awards Recipients for 2000

- J. David Henry - Amy C. Feindt-Zeitler
- Jens Otto Rick - Glenda M. Bromm
- Jack Pierson - Tony D. Thelen
- Robert Johnson – Michael D. Nelson
- John Norton – Scott W. Hopkins

Facilities and Industry Collaboration

The department has an excellent relationship with industry and employers which is the primary reason why so many donors help support the department. The following companies have donated over $100,000 dollars worth equipment, hardware and/or software:

1. Environmental System Research Institute of Redlands, California has donated software over a 9-year period with a value of approximately $500,000.
2. Trimble Navigation of Sunnyvale California has donated GPS equipment, hardware, software, and other accessories with a value of approximately $267,000.
3. Topcon Corporation has been loaning five total stations annually over the last

nine years. According to the arrangement worked out by Dominick Auletto, Vice President, Topcon Corporation and Dr. Thapa, Topcon sends these instruments at the beginning of the academic year and takes them back at the end of the academic year. This arrangement has helped students learn to use state-of-the-art equipment in our field laboratories.

4. Intergraph Corporation of Huntsville, AL, has donated many copies of Microstation as well as the MGE GIS software. In addition, it has donated an Image Station (a softcopy photogrammetric plotter). Intergraph's total donation to the department is valued at approximately $657,000.

Fund Raising Campaign 2000

During the 1999-2000 academic year, Dr. Thapa, Department Chair of Surveying Engineering, conducted a fundraising campaign, raising about $46,000. Donors consisted of private companies and alumni. The purpose of this campaign was to replace the computers used by the students in the computer mapping laboratory. Nineteen Dell 800 MHZ computers were purchased along with a laptop. The following companies and individuals are to be commended for their financial support:

Name	# of Computers
John Fenn, PS John Fenn and Associates	2
John Matonich, PS Rowe, Inc.	1
Jeff Wright, PS Urban Land Consultants	1
Tim Lapham, PS Paul Lapham Associates	1
David Smith, PS David Smith and Associates	1
BMJ Port Huron John C. Niederhauser, PS	1
Woolpert Mike Stanoikovich, PS	1
Metco Martin C. Dunn, PS	1
David Greer, PS	1
Wade Trim Thomas S. Brzezinski, PE	1

Atwell Hicks Todd Shelly, PS	1
Mcnamee Porter & Seeley Michael S. Hoben	1
Nederveld Gordon Nederveld	1
Wightman & Associates John G. Kamer, PS	1
Wilcox Associates Roxanne M. Hunter	1
Gould Engineering Kevin Cleaver, PS	1
Michigan Surveyors Supply John Lindstrom	1

SECTION 2

GRADUATE SURVEY, SURVEYING ENGINEERING

The questionnaire sent to graduates of the four-year Surveying Engineering program focused on five major areas: employment, professional skills, technical skills, solicitation of comments and graduate school. Sixty-eight surveys were returned representing alumni from the 1970's to present. The first nine questions of the survey were demographic in nature, (refer to Tab B for the actual instrument) so this discussion begins with question 10.

I. Employment.

Surveying Engineering (SURE) graduates are enjoying a strong economy and a very high demand for their skills. Average starting salaries for May 2000 graduates was in the $40,000 range. A detailed analysis of employment statistics may be found in the Labor Market Analysis.

II. Professional Skills.

Graduates were asked to rank the importance of four key professional skills: leadership, teamwork, communication and problem solving on a scale of 5 to 1 with 5 being critical and 1 being irrelevant.

Question 10, Relative Importance to Practice

Skill	Number of Responses						Percentages				
Importance	5	4	3	2	1	Total	5	4	3	2	1
Leadership	25	**33**	9	1	0	68	37	**49**	13	1	0
Teamwork	**30**	**30**	6	2	0	68	**44**	**44**	9	3	0
Communication	**43**	24	1	0	0	68	**63**	35	1	0	0
Problem Solving	30	**36**	2	0	0	68	44	**53**	3	0	0

(Bold numbers represent the highest number of responses and corresponding percentages.)

Scoring highest was communication ranked as critical by 63% of the graduates.

Graduates were then asked the degree to which their education at Ferris prepared them in the same four key areas.

Question 11, Ferris Preparation

Skill	Number of Responses						Percentages				
Importance	5	4	3	2	1	Total	5	4	3	2	1
Leadership	5	17	**32**	12	2	68	7	25	**47**	18	3
Teamwork	11	25	**28**	2	2	68	16	37	**41**	3	3
Communication	10	**26**	20	11	1	68	15	**38**	29	16	1
Problem Solving	23	**30**	13	1	1	68	34	**44**	19	1	1

(Bold numbers represent the highest number of responses and corresponding percentages.)

- 79% rated Ferris preparation in leadership as good (3) to excellent (5) with 47% being in the "good" (3) range.
- 94% rated Ferris preparation in teamwork as good (3) to excellent (5) with 41% being in the "good" (3) range.
- 82% rated Ferris preparation in communication as good (3) to excellent (5) with 38% being in the "very good" (4) range.
- 97% rated Ferris preparation in problem solving as good (3) to excellent (5) with 44% being in the "very good" (4) range.

The scores are encouraging and department faculty are keenly aware of the importance of these areas.

Leadership. Students have ample opportunity at Ferris to become involved, if they choose to do so. While leadership principles can be taught, developing an effective leadership style is an art that requires plenty of practice. Students in the Surveying Engineering program have two recognized student organizations which they may join, the Burt and Mullett Student Chapter of the American Congress on Surveying and Mapping (ACSM) and the Lambda Sigma Honors Society.

Membership in Burt and Mullett is open to any student in the department and is currently at an all time high. Students hold meetings each Tuesday and often there is standing room only. Guest speakers are brought in from government and private practice to give students a feel for the industry. Burt and Mullett hosts a venison dinner each November, organizes student participation in the Michigan Society of Professional Surveyors' annual conference which over 50 students typically attend, sends representatives to the ACSM national conference and gets involved in community projects such as Habitat for Humanity.

Membership in Lambda Sigma is open to the academic top one fourth of the junior class and the top one third of the senior class. Lambda Sigma members must be active Burt and Mullett members. Officers in Lambda Sigma cannot be officers in Burt and Mullett in order that maximum opportunity is provided for leadership in both organizations. Lambda Sigma hosts a scholarship night each fall, organizes a practice test and review sessions with department faculty for the first part of the survey licensing examination and conducts an inauguration each spring which involves a buffet luncheon, a guest speaker and an induction ceremony. This spring fifty people attended consisting of the eight inductees, parents, faculty, alumni and honorary members chosen for their generous past support to Ferris.

Outside of the department, Surveying Engineering students are involved with Big Brothers, Big Sisters, Boy Scouts, Girl Scouts, clothing drives, food drives, blood drives, tutoring local grade school children, serving Thanksgiving meals to the homeless and many, many other such activities too numerous to mention.

Reviewing the job titles of the 68 respondents, 15 are owners, presidents or CEO's, 25 are senior managers and 8 are first line supervisors. 71% of respondents are in leadership positions.

Teamwork: Teamwork is essential to the practicing surveyor. In a field environment, surveyors work in small groups from two to six people. Days are long, ten to twelve hours during busy seasons, and often crews are away from home for extended periods. Without effective teamwork, the survey project will fail. In an office environment, the professional surveyor is a critical part of a design team involving architects, engineers, bankers, attorneys, developers, title people and several federal, state and local government agencies. Surveyors analyze data, prepare maps, design subdivisions and parcel layouts, establish datums and coordinate systems for Geographic Information Systems, determine property boundary locations, provide construction control for buildings and infrastructure all as team members.

Numerous field courses where students work in small groups, open computer and photogrammetry labs and membership in student chapters of professional societies are designed to foster individual responsibility in a team environment.

Communication. The practice of surveying can arguably be reduced to a single word, *communication.* Surveyors communicate orally to court officials, clients, co-workers, government agents and the public in general. Surveyors communicate in writing with field notes, project reports, staff studies, requests for approvals, permit applications, letters of explanation, promotional materials and, yes, even letters to collection agencies. Surveyors communicate graphically in the form of maps, plans and charts. Surveyors communicate physically in the form of boundary monuments, construction stakes for alignment and grade, and utility layout. Surveyors communicate digitally to and from Land Information Systems (LIS) and Geographic Information Systems (GIS). There is nothing that a surveyor does that does not involve some form of communication.

Field courses emphasize field notes, physical elements and project reports; computer mapping, cartography, photogrammetry, and urban design emphasize the graphic elements; GIS and remote sensing emphasize the digital elements; speech, and the many opportunities presented inside and outside the class room to speak in front of groups, the oral elements; two English courses, two Legal Aspects courses, the professional practice courses, assigned term papers in the photogrammetry and geodesy courses emphasize the writing elements.

Communication is integrated into every aspect of this program.

Problem Solving. Surveyors communicate a lot because they solve a lot of problems; technical problems and people problems. Rigorous prerequisites in mathematics and the physical sciences coupled with cultural enrichment and social awareness courses added to the technical, business and legal requirements produce well rounded individuals with unique skill sets able to make real contributions to society and to the environment.

III. Technical Skills

Question 12 of the survey asked graduates to rate the relevance of 13 program areas to their practice. A score of 5 is critical, a score of 1 means irrelevant.

Question 12, Subject Area Relevance

Skill	Number of Responses						Percentage				
Importance	5	4	3	2	1	Total	5	4	3	2	1
Legal/Boundaries	**40**	18	7	1	2	68	**60**	26	10	1	3
Business Aspects	**25**	21	17	3	2	68	**37**	31	25	4	3
Geodesy/GPS	12	15	**24**	11	6	68	18	22	**35**	16	9
Photo/Remote Sensing	5	5	19	**28**	11	68	7	7	28	**42**	16
Data Analysis	18	17	**22**	8	3	68	27	25	**32**	12	4
Route/Traverse/COGO	**32**	24	10	1	1	68	**47**	35	15	1	1
GIS/LIS	6	8	19	**24**	11	68	9	12	28	**35**	16
CADD	**33**	23	7	2	3	68	**49**	34	10	3	4
Map Projections	14	**24**	18	9	3	68	21	**35**	26	13	4
Leveling	20	**25**	18	3	2	68	29	**37**	26	4	3
Land Use Design	12	17	**24**	10	5	68	18	25	**35**	15	7
Data Collecting/Processing	**30**	22	9	5	2	68	**44**	32	13	7	3
Soils/Drainage/Hydrology	8	13	**30**	12	5	68	12	19	**44**	18	7

(Bold numbers represent the highest number of responses and corresponding percentages.)

- Five areas were determined critical (5) by the most respondents: Legal/boundaries (59%), business aspects (37%), route/traverse/coordinate geometry (47%), CADD (49%), data collection/processing (44%).

- Rated very important (4) by the most respondents were leveling (37%) and map projections (35%).

- Rated important (3) by the most respondents were geodesy/GPS (35%), data analysis (32%), land use design (35%), soils/drainage/hydrology (44%).

- Rated not very important (2) by the most respondents were photogrammetry and remote sensing (41%) and GIS/LIS (35%). No area was rated irrelevant (1).

- The low ratings given photogrammetry/remote sensing and GIS/LIS do not correlate with the significant number of respondents (30 out of 68) who claimed GIS/LIS, of which photogrammetry and remote sensing form a significant part, a business activity. The ratings also do not correlate with the number (12 out of the 52 whom provided comments) who stated that more emphasis needed to be placed on the GIS/LIS arena.

The *1998-1999 Occupational Outlook Handbook* published by the U.S. Bureau of Labor Statistics states that: "Increasing demand for geographic data, as opposed to traditional surveying services, will mean better opportunities for mapping scientists involved in the development and use of geographic and land information systems." (See Labor Market Analysis)

As GIS/LIS systems become more widespread and as surveying engineers see the tremendous marketing and profit potentials for these technologies, perceived relevance of these program areas will increase exponentially. These are **emerging technologies** that offer outstanding opportunities for survey engineers and for Ferris State University. Kent County, Michigan is in the process of implementing a $16 million regional geographic information system (REGIS) that three of our students have interned with. Forming a partnership between the Surveying Engineering department and REGIS and offering a degree option in GIS are possibilities that cannot be overlooked.

Question 13 asked graduates to rate the degree to which their education at Ferris State University prepared them in the same thirteen areas.

Question 13, Ferris Preparation

Skill	Number of Responses						Percentage				
Importance	5	4	3	2	1	Total	5	4	3	2	1
Legal/Boundaries	15	**28**	22	3	0	68	22	**41**	32	4	0
Business Aspects	14	12	**31**	17	4	68	6	18	**46**	25	6
Geodesy/GPS	7	18	**28**	11	4	68	10	26	**41**	16	6
Photo/Remote Sensing	4	18	**31**	6	0	59	7	31	**53**	10	0
Data Analysis	13	**27**	15	5	1	61	21	**44**	25	8	2
Route/Traverse/COGO	12	**31**	16	4	1	64	19	**48**	25	6	2
GIS/LIS	4	7	**24**	13	9	57	7	12	**42**	23	16
CADD	7	12	**24**	10	7	60	12	20	**40**	17	12
Map Projections	8	**23**	**23**	8	0	62	13	**37**	**37**	13	0
Leveling	17	21	**22**	3	0	63	27	33	**35**	5	0
Land Use Design	5	8	**34**	12	1	60	8	13	**57**	20	2
Data Collecting/Processing	5	12	**18**	16	10	61	8	20	**30**	26	16
Soils/Drainage/Hydrology	6	13	**32**	10	1	62	10	10	**52**	16	2

(Bold numbers represent the highest number of responses and corresponding percentages.)

- Totals did not add up to 68 in all cases since not all respondents provided input to every item.
- Receiving highest numerical ratings of very good (4) were legal/boundaries, data analysis, route/traverse/coordinate geometry and map projections.
- All other areas received highest numerical ratings of good (3).

IV. Written Comments

Of the 68 respondents, 52 provided written comments. A complete transcript of those comments is provided in this chapter. Areas that received multiple comments were:

"The Surveying Engineering Department at Ferris State University needs to provide more..."

GPS	20 times
Business	13 times
GIS	12 times
Legal Aspects	12 times
Communication/People Skills	8 times

This program already requires 137 credit hours for graduation. There are 65 "mores" identified above. The single issue "mores" weren't even counted. The "lesses" could be counted on the fingers of one hand, with fingers left over. It must be remembered that these comments are coming from a population composed of 71% leaders!

With rapid changes and emerging technologies, with surveyors taking on larger projects and more of them over bigger and more diverse geographical areas, with a legal climate fostering ridiculous expectations, it is very evident that the formal education of a survey engineer **starts** with a bachelor's degree. Furthermore, a single degree program that attempts to cover all areas falling under the legal definition of the practice of surveying may no longer be the best approach. For these reasons, the faculty of the surveying engineering department is exploring degree options in such a way to meet the needs of the classical practitioner while providing opportunity for growth and development.

V. Post Graduate Education

Eight of the sixty-eight respondents (12%) have post graduate degrees. Degree and disciplines are listed below.

- 1 PhD Engineering
- 7 MSE/MS
  - Engineering
  - Environmental Engineering
  - Geodesy
  - Geomatics (GIS)
  - Photogrammetry
  - Space Systems Engineering
  - Soils/Natural Resources

An additional eighteen are interested in obtaining a graduate degree. Desired degrees and disciplines follow:

- 3 MS/MSE General Surveying
- 2 MS/MSE Geodesy
- 3 MS/MSE GIS
- 2 MSE Civil Engineering
- 1 MS Engineering Management
- 5 MBA Business Administration
- 2 JD Real Property Law (1 Enrolled)

Over one third or 38% of respondents have or are interested in obtaining a graduate degree. To this number may be added an additional two, one alumnus who did not respond and one graduating senior, who have been accepted at a major university for studies leading to masters degrees in surveying engineering.

ALUMNI SURVEY, SURVEYING TECHNOLOGY

The questionnaire sent to graduates of the two year Surveying Technology program focused on four major areas: employment, professional skills, technical skills and solicitation of comments. Forty-five surveys were returned representing alumni from the 1970's to present.

I. Employment.

Surveying Technology (SURT) graduates are enjoying a strong economy and a very high demand for their skills. All respondents reported being employed in some facet of the surveying industry. A detailed analysis of employment statistics may be found in the Labor Market Analysis.

II. Professional Skills.

Graduates were asked to rank the importance of four key professional skills: leadership, teamwork, communication and problem solving on a scale of 5 to 1 with 5 being critical.

Question 10, Relative Importance to Practice

Skill	Number of Responses						Percentages				
Importance	5	4	3	2	1	Total	5	4	3	2	1
Leadership	19	**21**	5	0	0	45	42	**47**	11	0	0
Teamwork	20	**22**	3	0	0	45	44	**49**	7	0	0
Communication	**25**	19	1	0	0	45	**56**	42	2	0	0
Problem Solving	**27**	18	0	0	0	45	**60**	40	0	0	0

(Bold numbers represent the highest number of responses and corresponding percentages.)

- 100% ranked leadership as being important (3) to critical (5).
- 100% ranked teamwork as being important (3) to critical (5).
- 100% ranked communication as being important (3) or critical (5).
- 100% ranked problem solving as very important (4) or critical (5).

Graduates were then asked the degree to which their education at Ferris prepared them in the same four key areas.

- 84% rated Ferris preparation in leadership as good (3) to excellent (5) with 64% being in the "good" (3) range.
- 92% rated Ferris preparation in teamwork as good (3) to excellent (5) with 47% being in the "very good" (4) range.
- 85% rated Ferris preparation in communication as good (3) to excellent (5) with 56% being in the "very good" (4) range.

- 93% rated Ferris preparation in problem solving as good (3) to excellent (5) with 49% being in the "very good" (4) range.

Question 11, Ferris Preparation

Skill	Number of Responses						Percentages				
Importance	5	4	3	2	1	Total	5	4	3	2	1
Leadership	19	**21**	5	0	0	45	42	**47**	11	0	0
Teamwork	20	**22**	3	0	0	45	44	**49**	7	0	0
Communication	**25**	19	1	0	0	45	**56**	42	2	0	0
Problem Solving	**27**	18	0	0	0	45	**60**	40	0	0	0

(Bold numbers represent the highest number of responses and corresponding percentages.)

The scores are encouraging and department faculty are keenly aware of the importance of these areas.

III. Technical Skills

Question 12 of the survey asked graduates to rate the relevance of 13 department areas to their practice. A score of 5 is critical, a score of 1 means irrelevant.

Question 12, Subject Area Relevance

Skill	Number of Responses						Percentage				
Importance	5	4	3	2	1	Total	5	4	3	2	1
Legal/Boundaries	**27**	11	0	3	4	45	**60**	24	0	7	9
Business Aspects	12	12	**14**	6	1	45	27	27	**31**	13	2
Geodesy/GPS	2	**20**	17	4	2	45	4	**44**	38	9	4
Photo/Remote Sensing	3	6	**21**	11	4	45	7	13	**47**	24	9
Data Analysis	15	**18**	8	4	0	45	33	**40**	18	9	0
Route/Traverse/COGO	**19**	15	9	2	0	45	**42**	33	20	4	0
GIS/LIS	2	11	**16**	13	3	45	4	24	**36**	29	7
CADD	**21**	15	8	1	0	45	**47**	33	18	2	0
Map Projections	15	**17**	9	2	2	45	33	**38**	20	4	4
Leveling	9	**16**	13	5	2	45	20	**36**	29	11	4
Land Use Design	8	**10**	**10**	12	5	45	18	**22**	**22**	27	11
Data Collecting/Processing	18	**19**	6	2	0	45	40	**42**	13	4	0
Soils/Drainage/Hydrology	9	5	**15**	8	8	45	20	11	**33**	18	18

(Bold numbers represent the highest number of responses and corresponding percentages.)

Three areas were determined critical (5):

Legal/boundaries (60%)
Route/traverse/coordinate geometry (42%)
CADD (47%)

Rated very important (4) were:
- Geodesy/GPS (44%)
- Map Projections (44%).
- Data Analysis (40 %)
- Leveling (36%)
- Data collection/processing (42%)

Rated important (3) were:
- Photogrammetry/Remote Sensing (47%)
- GIS/LIS (36 %)
- Soils/Drainage/Hydrology (33 %)
- Business Aspect (31 %)

Rated not very important was:
- Land Use Design (26%)

Major differences were noted between two-year and four year graduates. Two-year graduates rated land use design as not very important while four-year graduates rated this area important. This is not surprising since land use design would be appropriate to a four-year graduate.

Two-year graduates rated photogrammetry/ remote sensing and GIS/LIS as being important while four-year graduates rated these areas as not important. Two-year graduates are more likely to be involved in establishing ground control for photogrammetry than are four-year graduates.

Question 13 asked graduates to rate the degree to which their education at Ferris State University prepared them for those subject areas that are typically of concern to the survey technician and that they had ranked important in their practices. Totals, therefore, differ.

Question 13, Ferris Preparation

Skill	Number of Responses						Percentage				
Importance	5	4	3	2	1	Total	5	4	3	2	1
Legal/Boundaries	4	**19**	11	3	1	37	11	**51**	30	8	0
Route/Traverse/COGO	6	**16**	11	2	0	35	17	**46**	31	6	0
CADD	4	8	**10**	5	7	34	12	24	**29**	15	21
Leveling	9	**15**	10	0	0	34	26	44	**29**	0	0
Data Collecting/Processing	6	6	**10**	7	8	37	16	16	**27**	19	22

(Bold numbers represent the highest number of responses and corresponding percentages.)

- Receiving ratings of very good (4) were legal/boundaries (51%),

- Leveling (44%) and route/traverse/COGO (46%). CADD (29%) and Data collection/processing (24%) received ratings of good (3).

IV. Written Comments

Of the 45 respondents, 39 provided written comments. A complete transcript of those comments is provided in the appendix. Areas that received multiple comments were:

"The Surveying Department at Ferris State University needs to provide more..."

GPS	13 times
GIS	14 times
Legal Aspects	12 times
Communication/People Skills	7 times
Business	5 times

The relatively high rankings that GPS and GIS/LIS achieved among a population for whom those courses are not required coupled with the number of comments indicate that the curriculum content in the two-year program needs to be evaluated. A four-year degree option in a specific field such as GIS/LIS may attract students from this group.

SECTION 3

EMPLOYER SURVEY

The graduates' employer survey consists of 16 questions where the employers rated their impression of the graduates on a scale of 5 to 1. Five, meaning they strongly agree with the statement on the questionnaire and 1 meaning they strongly disagree. The survey was conducted by mail and **39** employers returned the survey for the four-year graduates, and only **8** employers returned the survey for the two-year graduates. Both the two year and the four-year graduate employer surveys were identical in their contents and all the employers were sent two separate surveys one labeled "2 Year Graduates Only" and the other labeled "4 Year Graduates Only". One possible explanation for lower response rate for the two-year graduates could be that employers may not have taken the time to fill out two identical sets of questionnaires.

The results of the survey are summarized for every question and are shown below for both the two-year and four year graduates. It should also be pointed out that not all respondents for the four-year graduates answered all questions, therefore, the total number of respondents may not add up to 39 for all questions.

1. The graduates have adequate theoretical knowledge.

	Four Yr.	**Two Yr.**
Strongly agree (5)	10	3
Agree (4)	20	1
Neutral (3)	7	3
Disagree (2)	1	10
Strongly disagree (1)	1	1
Not applicable (0)	0	0
Mean	3.9	2.7

2. The graduates have adequate technical skills.

	Four Yr.	**Two Yr.**
Strongly agree (5)	9	4
Agree (4)	21	1
Neutral (3)	6	3
Disagree (2)	2	0
Strongly disagree (1)	0	0
Not applicable (0)	0	0
Mean	4.0	4.1

3. The graduates have ability to apply knowledge in practical situations.

	Four Yr.	Two Yr.
Strongly agree (5)	5	4
Agree (4)	13	1
Neutral (3)	13	3
Disagree (2)	4	0
Strongly disagree (1)	0	0
Not applicable (0)	0	0
Mean	3.5	4.1

4. The graduates were prepared to assume entry level duties

	Four Yr.	Two Yr.
Strongly agree (5)	10	3
Agree (4)	20	2
Neutral (3)	7	1
Disagree (2)	1	2
Strongly disagree (1)	1	0
Not applicable (0)	0	0
Mean	3.9	3.8

5. The graduates exhibit willingness to learn and apply new experiences.

	Four Yr.	Two Yr.
Strongly agree (5)	14	5
Agree (4)	20	3
Neutral (3)	1	0
Disagree (2)	0	0
Strongly disagree (1)	1	0
Not applicable (0)	0	0
Mean	4.3	4.6

6. The graduates are competent in problem solving.

	Four Yr.	Two Yr.
Strongly agree (5)	5	2
Agree (4)	23	4
Neutral (3)	8	2
Disagree (2)	2	0
Strongly disagree (1)	1	0
Not applicable (0)	0	0
Mean	3.7	4.0

7. The graduates have grown and developed since hired.

	Four Yr.	Two Yr.
Strongly agree (5)	15	5
Agree (4)	17	3
Neutral (3)	5	0
Disagree (2)	0	0
Strongly disagree (1)	1	0
Not applicable (0)	0	0
Mean	4.2	4.6

8. The graduates are prompt in arriving for appointments.

	Four Yr.	Two Yr.
Strongly agree (5)	12	3
Agree (4)	21	4
Neutral (3)	3	1
Disagree (2)	0	0
Strongly disagree (1)	0	0
Not applicable (0)	1	0
Mean	4.3	4.3

9. The graduates are prompt in completing assignments.

	Four Yr.	Two Yr.
Strongly agree (5)	9	2
Agree (4)	17	4
Neutral (3)	8	2
Disagree (2)	2	0
Strongly disagree (1)	0	0
Not applicable (0)	0	0
Mean	3.9	4.0

10. The graduates exhibit an adequate level of ethical behavior.

	Four Yr.	Two Yr.
Strongly agree (5)	13	5
Agree (4)	19	3
Neutral (3)	6	0
Disagree (2)	0	0
Strongly disagree (1)	1	0
Not applicable (0)	0	0
Mean	4.1	4.6

11. The graduates demonstrate an adequate level of enthusiasm for the assigned tasks.

Strongly agree (5)	8	4
Agree (4)	19	4
Neutral (3)	9	0
Disagree (2)	1	0
Strongly disagree (1)	0	0
Not applicable (0)	0	0
Mean	3.9	4.5

12. The graduates effectively communicate orally with others.

	Four Yr.	**Two Yr.**
Strongly agree (5)	4	2
Agree (4)	21	2
Neutral (3)	13	4
Disagree (2)	2	0
Strongly disagree (1)	0	0
Not applicable (0)	0	0
Mean	3.7	3.8

13. The graduates use written communication effectively.

	Four Yr.	**Two Yr.**
Strongly agree (5)	3	2
Agree (4)	11	2
Neutral (3)	10	1
Disagree (2)	8	1
Strongly disagree (1)	1	1
Not applicable (0)	2	1
Mean	3.2	3.4

14. The graduates possess adequate computer competency.

	Four Yr.	**Two Yr.**
Strongly agree (5)	12	3
Agree (4)	16	3
Neutral (3)	3	0
Disagree (2)	3	2
Strongly disagree (1)	0	0
Not applicable (0)	0	0
Mean	4.1	3.9

15. The graduates recognize teamwork and work well in a team.

	Four Yr.	Two Yr.
Strongly agree (5)	8	4
Agree (4)	17	3
Neutral (3)	12	1
Disagree (2)	1	0
Strongly disagree (1)	0	0
Not applicable (0)	0	0
Mean	3.8	4.4

16. The graduates demonstrate leadership.

	Four Yr.	Two Yr.
Strongly agree (5)	7	3
Agree (4)	16	1
Neutral (3)	13	3
Disagree (2)	2	0
Strongly disagree (1)	1	0
Not applicable (0)	0	1
Mean	3.7	4.0

In addition, employers were asked five questions (17 through 21). The results for these questions along with some pertinent comments from the employers are shown below.

17. If the opportunity arose, please indicate your willingness to hire another Ferris graduate to work in your organization. Please explain your answer.

	Four Yr.	Two Yr.
High (5)	29	7
Moderate (4)	5	1
Low (3)	0	0
	0	0
	0	0
	0	0
Mean	4.9	4.9

This question fairly well summarizes how highly in demand Ferris graduates are in the profession.

18. Are there competencies in any specialty areas you feel a Ferris graduate should possess?

The following is the highlight of some typical responses the employers wrote:

- GPS specialty
- Construction, CAD, GPS…

- Additional business courses…
- Legal aspects of surveying…
- FSU has produced excellent surveyors
- FSU runs a good department
- Technology does not change understanding basic knowledge. Principles do not change tool change…
- Use of data collectors and GPS…
- FSU graduates seem to know SPC well
- People skills…
- Knowledge of day-to-day practice is weak
- More information on government surveys
- GPS and computers
- Computers and understanding GLO
- Urban surveying, re-establishing of older plats
- Communication and business
- Topography and engineering surveying skills are not taught to the same degree of property surveys
- Land description, problem solving, communication
- Basic understanding of business issues
- CAD training, GPS knowledge, problem solving (boundary)
- GIS/LIS

19. Based on today's surveying and mapping demands, are there any particular areas you feel Ferris should emphasize in the curriculum?

The following are typical responses the employers wrote:

- More communication skills, more time on GIS software
- Teach them how to teach themselves. Teach fundamentals, PLSS
- Emphasize laws directly affecting the profession
- Stay on the current edge of technology
- Greater emphasis on least squares
- Technically, FSU graduates are sound, need more people skills
- AutoCAD land development programs
- GPS & GIS
- Legal aspects of surveying
- GPS, GIS, State Plane…
- Teamwork, leadership responsibilities
- Construction staking
- GPS, GIS, Mapping, data analysis
- GIS
- AutoCAD
- GIS/LIS

20. What do you see as the emerging issues in the field of surveying and mapping?

The following are typical responses the employers wrote:

- GIS
- Strong economy graduates are pushed to management while lacking management skills
- Continuing education in boundary
- Wetlands & soil erosion control
- GPS robotics
- Danger that surveying will merge back with civil engineering
- Community feels that surveyors could not make it on their own
- Contracts, estimating & time management
- GIS & surveying
- Daily use of GPS
- GPS
- GIS
- GPS & GIS are major areas of future of surveying
- GPS, GIS
- GIS
- GIS/LIS

21. Are there any other areas not included in the survey that you would like to comment on?

The following are typical responses the employers wrote:

- Good results with Ferris graduates. I rank Ferris higher than its competitor…
- Our firm has had 7 4-yr. graduates, currently have 3
- Appreciation for older methods vs. GPS, learning motivating others
- Written communication skills
- High school recruiting, need more surveyors…
- Work ethics – people should be willing to work after 5 if they want to be successful
- Graduates are quite weak in preparing field notes
- Graduates believe they have an engineering degree. Engineering curriculum is weak and should be replaced w/ other courses or students should be appraised of the fact that they do not have en engineering background to assume engineering positions, but they have excellent credentials for entry surveying positions
- …unemployment in yrs. 2005-2008…curtail enrollment

Summary

It is clear that the current and the anticipated trends in new technologies are bringing to sharp focus the use of Global Positioning Systems (GPS) and Geographic Information System (GIS). The comments of many respondents echo this very need that we must address. Our attempt to introduce a new baccalaureate degree option in GIS will be a significant factor in strengthening the GIS, GPS components of the existing department. Furthermore, this new option will provide more specialized graduates in the GIS arena.

Overall, the employers seem to have high approval rate (3.9/5). The areas of improvements seem to be more GIS and GPS integration, CAD applications, more emphasis on written and verbal communications, and better coverage of US public land survey systems.

The results for the two-year graduates seem to portray similar trends, although the sample size being only 8 is not statistically large enough. The reason for this generalization is because the employers for the two-year graduates are the same as those for the four-year graduates.

SECTION 4

STUDENT SURVEY

In November 1999, a survey was conducted of the students within the surveying department areas. Student groups consisted of: Surveying Engineering (SURE) and Surveying Technology (SURT). There is very little difference between the two curricula in the surveying course contents for the first two years. The main difference lies in the support courses.

There were 64 responses from students within the SURE curriculum with 12 completed surveys from SURT students. It should be pointed out that most of the students in the SURT program are actually working towards their bachelors degree but are not eligible to be placed in the SURE program because they may be deficient in their mathematics background. Students can only be admitted into the Surveying Engineering program once they are eligible to enroll in MATH 130 or have transferred to Ferris with equivalent mathematics coursework.

A copy of the survey given to the students can be found in the appendix. The results of the two individual surveys are presented in tables 1 and 2 and are shown graphically in figures 1 and 2.

When looking at the results, it is easy to see that courses in the surveying department are challenging and intellectually inspiring, based on realistic prerequisites and help prepare the students for their future in the profession. There is no statistical difference in the responses between the SURE and SURT student groups. Students in both groups also agree that the written course objectives are available to the students and describe what will be learned in the course. The perspective of the students in both groups is a little higher than neutral in the area of the instructor using those instruments to keep the student abreast of their progress within the course.

All the students either agree or nearly agree with the questions on teaching methods, procedures and course content. In the SURT group, the question on the course meeting their projected career needs, interests and objectives is a little lower than that of the SURE students. Part of this can be explained that during the first two years of study in either curriculum the students are taking their math and science courses and they often do not see the relevance directly. These courses provide the foundation that will be used in subsequent course work where their relevance is more evident. Responses from both groups also show that, in general, the students agree that the surveying faculty know their subject matter, provide adequate advising, are available for outside help, and provide interesting and understandable instruction.

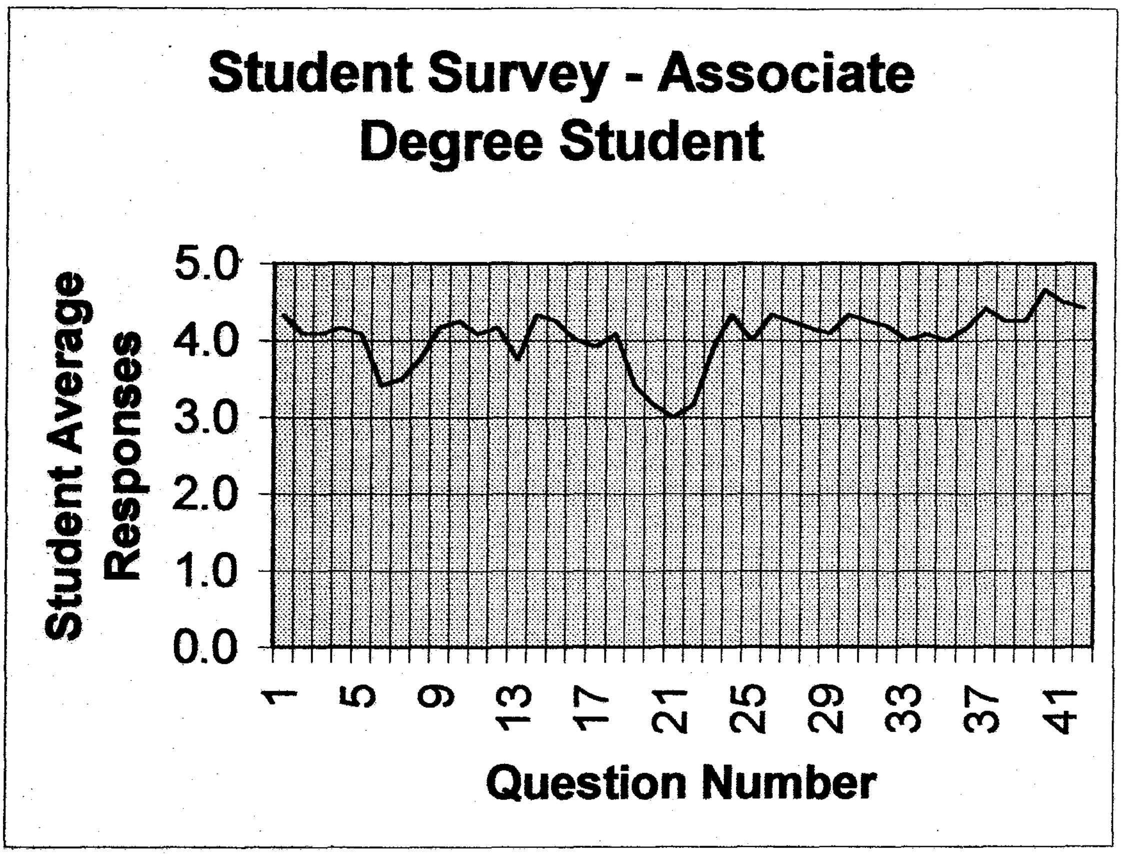
Questions that pertain to both related course work and faculty in areas such as English and Mathematics receive grades similar to the surveying faculty. The section addressing the surveying laboratories receives the lowest scores by the students. While these questions address the computer, photogrammetry, and mapping laboratories, there is a clear distinction made by the students between these facilities. In fact, it appears from the comments that there is widespread dissatisfaction with the computers and the software on those computers. The facility has only received band-aide assistance over the last five years and is inadequate in meeting the needs of the students. Software, when it does run, often does not run correctly. Since the SURE students rely heavily on the computer facility, their criticism is particularly important. The problem is so pervasive that many of the students have their own computers and use pirated software to complete assignments. The faculty do discourage this activity. The question addressing the sufficiency of open hours to work in the lab shows that students rate this higher than the other areas. Since many of the students have access to computers outside the labs and because they know that the computers/software may not work properly within our labs, they have a tendency to use their own computers. The issue of open hours is mainly restricted to those students who must rely on the computer laboratory and in these cases the availability is lower.

The weaknesses within the computer laboratory are also borne out in the written comments of the students about how courses are taught within the department. Projects become increasingly difficult to complete when computer operating systems change and programs that ran before cannot be used now. An example is the change in the operating system from NT to Windows 98 which occurred this last year. Some of the programs the department uses were based on the NT operating platform and were unavailable for use this year. In addition, when new upgrades to software are available, there is an inordinate amount of time between when the upgrade was received and the system installed on the computer network. This leads to frustration by both the faculty and the students.

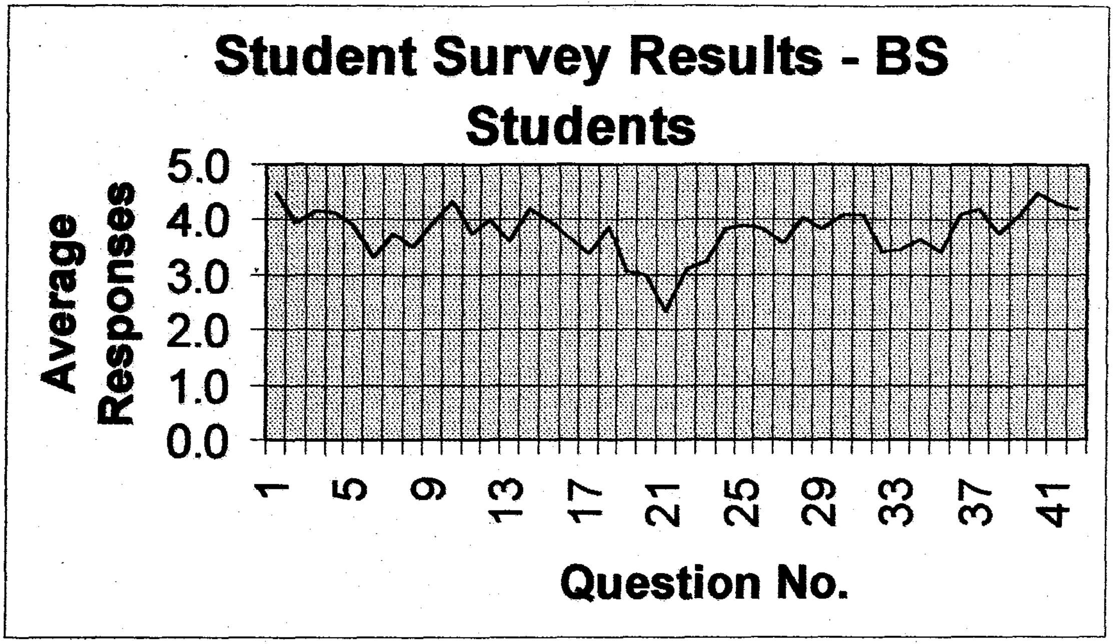
The students favorably graded the other laboratories. While the SURE students rate these facilities a little lower than the SURT students, they meet their needs within the curriculum. Moreover, the students agree that the surveying and mapping instruments are current, of sufficient quantity, and in good operating condition. There has been a lot of emphasis in the past couple of years to seek industry support to maintain the surveying instruments and they do represent the technology found in the industry to date. Other areas, such as the photogrammetry laboratory, need that same level of dedication to bring it up to industry norm. Students also agree that the instructional materials are current, meaningful, and easily obtainable. The question on the ease obtaining instructional material through the bookstore would not receive high rankings if the survey were done today. Students are having difficulty in obtaining the required textbooks and have had to rely on outside resources like the web to purchase their books. Note that this problem has occurred during the transition from a FSU bookstore to the new Barnes and Noble Bookstore.

Institutional support is important to the students. Generally, they agree that these support services meet their needs. SURE students rate the university library holdings lower in terms of currency and sufficiency. Another reason for the lower grade here is that many of the journals in the surveying and mapping area are not indexed in the normal indices at the library which forces the students to manually search past journals for relevant articles to topics they are researching. The library liaison for the department has been very helpful.

Finally, the students are very satisfied in their selection of surveying as a profession and in choosing Ferris State University as the institution where they want to study surveying. The department has an excellent national reputation and the students know this and feel good about what is being taught within the curriculum. They also agree that the faculty encourage them to become involved professionally. The overall grade for all respondents is 3.8 out of a maximum of 5.


Student Survey - Associate Degree Student
Student Average Responses
5.0
4.0
3.0
2.0
1.0
0.0
1
5
9
13
17
21
25
29
33
37
41
Question Number

	SURVEYING TECHNOLOGY	Mean	St. Dev
1	Challenging & inspriring	4.3	0.7
2	Realistic prerequisites	4.1	0.5
3	Help prepare me for future	4.1	0.7
4	Available to student	4.2	0.6
5	Describe what will be learned	4.1	0.3
6	Used by instructor	3.4	0.7
7	Meet career needs	3.5	1.3
8	Adequate supervised activities	3.8	0.8
9	Appropriate monitoring	4.2	0.6
10	Faculty knowledgeable	4.3	0.6
11	Adequate academic advising	4.1	0.7
12	Available for help	4.2	0.7
13	Interesting/understanding lecture	3.8	0.8
14			
15	Faculty knowledgeable	4.3	0.5
16	Available for help	4.3	0.6
17	Interesting/understanding lecture	4.0	0.4
18	Relevant to surveying program	3.9	0.7
19	Adquate lighting, etc.	4.1	0.5
20	Enough work stations	3.4	0.9
21	Hardware sufficient	3.2	1.5
22	Software maintained	3.0	1.3
23	Laboratories safe, etc.	3.2	1.3
24	Laboratories open sufficiently	3.9	0.7
25	Adquate lighting, etc.	4.3	0.7
26	Enough work stations	4.0	0.9
27	Laboratories safe, etc.	4.3	0.7
28	Laboratories open sufficiently	4.3	0.9
29	Representative of profession	4.2	0.6
30	Sufficient quantity	4.1	0.7
31	Safe & good operating condition	4.3	0.5
32	Current & meaningful	4.3	0.5
33	Easily obtainable	4.2	0.6
34	Meets needs and interests	4.0	0.4
35	Provided by knowledgeable staff	4.1	0.7
36	Library holdings current & sufficient	4.0	0.7
37	Classrooms provide adequate lighting	4.2	0.6
38	Classrooms have enough seats	4.4	0.5
39	Support facilities use encouraged	4.3	0.6
40	University safe, functional	4.3	0.5
41	Satisfied in choosing surveying	4.7	0.5
42	Satisfied in choosing Ferris	4.5	0.5
43	Encourage professional activities	4.4	0.5
		4.0	0.5


Student Survey Results - BS Students
Average Responses
5.0
4.0
3.0
2.0
1.0
0.0
1
5
9
13
17
21
25
29
33
37
41
Question No.

	SURVEYING ENGINEERING	Mean	St. Dev
1	Challenging & inspriring	4.5	0.6
2	Realistic prerequisites	3.9	0.8
3	Help prepare me for future	4.2	0.7
4	Available to student	4.1	0.8
5	Describe what will be learned	3.9	0.8
6	Used by instructor	3.3	1.0
7	Meet career needs	3.8	0.8
8	Adequate supervised activities	3.5	1.2
9	Appropriate monitoring	3.9	1.0
10	Faculty knowledgeable	4.4	0.7
11	Adequate academic advising	3.7	1.1
12	Available for help	4.0	0.8
13	Interesting/understanding lecture	3.6	1.1
14			
15	Faculty knowledgeable	4.2	0.7
16	Available for help	4.0	0.9
17	Interesting/understanding lecture	3.7	1.1
18	Relevant to surveying program	3.4	1.0
19	Adquate lighting, etc.	3.9	0.9
20	Enough work stations	3.1	1.4
21	Hardware sufficient	3.0	1.3
22	Software maintained	2.4	1.3
23	Laboratories safe, etc.	3.1	1.3
24	Laboratories open sufficiently	3.3	1.1
25	Adquate lighting, etc.	3.8	0.9
26	Enough work stations	3.9	1.1
27	Laboratories safe, etc.	3.9	1.0
28	Laboratories open sufficiently	3.6	1.1
29	Representative of profession	4.1	1.0
30	Sufficient quantity	3.8	1.1
31	Safe & good operating condition	4.1	0.9
32	Current & meaningful	4.1	0.7
33	Easily obtainable	3.4	1.2
34	Meets needs and interests	3.5	1.0
35	Provided by knowledgeable staff	3.7	0.9
36	Library holdings current & sufficient	3.4	1.0
37	Classrooms provide adequate lighting	4.1	0.6
38	Classrooms have enough seats	4.2	0.7
39	Support facilities use encouraged	3.8	0.9
40	University safe, functional	4.1	0.5
41	Satisfied in choosing surveying	4.5	0.6
42	Satisfied in choosing Ferris	4.3	0.8
43	Encourage professional activities	4.2	1.0
		3.8	1.6

SECTION 5

FACULTY SURVEY

Interpretation and Evaluation of the Surveying Technology and the Surveying Engineering Faculty Perceptions Survey

The Surveying Engineering (SURE) and the Surveying Technology (SURT) faculty of the College of Technology's Surveying Engineering Department were asked to complete a questionnaire, rating their perceptions of both programs. The survey instrument used was a modification of the PROE (Program Review of Occupational Education) document. Three (3) faculty members completed the survey. One (1) recently retired faculty member also completed the survey but it was not included in the statistical analysis. All questions were graded from one to five as follows:

5	=	Excellent
4	=	Good
3	=	Acceptable
2	=	Below Expectations
1	=	Poor

Sample surveys and average numerical values for each question are included in Appendix D. Results of the surveys are summarized below.

Overall, the mean rating of the Surveying Technology program was 3.13 while the mean rating of the Surveying Engineering program was slightly higher at 3.38. The differences between the two curricula were spread over each of the three units (Goals and Objectives, Processes, and Resources), however the widest disparity was observed in the Goals and Objectives unit. The Technology curriculum received an average 3.28 in this unit while the Engineering curriculum received a 3.81. Within this unit, the questions with the widest disparity were noted in items 2 (Program Goals), 5 (Use of Information on Job Performance Requirements), and 6 (Use of Professional/Industry Standards). From an evaluation of the written comments, it appears that the faculty feel that the program is subservient to the Engineering curriculum and needs an "advocate" because of its "unique needs."

The following areas were rated Good to Excellent (between 4 and 5):

<u>**Surveying Engineering:**</u>
- Program Goals
- Use of Information on Job Performance Requirements
- Use of Profession / Industry Standards
- Relevance of Supportive Courses
- Program Availability and Accessibility

- Efforts to Achieve Gender Equity
- Provisions for Program Advisement
- Provision for Career Planning and Guidance
- Adequacy of Career Planning and Guidance
- Provision for Employability Information
- Placement Effectiveness for Students in this Program
- Qualifications of Instructional Staff
- Scheduling of Instructional Facilities
- Use of Advisory Committee

Surveying Technology:
- Relevance of Supportive Courses
- Program Availability and Accessibility
- Provisions for Program Advisement
- Provision for Employability Information
- Placement Effectiveness for Students in this Program
- Qualifications of Instructional Staff
- Scheduling of Instructional Facilities

Based upon the above, it appears that the faculty are doing an excellent job in educating students. The instructional faculty are well educated, well qualified, and do a good job of teaching and advising.

Several areas received low marks (ranked Below Expectations to Poor) by the faculty (between 1 and 2):

Surveying Engineering:
- Instructional Staffing
- Professional Development Opportunities
- Use of Instructional Support Staff
- Use of Clerical Support Staff
- Adequacy and Availability of Learning Resources
- Provisions in Capital Outlay Budget for Equipment

Surveying Technology:
- Instructional Staffing
- Professional Development Opportunities
- Use of Instructional Support Staff
- Use of Clerical Support Staff
- Adequacy and Availability of Learning Resources
- Provisions in Current Operating Budget
- Provisions in Capital Outlay Budget for Equipment

From the above, and from the open-ended comments, it appears that the faculty are concerned about the continued use of part-time faculty and about equipment, particularly the computer laboratory. Faculty also rate the use of instructional support staff and clerical staff low. Faculty also feel that professional development opportunities are inadequately funded.

Reviewer's evaluation: With an overall mean for SURE of 3.38 and for SURT of 3.13, it is disappointing to see a department, widely viewed across the campus as a national center of excellence, viewed by its own faculty as merely "acceptable."

SECTION 6

ADVISORY COMMITTEE SURVEY

The Surveying Engineering Advisory Committee has the responsibility of advising the FSU faculty on both the Surveying Engineering and Surveying Technology programs. Every member of the committee was mailed a separate survey for each degree.

The committee members were asked a range of questions about the knowledge and expertise needed in the profession, demand for graduates, the role of the programs to produce competent graduates, physical facilities such as surveying equipment and computer hardware and software, and the nature of the curriculum in terms of meeting the demands of the profession. In addition, they were asked about the qualifications and competency of the faculty and the adequacy of the number of faculty needed in the program. They were also surveyed about the competency of the graduates vis-à-vis the graduates of the similar programs in the country. Furthermore, the committee was asked if the department received adequate financial support from the university. These questions were common to both programs. For the Surveying Engineering program, they were asked two additional questions: whether the university should add a GIS option and/or business option to expand the current programs. Survey questions were scaled one to five, as follows:

5 = Strongly Agree
4 = Agree
3 = Neutral
2 = Disagree
1 = Strongly Disagree
There was also a column labeled N/A, Not Applicable.

There are eleven members in the committee, three of which are ex-officio members. A similar survey was conducted last year for the ABET study with 100% response from the committee members. However, this year only six members responded to the survey. One reason for this low return rate may be due to the fact that many of them received numerous other surveys for this program review. For example, there is one member of the advisory committee who is a graduate from both the associate and bachelor degree programs. He could have received up to six different surveys to complete.

Regarding the questions of knowledge and expertise provided by the department, demand for graduates, the role played by the department in the profession, 100% of the respondents either strongly agreed (5) or agreed (4). Seventeen percent of the respondents disagreed (3) that the department had enough physical facilities, computers and equipment while 83% agreed (4) or strongly agreed (5) with this question. It should be noted that in terms of the survey equipment lab, the department is the best equipped in the nation. However, the computer lab is about five years old. Sixty percent felt that the department did not receive adequate financial support from the university.

Eighty-three percent of the respondents either agreed or strongly agreed that the department met the demands of the industry while 17% disagreed (3). Note that from both the alumni survey and employers survey and the requests for graduates of the department, it is clear that the department needs to produce more graduates to meet the demands of the industry.

Sixty-seven percent of the respondents either disagreed or were neutral on the issue of adequacy of the faculty for the department, despite the fact that one adjunct faculty has been working on semester-by-semester basis for the past seven years. It is evident that the advisory committee does not differentiate between full-time, tenure-track faculty and adjunct faculty. All of the respondents agreed that the department has faculty with adequate academic credentials and experience. On the question of financial support for faculty development and professional involvement, 67% of the respondents either disagreed (3) or checked (N/A).

All of the respondents agreed or strongly agreed that the department produces technically competent graduates and are competitive with the graduates of similar departments nationwide.

Sixty-six percent of the respondents felt that the surveying engineering department should be expanded to include GIS option while 83% felt that the program be expanded in the business area.

The questionnaire for the two-year AAS degree in surveying technology had identical questions as in the four-year surveying engineering degree except for the questions on program expansion as stated above. The nature of answers were pretty much the same as those for the four-year degree.

SECTION 7

LABOR MARKET ANALYSIS

The Bureau of Labor Statistics in the *1998-1999 Occupational Outlook Handbook* provides the following Job Outlook for Surveying and Mapping Scientists.

> Employment of surveyors and mapping scientists is expected to **decline** slightly through the year 2006, as the widespread availability and **use of advanced technologies such as the Global Positioning System, Geographic Information Systems, and remote sensing, are increasing both the accuracy and productivity of survey and mapping work.** Job openings, however, will continue to result from the **need to replace workers who transfer to other occupations or leave the labor force altogether.**
>
> As technologies become more complex, **opportunities will be best for surveyors and mapping scientists who have at least a bachelor's degree and strong technological skills.** Increasing demand for geographic data, as opposed to traditional surveying services, will mean **better opportunities for mapping scientists involved in the development and use of geographic and land information systems. New technologies, such as GPS and GIS may also enhance employment opportunities for surveyors and survey technicians who have the educational background enabling them to use these systems,** but upgraded licensing requirements will continue to limit opportunities for those with less education.
>
> Even as demand is increasing in nontraditional areas such as urban planning and natural resource exploration and mapping, **opportunities for surveyors and mapping scientists should remain concentrated in engineering, architectural and surveying services firms.** Growth in construction through the year 2006 should require surveyors to lay out streets, shopping centers, housing developments, factories, office buildings and recreation areas. However, employment may fluctuate from year to year along with construction activity. In addition, employment of mapping scientists and surveyors by private firms and the Federal Government will continue to be affected by budget cutbacks and technological efficiency.

A sampling of current data provided by the Michigan Department of Career Development in its *Michigan Occupational Forecast* seems to confirm data published by the Bureau of Labor Statistics is included with this report.

These analyses may at first leave the reader with the impression that the outlook for graduates of the Surveying Engineering program may be limited. Some key points need to be addressed

Many surveyors are indeed approaching retirement age. Others may be leaving active practice to pursue other interests. Coupled with a booming economy, **a severe shortage of qualified personnel has resulted.**

This program graduates approximately 25 students per year. There are several jobs available for each graduate. The Surveying Engineering bulletin board on the second floor of the Swan building is filled every spring with openings in Michigan and throughout the country. Each Tuesday, representatives from government and private industry speak at the Burt and Mullet student chapter meeting. All have candidly admitted to being on recruiting missions. Department faculty are barraged with phone calls, faxes and face to face requests for graduates and interns. This year alone students have printed and distributed over 350 copies of their resume books to hungry potential employers.

This department is not producing enough graduates to even fill positions created by normal attrition let alone by an expanding economy. The data compiled by the Federal Bureau of Labor Statistics and the Michigan Department of Career Development are not being questioned. What is being questioned is the analysis of those data. **Declining numbers have not been caused by lack of opportunity, but by lack of qualified people to fill available positions** especially among technicians in the more densely populated areas.

The faculty agrees with reported trends in further automation. Remarks in surveys taken for this program review as well as responses to questions asking for the type of work graduates are involved with show that classical surveying is alive and well as evidenced by an expressed need for more courses in legal aspects of surveying and business. In addition, a significant number of graduates are working with and feel the need for additional education in the Global Positioning System (GPS), Geographic Information Systems (GIS) and especially "people skills" such as leadership, teamwork and communication.

Article 20 of Public Act 299 of 1980, The Michigan Occupational Code, states that the Practice of Surveying includes all of the following:

(i) Land Surveying which is the surveying of an area for its correct determination or description for its conveyance, or for the establishment or reestablishment of a land boundary and its designing or design coordination of the plotting of land and the subdivision of land.

(ii) Geodetic Surveying which includes surveying for determination for the size and shape of the earth both horizontally and vertically and the precise positioning of points on the earth utilizing angular and linear measurements through spatially oriented spherical geometry.

(iii) Utilizing and managing Land Information Systems through establishment of datums and local coordinate systems and points of reference.

(iv) Engineering and Architectural Surveying for design and construction layout of infrastructure.

(v) Cartographic Surveying for the making of maps, including topographic and hydrographic mapping.

Individuals surveyed were asked to specify which of the above area(s) their firms were involved with. Results are expressed in the table below.

PROGRAM	RESPONDENTS	LS	GEOD	GIS/LIS	E&A	CARTOG
SURE	68	62	30	30	60	50
SURT	45	36	27	25	34	34

LS = Land Surveying
GEOD = Geodesy
GIS/LIS = Geographic Information System/Land Information System
E&A = Engineering & Architecture
CARTOG = Cartography

From this table, three important points emerge.

- Many firms provide an array of services, all which fall under the umbrella of "surveying".
- Classical surveying is alive and well as evidenced by the large numbers in both programs performing land surveys, engineering, and architectural surveys.
- Nearly half of respondents from both programs provide geodetic surveying and GIS/LIS. These are new and emerging technologies for which there is an obvious demand by both providers and users.

Michigan and many other states require a bachelor's degree to become licensed as a professional surveyor. This requirement has been in place in Michigan since 1972. Individuals without a degree were allowed to "grandfather" up until last year. This means that if they were eligible to sit for the licensing exam when the law went into effect and did not pass, applicants could continue to take the exam. Because very few, if any, were passing subsequent exams, they had to successfully pass the exam in 1999 or meet the law's requirements in order to take the exam in the future.

The trend of requiring the four-year degree is on the increase. While the current alumni survey indicated that two-year graduates are doing very well, sometimes better than four-year graduates, time is on the side of the four-year graduate. Generally, four-year graduates working for big firms in large to medium sized metropolitan areas do better financially than four-year and two year graduates working for smaller firms outside of the larger metropolitan areas. There are exceptions, but this trend is expected to continue as the larger firms in the larger areas offer better salaries, more employment diversity, increased opportunity for continuing education and wider scales of economy.

The surveying engineering program is optimistic about its future. A number of positive indicators show an increase in the potential demand for surveying engineering graduates. Among these indicators are:

- Michigan becoming a national leader in attracting new or expanded manufacturing facilities.
- The huge influx of federal and state monies in the State of Michigan for highway and bridge construction.
- Urban Revitalization bringing with it renaissance zones, brown fields redevelopment, urban waterfront improvements, and a new emphasis on core cities as being desirable places to work, to play and to reside.
- Exploding increases in construction permits and mortgage financing.
- Emphasis on Sustainable Development of limited resources.
- A projected 5% increase in the population of the State of Michigan based on the 2000 census.

All of these indicators point to further demand for highly trained and multi-disciplined surveying engineering graduates who are ready to play key roles in making all of the above happen.

On the negative side it must be realized that the surveying industry is extremely sensitive to interest rates and reacts immediately to any changes. Actions by the Federal Reserve Board to slow the rate of economic growth in fiscal years 1999 and 2000 are being felt in the industry. Informal polls among practicing professionals reveal a current positive business climate where everyone is busy and overtime abounds, but not as busy or not as much overtime as in the past two years. Graduates continue to be in extremely high demand, however, and the slight slow down in growth rates has had no adverse effects on employment.

Labor Market Analysis, SURE

The following is a brief synopsis of key areas reported by the 68 respondents to the questionnaire sent to Surveying Engineering graduates.

1. Professional Licensing

- Of the 68 respondents, 49 are Licensed Professional Surveyors. 62 respondents, including those licensed, have passed the Fundamentals of Surveying Examination. Of the difference (68 - 49 = 13) 10 do not yet have the required minimum of four years of experience. From these figures, it is concluded that the vast majority (91%) of those who enter the Surveying Engineering program do so to become licensed and succeed in doing so.

2. Employment Arenas

- 81% of respondents are employed in the private sector.

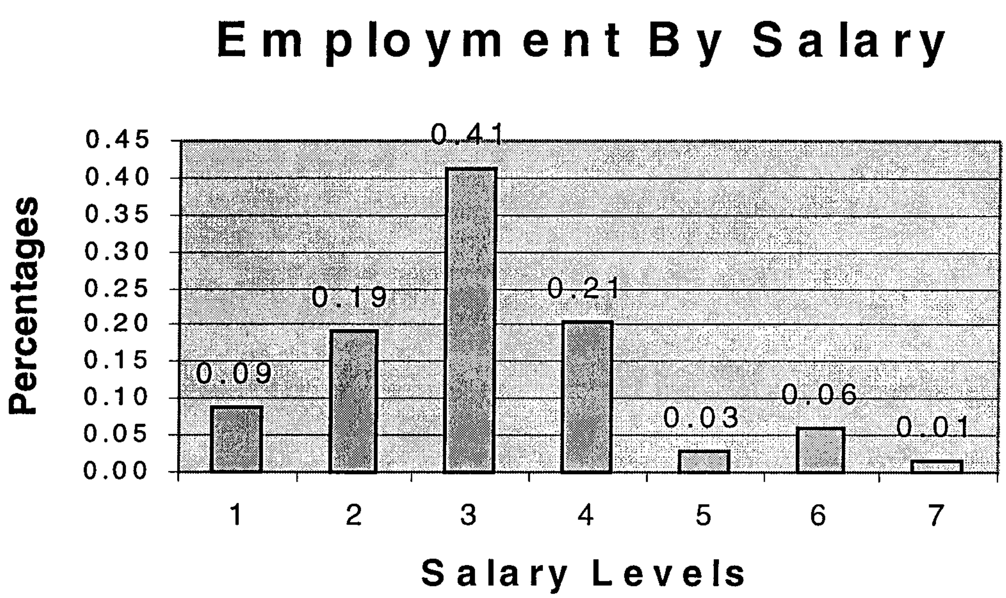
- 16% of respondents are employed in the public sector.
- 3% of respondents report not being employed as surveyors.

3. Organizational Size

- 49% of respondents are employed by firms of 50 or more people.
- 15% of respondents are employed by firms of 25 to 50 people.
- 13% of respondents are employed by firms of 10 to 25 people.
- 7% of respondents are employed by firms of 5 to 10 people.
- 13% of respondents are employed by firms consisting of 1 person.

4. Salaries (Note that level indicates salary level in the accompanying figure.)

- 9% of respondents report annual salaries of over $100,000 (Level 1).
- 19% of respondents report salaries ranging between $75,000 and $100,000 (Level 2).
- 41% of respondents report salaries ranging between $50,000 and $75,000 (Level 3).
- 21% of respondents report salaries ranging between $40,000 and $50,000 (Level 4).
- 10% of respondents report salaries of less than $40,000 (Levels 5,6,7).



5. Geographical Areas

- 27% of respondents are employed in the metro Detroit area.
- 21% of respondents are employed in the metro Grand Rapids area.
- 10% of respondents are employed in the metro Lansing area.
- 7% of respondents are employed in the Saginaw/Bay City area.
- 7% of respondents are employed in the metro Flint area

- 3% of respondents are employed in the Jackson/Kalamazoo area
- 12% of respondents are employed in that part of the northern portion of Michigan's Lower Peninsula lying North of M-57.
- 12% of respondents are employed out of state.

Labor Market Analysis, SURT

1. Professional Licensing

Since 1972 the State of Michigan has required a bachelor's degree for licensure as a professional surveyor. 30 of the 45 respondents to the questionnaire stated that they were licensed. It is believed that the reason is two fold.

A. Names of graduates from both programs were provided by the alumni office. The lists may not be up to date. Many four-year graduates also obtain the two-year degree. Those in the dual degree category may have been sent the wrong form.

B. Further analysis paints a better picture. 10 of the 30 are licensed in states that do not require a four-year degree. Five report having bachelors' degrees in other areas. This group may be licensed providing they have the course work described in the Michigan Occupational Code and providing that they have a four-year degree acceptable to the board. Others may have "grandfathered" in with experience and felt the two-year degree was sufficient. Except for those out of state, we are dealing with speculation.

2. Salaries

- 0% of respondents report annual salaries of over $100,000 (Level 1).
- 11% of respondents report salaries ranging between $75,000 and $100,000 (Level 2). All except 1 in this category are licensed surveyors in other states. The one exception in a licensed surveyor who is president of a firm in Cadillac, MI. This entry is suspect.
- 40% of respondents report salaries ranging between $50,000 and $75,000 (Level 3). This percentage compares evenly with that of the four-year graduates. It should be noted, however, that this appears to be the top range for two-year graduates and only if they are licensed which in Michigan is no longer a possibility. Many may be hourly employees and these numbers reflect many hours of over time.
- 27% of respondents report salaries ranging between $40,000 and $50,000 (Level 4).
- 22% of respondents report salaries of less than $40,000 (Levels 3,2,1).

3. Employment Arenas

- 80% of respondents are employed in the private sector.
- 20% of respondents are employed in the public sector.

These percentages are virtually identical to those of four-year graduates.

4. Organizational Size

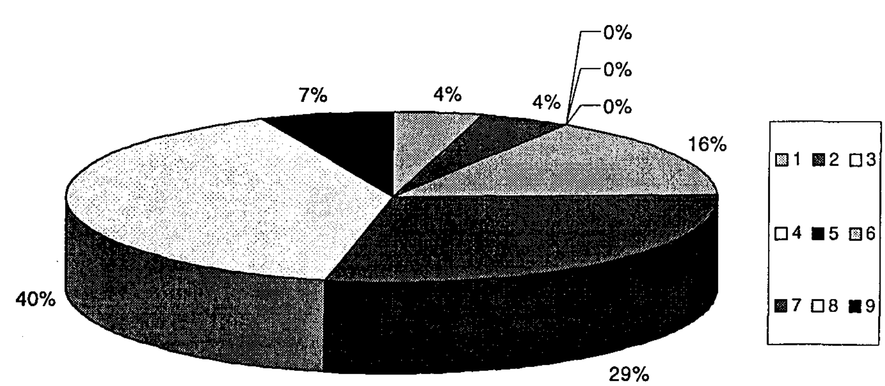
- 62% of respondents are employed by firms of 50 or more people. This is significantly higher than the 49% of four-year graduates.
- 11% of respondents are employed by firms of 25 to 50 people.
- 9% of respondents are employed by firms of 10 to 25 people.
- 7% of respondents are employed by firms of 5 to 10 people.
- 11% of respondents are employed by firms consisting of 1 person. This statistic is suspect. Three of the five in this category are licensed surveyors and are probably consultants. The two remaining would have to be working with at least one licensed person or be practicing illegally.

5. Geographical Areas

- 4% of respondents are employed in the metro Detroit area. (Area 1)
- 4% of respondents are employed in the metro Grand Rapids area. (Area 2)
- 0% of respondents are employed in the metro Lansing area. (Area 3)
- 0% of respondents are employed in the Saginaw/Bay City area. (Area 4)
- 0% of respondents are employed in the metro Flint area (Area 5)
- 7% of respondents are employed in the Jackson/Kalamazoo area (Area 6)
- 29% of respondents are employed in that part of the northern portion of Michigan's Lower Peninsula lying North of M-57. (Area 7)
- 40% of respondents are employed out of state. (Area 8)
- 7% are employed in Michigan's Upper Peninsula (Area 9)

There are significant differences between SURE respondents and SURT respondents. A full 40% of SURT respondents work out of state. This may be due to less rigorous licensing requirements in other states. Thirty-six percent work in the northern portion of Michigan's Lower Peninsula or the Upper Peninsula.

Geographic Area - SURT



Summary

1. There exists a severe shortage of both SURE and SURT graduates.
2. Future opportunities will be best for those with skills in advanced technologies coupled with a thorough understanding of classical surveying.
3. Licensing requirements will provide less opportunity for SURT graduates than they have enjoyed in the past.

SECTION 8
FACILITIES AND EQUIPMENT

The computers in the Surveying Engineering department computer laboratory have been replaced this summer entirely through industry donations.

Surveying instruments and support equipment available to the faculty and students are both modern and representative of the surveying and mapping industry. The surveying and mapping instrument inventory at Ferris State University has been assembled over forty-three years. It has always been the objective of the faculty to provide a sufficient supply of high quality and well-maintained instruments to the students. University funding, industrial consignment and donations, government loans by the National Imagery and Mapping Agency and matching grants from the National Science Foundation have enabled the department to acquire many sophisticated instruments and software. As a result, the department has maintained modern and advanced surveying and mapping instrumentation.

Consignments from instrument manufacturers include:

Five total stations and a digital level from TOPCON Corporation of America have been consigned to the department yearly for the last eight years. In addition, the department has been able to obtain the following systems via industry donations:

- Two Trimble SSTI geodetic Global Positioning Systems (GPS) receivers with software.
- Intergraph Image Station Softcopy Photogrammetic Plotter.
- Two Magellan NAV 5000 PRO GPS receivers with submeter kit and software.

The department has also been able to purchase additional equipment for student instruction through grants from the National Science Foundation. They include:

- $72,000 Instrumentation and Laboratory Improvement (ILI) grant received for the purchase of analytical and softcopy photogrammetry equipment. The university provided an additional $72,000 in matching funds. This money was used to purchase one Leica SD-2000 analytical stereoplotter, one Zeiss P-33 analytical stereoplotter, three softcopy Digital Video Photogrammetry (DVP) stations, and four Kork Systems mapping software systems. These systems are in need of upgrading. The first phase of this modernization occurred this summer with the purchase of newer versions of the DVD software.

- $25,000 Instrumentation and Laboratory Improvement (ILI) grant received for the purchase of "field-to-finish" surveying equipment. The university provided an additional $25,000 as matching funds. This grant allowed the department to purchase three Leica total stations, three 80386 microcomputers, and one HP Draftmaster plotter. All of this equipment has been subsequently upgraded.

Newer specific state-of-the art equipment available to accomplish department objectives is listed below.

1. Total Stations, Levels, and Theodolites

    5 TOPCON Total Stations
    5 LEICA Total Stations
    6 TOPCON Digital levels each with bar-coded rods
    5 Leica Automatic Levels
    5 Wild T3 Precision Theodolites
    10 LEICA Electronic Theodolites

2. GPS Hardware and Software

    4 PROXR Receivers
    2 SST Trimble receivers capable of kinematic measurements.
    2 SSI Trimble receivers capable of kinematic measurements.
    2 Magellan NAV 5000 PRO receivers with submeter kit and software

3. Computers

    1 Pentium 700 MHZ Server with 10 GB Hard Drive
    19 Pentium 800 MHZ processor Dell microcomputers
    1 HP LaserJet Printer
    1 24" x 36" Calcomp Digitizing Tablet
    2 HP plotters

4. Photogrammetric Equipment

    1 SD-2000 Leica analytical plotter with ATLAS mapping software
    1 Zeiss P-33 analytical plotter with CADMAP software
    3 DVP softcopy photogrammetry stations
    1 Intergraph Imagestation
    8 Analog photogrammetry plotters, 4 of which are computer controlled and run with the Kork Mapping System

5. Major Software

    Complete package of EAGLE POINT

3 Tripod Data System TDS
10 ARC VIEW
10 PC ARC/INFO (NT versions)
4 PATHFINDER OFFICES
15 ERDAS Remote Sensing/Image Processing Software
4 Kork Systems mapping software for analogue stereoplotters

The laboratory equipment is sufficient and adequate for the number of students currently enrolled in the department. However, an increase in enrollment will require additional equipment through university funding as well as outside support. While the photogrammetry lab is adequate, the software in use is a couple of generations behind the systems currently found in the industry. The maintenance costs are expensive and beyond the resources currently available to the department.

The following laboratory and classroom space is available for instruction:

Computing Laboratory Swan 206 - 1000 sq. ft.

This laboratory houses 19 microcomputer stations, one laser printer, two plotters, and one Calcomp digitizer. These computers are all linked by a NOVEL Local Area Network. The network has graphics packages, high level programming language compilers, spreadsheets, word processor and the surveying and mapping specialty software. In addition, these computers are connected to the Business Technology Consortium file server. A link to the outside the university is facilitated by T1 line which provides Internet access. Additional microcomputer stations are housed in Swan 201, Mapping Laboratory, adjacent to Swan 206.

Mapping Laboratory Swan 201, 204 - 1980 sq. ft.

This laboratory houses 13 photogrammetric stereoplotters, and 6 microcomputers. Of the 13 plotters, 2 are analytical plotters, 7 are analog plotters with four being interfaced with computers, three are DVP units (located in the adjacent computing laboratory), and one is an Intergraph Image Station.

Mapping Laboratory General Campus - 750 Acres

All outdoor surveying laboratory courses are taught and supervised by faculty themselves. The university owns approximately 750 acres of land that provides ample space to perform surveying functions.

Surveying Engineering Classroom Swan 211 - 930 Sq. ft

This area serves as a primary classroom/lab for the Surveying Engineering department. It is located close to the surveying instrument room, and is convenient for teaching courses which require actual equipment demonstration. It also houses a Mapograph in the back of the room, and some display cases. The classroom furnishings are adequate. This room was remodeled in 1988, is carpeted and has excellent new furniture. All field-surveying courses use this room. A large screen monitor and computer are available to facilitate computer instruction.

Surveying Instrument Room Swan 209 and 210 - 600 sq. ft.

This area houses all the surveying and surveying related equipment, and also has an equipment dispensing area with counter as well as office space for the dispensing personnel.

Construction Materials Lab CTC 107 - 5600 sq. ft.

This laboratory provides a well-equipped 1200 SF soils and material laboratory and a construction assembly and testing laboratory of 4400 SF. The space and equipment in this lab are used for teaching soils, materials, and construction practices courses. CONM 121 and SURE 421 use this facility. This facility is primarily used for other courses within the Construction and Facilities Department.

PAST EQUIPMENT MAINTENANCE AND UPGRADE

* COT means College of Technology
** S. & E. means Supplies and Expenses allocation fund

Five-Year Plan

	COST	FUNDING SOURCE
First Year: 1993/94		
Upgrade 8 80386 Microcomputers @ $800 each	$6,400	*COT Equipment Allocation
Remodeling of Surveying Instrument Room	$4,000	Development Fund
Replacement of existing laser printer	$1,500	COT Equipment Allocation
Equipment Maintenance Cost	$3,500	**Department S. & E. Fund
	$15,400	
Second Year: 1994/95		
Upgrade remaining 8 80386 Microcomputers at $800 ea.	$4,800	COT Equipment Allocation
One Additional hard drive for the Server	$2,500	COT Equipment Allocation
Equipment Maintenance	$3,500	Dept. S. & E. Fund
	$16,400	
Third year: 1995/96		
Replacement of Existing Server, and software	$8,000	COT Equipment Allocation
4 microcomputers $2,000 ea.	$8,000	COT Equipment Allocation
Equipment maintenance	$4,000	Dept. S. & E. Funds
	$20,000	
Fourth Year: 1996/97		
4 microcomputers	$8,000	COT Equipment Allocation
Equipment Maintenance	$4,000	Dept. S. & E. Funds
	$22,500	

Fifth Year: 1997/98

Replacement of laser Printer	$1,500	COT Equipment Allocation
Replacement of HP Plotter	$5,000	COT Equipment Allocation
4 microcomputer upgrades	$3,200	COT Equipment Allocation
Replacement of 2 EDMIs	$6,000	COT Equipment Allocation
Equipment maintenance	$4,500	Dept. S. & E. Funds
	$20,200	

Fifth Year: 1998/99

5 Leica Total Stations	$20,000	S & E and Vocational Education Funds
TDS Software	$300	University equipment funding
EAGLE POINT Software	$1,500	University equipment funding
TOPCON Digital level	$3,500	University equipment funding
Upgrade photogrammetry equipment	$2,500	University equipment funding
Upgrade computer Lab. (hard drives, memory and zip drives)	$ 4,685	University equipment funding
	$32,485	

- Five Total Stations were obtained on loan from Topcon Corporation in September 1999. These instruments are on consignment from the company. They will be returned to Topcon at the end of the academic year.

- Three copies of Direct View Photogrammetry software package for $1500 were purchased. It has a retail value of $30,000. This software is used both in SURE 340 and SURE 440 courses.

- Twenty licenses of MathCAD, which is used in several courses, have been purchased in May 2000.

- Three digital levels were purchased bringing our current inventory to six digital levels.

- Ten Leica Digital Theodolites

SECTION 9

CURRICULUM

Program Educational Objectives

THE VISION:

The vision of the Surveying Engineering department is to provide quality education to the students. The department is designed to achieve the following program goals:

- Educate a new generation of surveying engineers to meet the challenges of the future.
- Promote a sense of scholarship, leadership, and service to the community.
- Disseminate new knowledge.
- Play a leadership role in fostering interdisciplinary education which could help to solve the complex problems facing the modern society.

The Surveying Engineering department is designed to meet the demands of our students, employers, and society. The educational objectives associated with the program, a list of outcomes, and a description of assessment methods used to determine how well the outcomes are being satisfied are given below:

EDUCATIONAL OBJECTIVES:

1. Provide an educational experience that prepares the students for the challenges of the surveying profession that they will encounter during their professional life.

2. Provide opportunities for the students to exhibit creativity, leadership and team-building abilities, cultural appreciation, global understanding, and social issues.

3. Employ state-of-the-art technologies in the surveying engineering curriculum.

4. Incorporate interdisciplinary concepts and problem solving exercises in the program.

5. Provide a broad educational experience including communications skills, mathematics and basic science, preparing students for life-long learning.

THE MISSION OF FERRIS STATE UNIVERSITY:

"Ferris State University will be a national leader in providing opportunities for innovative teaching and learning in career-oriented, technological and professional education."

Keywords in this mission statement are: national leader, career-oriented, technological and professional education. Surveying Engineering is certainly a program which satisfies all the keywords of the mission of the university. Ferris State University is considered a national leader in undergraduate surveying engineering education. Further, it is highly technical and uses state-of-the-art technology such as Global Positioning Systems (GPS), digital mapping, Geographic Information Systems (GIS), and electronic methods of surveying. The program is professional because its graduates can attain licensure as professional surveyors once they pass the appropriate tests and gain the required experience. The administration and faculty believe that the program is very relevant and appropriate to the mission of the university.

A team from Accreditation Board for Engineering and Technology (ABET) visited campus during the third week of October, 1999. After three days of checking students work, equipment, curriculum and individually talking to faculty, administrators, and students, the team found no deficiencies in the program. An initial report from ABET was received on March 29, 2000. Apart from a few concerns such as the lack of a sixth tenure-track faculty and required improvement in the computer laboratory, ABET had a very positive report both on the program and the university. Surveying Engineering at FSU was the first program in the U.S. in this discipline to follow the new Engineering Criteria 2000 (EC2000). This attests to the national reputation of this program.

SIGNIFICANT CONSTITUENCIES OF THE PROGRAM:

The following groups are considered to be the constituencies of the program:

1. The employers of the graduates of the program.
2. Alumni of the program.
3. Students in the program.
4. Department Advisory Committee members
5. Faculty of the department.

Since the introduction of ABET Engineering Criteria 2000, the following assessment tools have been developed and will be incorporated into future assessments:

1. Employer survey.
2. Student survey.
3. Alumni survey.
4. Advisory committee survey.
5. Faculty survey.

The department is critically examining the results of these five surveys and will incorporate appropriate changes that will improve the effectiveness of the program. Surveys will be conducted every two years as required by ABET. The data from these questionnaires, along with the requirements of the Michigan Licensing Board for Professional Surveying, EAC/ABET, and Ferris State University general education are all taken into account before revising the program's educational objectives. Ferris State University has over 43 years of experience in surveying education. Its alumni serve as owners and employers of major surveying firms, hold high-level positions in federal, state and local government and serve with distinction in high-technology companies. They can be found working in almost every state in the union and many parts of the world.

The department is very dynamic and responsive to the changes that are taking place in the industry. The faculty regularly attend and actively participate in national and international conferences and symposia. They are aware of the rapid technological changes that are taking place in the profession of surveying, including geodesy, digital mapping, photogrammetry, and GIS. The development of GPS and advancements in CAD and GIS have had significant impact on the profession. In response to these developments, the department has significantly reduced the coverage of topics such as astronomy and introduced new courses in GIS (SURE 325 and SURE 425) and CAD (SURE 115 and SURE 116). The introduction of CAD courses was requested both by the alumni and advisory committee members. In addition, we have increased the coverage of GPS in SURE 453. The discussion on state plane coordinate systems was expanded in both SURE 452 and SURE 453. A course on oral communication (COMM 121) was added to increase the communication skills of the graduates. To emphasize the importance of ethics and professionalism, (SURE/HUMN 331) Ethics and Professionalism in Engineering and Technology was incorporated in the program. These are solid examples of the dynamic, responsible, and mature program which continues to contribute to the profession. The department has continually achieved its educational objectives and the introduction of EC2000 has solidified and formalized the procedure the department has always followed.

In order to satisfy the educational objectives of the program, the curriculum provides a strong foundation in basic theory and field surveying in SURE 110, SURE 220, SURE 230, and SURE 215. Project design as well as error detection and analysis are emphasized. Students learn to work as a team and to develop leadership skills through rotating group leadership roles.

Excellent employment opportunities exist for the both the graduates and continuing students who are continuing their study in the program. Employers from all over the country are actively looking for graduates for full time employment and students for summer jobs. Unfortunately, there are never enough students to fulfill this demand. This year alone the department has received more than 300 requests for employment. There is hardly a day when we do not receive calls, faxes or letters from employers looking for graduates or students.

In order to ensure that the program's educational objectives are continually met, the university and department use four different processes: academic program reviews conducted every six years by the university, ABET evaluations, licensing examination results, and the constituent surveys mentioned above. The constituency surveys were very good. Ferris State University graduates had the highest percentage of success in the licensing examination in 1997-98. Good results indicate that the department is achieving its objectives.

Membership and active participation in professional societies is encouraged. The Surveying Engineering and Surveying Technology programs support the Burt and Mullett student chapter affiliated with both the Michigan Society of Professional Surveyors (MSPS) and the American Congress on Surveying and Mapping (ACSM). Student attendance at the annual MSPS conference has been increasing each year and this year the number of Ferris student participants exceeded 50. For each of the past three years there has been Ferris student representation at the annual ACSM conference. Students have actively participated in conferences sponsored by both organizations by staffing booths, acting as runners and assisting with presentations. A measure of student participation is the number of state and national scholarships awarded to Ferris students as listed in Section 1.

As a minimum, students must have a year of college mathematics at the calculus level and basic sciences. The 19 semester hours of mathematics (includes SURE 372 and a part of SURE 373) and 18 hours of physics, chemistry and geology prepare the student to meet the challenges of the upper division courses within the department. The mathematics and science courses provide the basic tools necessary for students to understand the surveying engineering courses. In addition, the science courses are critical in providing the experimental experience that the students need in the engineering design portion of the curriculum.

A minimum of one and one-half years of engineering topics are also required. The 65 semester hours of engineering courses are designed to prepare the graduate for the work place of tomorrow. Just as engineering has a number of divisions, survey engineering has a number of specialties. With the onset of new technologies such as GPS and GIS, it is essential that the graduates be prepared to enter a profession that will change considerably during their working years. The goal is to give the student the ability to see how technology has transformed the work place. The program consists of a mixture of practice and theory so that the graduates understand not only the advantages of this technology but also the limitations of these tools.

General education courses function to help students grow into productive citizens of the community where they will reside. For a community to survive, it needs the support of its citizenry. The commitment to help and serve is nurtured through the general education requirements all students must complete prior to graduation. The general education requirements at Ferris State University require graduates to be able to communicate effectively and to understand issues of race, gender and ethnicity. In addition, cultural enrichment, social awareness and global consciousness courses help to make that graduate a more well-rounded individual. This program has integrated general education principles into the curriculum. This is done with writing intensive coursework, requirements of papers and reports, oral presentations, and a host of other activities that the faculty have incorporated within their courses. In addition, some courses also bring in invited speakers from industry to supplement the formal lectures the students receive.

To ensure that graduates are capable of functioning within the broad engineering field, the specialization of surveying is augmented with other engineering courses. In particular, students must successfully complete coursework in materials, testing, statics and strengths of materials, soils engineering, hydrology and hydraulics engineering. These courses provide the breadth necessary to function as an engineering team member on design projects.

The ability to design and undertake experiments is critical for the surveying engineer since real-world problems are diverse and seldom follow the ideal setting found in textbooks. There are 18 courses within the program with a laboratory component. These problem-solving experiences are designed to augment the material presented within the lectures. In addition, students gain experience in formulating experiments, conducting data collection, and analysis of the results. It is also important for students to be exposed to "real-world" experiences as much as possible before they enter their professional lives. This approach to education has led to the success of the department as shown in the results of the Surveyor Fundamentals examination that most of the graduates take during their senior year. In 1998, Ferris graduates had the highest percentage of success from all universities/colleges in the country (considering only those programs with more than two test takers).

The program is designed to show that it is incumbent upon the graduates to consider their degree as just the first step in a life-long commitment to education. Professional status is maintained through a program of continuing education. Students are encouraged by faculty to commit to continuing education. For example, the Michigan Society of Professional Surveyors (MSPS) allows students to attend seminars for only $25.00. It also allows students to attend the annual conference free. In both cases the students receive the same treatment as professional MSPS members. Most students take advantage of this. Students are encouraged to become involved in professional organizations. Again, many are student members of at least one professional organization. This activity sometimes diminishes once they graduate but those who remain committed form a very active core. For example, 50% of the current officers on the MSPS Board of Directors are Ferris State University graduates.

The capstone course, SURE 435, requires students to draw upon their diverse background in a major design project. The creation of a subdivision forces the student to look at the economic, technical and aesthetic components of development. Economically, students see the dichotomous needs of maximizing profits for the developer with societal goals of sustainable development. Legal restrictions may limit the actual number of parcels that can be created but when tied into the fabric of the development, it can enhance the return for the developer. Technically students see the impact that development has on its surroundings.

Students learn best when they are given the tools that they will be utilizing in their career. For that reason the department maintains a well-equipped and modern facility. The computer has permeated the complete curriculum from solving complex surveying and engineering problems to simple word processing and spreadsheet utilization. The computer is the tool used for most of the problem solving within the curriculum. Modern surveying instruments are generally integrated with computers to facilitate data processing. CAD is so ingrained within the curriculum that in many classes its utilization in problem solving is as routine as the hand-held calculator.

SECTION 10

ENROLLMENT TRENDS

Enrollment data for the AAS Surveying Technology (AAS SURT) and the BS Surveying Engineering (BS SURE) is tabulated below:

	Fall 1995	Fall 1996	Fall 1997	Fall 1998	Fall 1999
AAS SURT	36	28	17	12	12
BS SURE	79	80	81	80	83
Total	115	108	98	92	95
Pre- AAS SURT	1	3	2	2	3
Pre-BS SURE	2	4	3	5	3
Total Pre-Tech	3	7	5	7	6

The total of the above numbers, including the Pre-AAS SURT and Pre-BS SURE students, produces the following data:

	Fall 1995	Fall 1996	Fall 1997	Fall 1998	Fall 1999
Overall Total	118	115	103	97	101

Looking at these total numbers one can see that there was a gradual decline in total number of students from the Fall, 1995 (118). It bottomed in the Fall, 1998 (97) a decline of 18%. During this same period, university enrollment declined by almost 33%. However, there has been a 4% increase from the Fall, 1998 to the Fall, 1999. One year's data alone would not establish a trend. Nevertheless, the enrollment in the Fall, 1999 was higher than that of 1998. Moreover, the enrollment trend for the BS program is very stable. The decline has taken place in the SURT program. This may be an indication that the students are more interested in the BS program instead of the AAS degree.

This year the department received $3000 from Academic Affairs to actively try to recruit students from high schools and community colleges. The department has placed advertisements in high school yearbooks in several schools in Grand Rapids area. In addition, the department has directly involved the students in the enrollment process. Following is an example of the program that was implemented to encourage students to help in our recruitment program:

ANNOUNCEMENT!

WE ARE SETTING UP A COMPETITION FOR RECRUITING STUDENTS TO THE PROGRAM.

Those who want to go to high schools and recruit students for the program will be given the following rewards:

First Prize: $200 gift certificate from Great Lakes Books & Supplies (Fifty percent matched by the store).

Second Prize: $150 gift certificate from the College Store
(Fifty percent matched by the store).

Third Prize: $100 gift certificate from the College Store
(Fifty percent matched by the store).

In addition, there will be six more prizes of one Ferris T-shirt each (Donated by Ferris Bookstore).

All you have to do is visit one or more high school(s) and come up with the name and phone number of students who are interested in studying Surveying Engineering. Submit the names to Dr. Thapa. The person with the list that results in the highest number of students enrolling in the program will be awarded the first prize.

Program literature is available from Dr. Thapa. Every student in the program is encouraged to participate.

In addition, the program coordinator has visited Math classes and UNIV courses to try to inform undecided students with good Math and Science skills, to consider entering the surveying programs. Because of this effort, seven new students entered the program in the Winter 2000 semester.

Several Michigan community colleges, such as Delta and Glen Oaks, are developing 2+2 transfer agreements. In addition, Vincennes University in Indiana is interested in collaborating with us for a 2+2 degree arrangement. Saudi Aramco, an oil company in Saudi Arabia, has set up a program whereby students in the company can attend Ferris State University to study Surveying Engineering. Currently there are 10 Saudi students in the program.

In order to increase the enrollment in the program and increase the visibility of the program among community colleges, the Surveying Engineering Department is hosting the annual meeting of the liaison between four-year engineering colleges and community colleges in 2003.

SECTION 11

PROGRAM PRODUCTIVITY/COST

Productivity data for the AAS Surveying Technology and BS Surveying Engineering SURE prefix courses is tabulated below. Data for Ferris State University, the College of Technology and the three departments within the college are included for comparison purposes.

PRODUCTIVITY REPORT
SCH/FTEF
1994-1999

Area	1994/1995	1995/1996	1996/1997	1997/1998	1998/1999
FSU	466	464	447	442	457
College of Technology	334	339	333	323	331
Transportation & Electronics Department	287	325	304	297	301
Design, Manufacturing & Graphic Arts Department	361	324	324	306	323
Construction & Facilities Department	352	380	384	384	378
SURE Prefix Courses	367	449	335	286	276

Academic year 1998-1999 program teaching costs for the AAS Surveying Technology and the BS Surveying Engineering are tabulated below. Data for Ferris State University, the College of Technology and the three departments within the college are included for comparison purposes.

Program Teaching Costs, Academic Year 1998-1999:

	Average Instructor Cost per SCH	Average Department Cost per SCH	Average Dean's Cost per SCH	Total Cost per SCH
FSU	$132.12	$35.81	$14.97	$182.90
College of Technology	$152.95	$45.75	$15.33	$214.03
Transportation and Electronics Department	$172.68	$45.93	$15.28	$233.90
Design, Manufacturing and Graphic Arts Department	$149.08	$51.55	$15.42	$216.05
Construction and Facilities Department	$127.75	$39.80	$15.31	$182.86
AAS SURT	$150.77	$36.45	$14.34	$201.57 60th out of 183 programs
BS SURE	$160.27	$39.14	$15.14	$214.56 50th out of 183 programs
23 SURE courses	$216.83 17th out of 135 course prefixes			

Total program cost per SCH for the AAS Surveying Technology is below the College of Technology average, and slightly above the university average. Total program cost per SCH for the BS Surveying Engineering is at the College of Technology average and above the university average.

S&E funding for the AAS Surveying Technology program cannot be separated from the S&E funding for the BS Surveying Engineering program. Nevertheless, S&E funding are marginal. S&E data is tabulated in Appendix A. Two major areas of concern exist. First, the AAS program is highly dependent on Voc Ed funding, which cannot be relied upon year after year. Both programs depend on special or year-end equipment funds, which are becoming scarcer, given the new budget procedures in the Office of the Vice President for Academic Affairs.

SECTION 12

CONCLUSIONS

- Both the AAS degree and BS degree are very relevant to the centrality of the mission of Ferris State University. In fact, the bachelors degree in Surveying Engineering uniquely matches all the key words of the mission of the university as pointed out in the Curriculum section of the report.

- The BS degree in Surveying Engineering is the only such program in Michigan and one of only four in the nation. The program has high visibility due to the quality of the program and the involvement of the faculty in both national and state level organizations. About 10% of the students are from foreign countries. Input from the ABET, employer survey, alumni survey, and advisory survey indicates that the BS degree in Surveying Engineering is a leading program in the nation.

- The program serves both the State of Michigan as well as the US with highly qualified graduates for the surveying profession. The program graduates are playing leading roles in such federal government agencies as the Bureau of Land Management, US Forest Service and US Park Service. Many graduates also own their own business; and graduates are working in every county in Michigan.

- Continued and sustained enrollment in the program indicates that there is strong demand by students.

- Input from students, alumni, employers, members of the advisory committee, and the ABET all indicate a very high quality of instruction.

- Feedback from the employers, alumni, and advisory committee indicates that there is a very strong demand for our graduates nationwide. This demand is based on the strength of all facets of the program and the preparedness of our graduates to go to work as members of the surveying profession.

- Placement rates for the graduates are 100% year after year. Starting salaries are highly competitive and are increasing every year. Average entry-level salary of 1999 graduates was $37,735 per year.

- The course designated as CONM 122 Construction Surveying and Management is taught by Surveying Engineering program faculty and use the equipment from the program. This course is taken by students in AAS in Building Construction Technology, AAS in Civil Engineering Technology, and BS in Construction Management. In addition SURE/HUMN 331 Ethics and Professionalism in Engineering and Technology is open to all students in the campus.

- The department has established very strong industry relationships as pointed out in the overview section of the report. Without the support of industry for equipment hardware and software, this department could have never achieved its national stature. The department is very well equipped with the state-of-the-art technology—hardware, software and equipment.

- Library information resources are adequate.

- Total program cost per SCH for the AAS Surveying Technology is below the College of Technology average and slightly above the university average. Total program cost per SCH for the BS Surveying Engineering is at the College of Technology average and above the university average.

- Results from the alumni, student, and advisory committee surveys show that the faculty in the department are very knowledgeable of the subject matter and that they are professionally and scholarly active at both the state and national level.

- The faculty, student and advisory committee surveys indicate that administrative effectiveness is adequate.

- The preliminary report from the Fall 1999 ABET visit and feedback from the advisory committee and faculty demonstrate the need to convert the temporary faculty position into a tenure track position. The temporary faculty has been hired on semester-by-semester basis for the last seven years.

- Both the advisory committee and faculty surveys indicate that the ABET accreditation of the BS program is very important.

- The initial report from ABET was very positive. It indicates that no deficiencies exist in the program. However, they did express concerns over computer lab improvement (now corrected) and conversion of the temporary faculty position into a tenure-track position.

- The alumni, faculty, and advisory surveys indicate that there is a need for knowledgeable graduates in GIS and GPS.

- As required by the ABET's Engineering Criteria 2000, the faculty continue to review and revise the curriculum as appropriate to address the issues raised in the employer, alumni, student, advisory committee, and faculty surveys.

- As recommended by the ABET constituencies surveys will be conducted every two years.

- Recent restructuring of the College of Technology made the Surveying Engineering Program a separate and independent department. This will provide the visibility, independence, and increased marketability of the program. Members of the advisory committee, faculty, and students feel that it is a very positive development for surveying education at Ferris State University.

SECTION 13

RECOMMENDATIONS

- Enhance both the AAS Survey Technology and BS in Surveying Engineering programs with the addition of a new full-time tenure-track faculty position. This recommendation will enhance the opportunity for increased faculty professional development and scholarly activities, and additional recruiting efforts. This is necessary for the continued and needed growth of both programs.

- Provide an adequate budget to replace and maintain the computer laboratory, surveying equipment and software, and photogrammetry equipment software with a plan to continually allocate funds for periodic upgrade.

- Encourage faculty to explore the viability of a BS degree in GIS Engineering.

- Increase the faculty development budget.

PROGRAM REVIEW PANEL EVALUATION

Program: _Surveying Engineering and Surveying Technology

Instructions: Circle the number which most closely describes t he program you are evaluating.

1. Student Perception of Instruction **Average Score _4.1___**

5 (2)	4(4)	3(1)	2	1

Currently enrolled students rate instructional effectiveness as extremely high.

Currently enrolled students rate the instructional effectiveness as below average.

2. Student Satisfaction with Program **Average Score __3.7___**

5 (1)	4 (3)	3 (3)	2	1

Currently enrolled students are very satisfied with the program faculty, equipment, facilities, and curriculum.

Currently enrolled students are not satisfied with program faculty, equipment, facilities, or curriculum.

3. Advisory Committee Perceptions of Program **Average Score _____4.3**

5 (2)	4 (4)	3	2	1

Advisory committee members perceive the program curriculum, facilities, and equipment to be of the highest quality.

Advisory committee members perceive the program curriculum, facilities, and equipment needs improvement.

4. Demand for Graduates **Average Score ___4.8___**

5 (6)	4(1)	3	2	1

Graduates easily find employment in field.

Graduates are sometimes forced to find positions out of their field.

5. Use of Information on Labor Market **Average Score ____4.3___**

5(2)	4(4)	3	2	1

The faculty and administrators use current data on labor market needs and emerging trends in job openings to systematically develop and evaluate the program.

The faculty and administrators do not use labor market data in planning or evaluating the program.

6. Use of Profession/Industry Standards Average Score _4.6_____

5 (4)	4(3)	3	2	1

Profession/industry standards (such as licensing, certification, accreditation) are consistently used in planning and evaluating this program and content of its courses.

Little or no recognition is given to specific profession/industry standards in planning and evaluating this program.

7. Use of Student Follow-up Information Average Score ____3.2___

5	4(3)	3(2)	2	1(1)

Current follow-up data on completers and leavers are consistently and systematically used in evaluating this program.

Student follow-up information has not been collected for use in evaluating this program.

8. Relevance of Supportive Courses Average Score ____3.8___

5(1)	4(4)	3(2)	2	1

Applicable supportive courses are closely coordinated with this program and are kept relevant to program goals and current to the needs of students.

Supportive course content reflects no planned approach to meeting needs of students in this program.

9. Qualifications of Administrators and Supervisors Average Score ____3.7___

5 (2)	4(1)	3(2)	2(2)	1

All persons responsible for directing and coordinating this program demonstrate a high level of administrative ability.

Persons responsible for directing and coordinating this program have little administrative training and experience.

10. Instructional Staffing Average Score _____2.1___

5	4(1)	3	2(5)	1(1)

Instructional staffing for this program is sufficient to permit optimum program effectiveness.

Staffing is inadequate to meet the needs of this program effectively.

11. Facilities Average Score ____3.4____

5 (1)	4(3)	3(1)	2(2)	1

Present facilities are sufficient to support a high quality program.

Present facilities are a major problem for program quality.

12. Scheduling of Instructional Facilities Average Score ____3.7___

5 (1)	4 (4)	3 (1)	2 (1)	1

Scheduling of facilities and equipment for this program is planned to maximize use and be consistent with quality instruction.

Facilities and equipment for this are significantly under-or-over scheduled.

13. Equipment Average Score ____3.4___

5	4 (5)	3(1)	2	1(1)

Present equipment is sufficient to support a high quality program.

Present equipment is not adequate and represents a threat to program quality.

14. Adaption of Instruction Average Score ____3.6___

5	4 (5)	3 (1)	2(1)	1

Instruction in all courses required for this program recognizes and responds to individual student interests, learning styles, skills, and abilities through a variety of instructional methods (such as, small group or individualized instruction, laboratory or "hands on" experiences, credit by examination).

Instructional approaches in this program do no consider individual student differences.

15. Adequate and Availability of Instructional Materials and Supplies Average Score ____3.0__

5	4 (2)	3 (4)	2	1(1)

Faculty rate that the instructional materials and supplies as being readily available and in sufficient quantity to support quality instruction.

Faculty rate that the instructional materials are limited in amount, generally outdated, and lack relevance to program and student needs.

Academic Program Review Data A

ADMINISTRATIVE PROGRAM REVIEW: 1999

Program/Department: AAS SURT AND B.S. SURV. ENGR.   Date Submitted: December 1, 1999

Dean: Technology

Please provide the following information:

Enrollment

	Fall 1995	Fall 1996	Fall 1997	Fall 1998	Fall 1999
Tenure Track FTE	4	4	4.5	4.5	4.5
Overload/Supplemental FTEF					
Adjunct/Clinical FTEF (unpaid)	1	1	1	1	1
Enrollment on-campus total*	36 / 79	28 / 80	17 / 81	12 / 80	12 / 83
Freshman	13 / 3	4 / 8	3 / 4	5 / 13	4 / 13
Sophomore	8 / 10	12 / 6	3 / 7	4 / 9	8 / 16
Junior	5 / 11	6 / 15	5 / 9	0 / 14	0 / 11
Senior	5 / 43	5 / 41	3 / 51	3 / 44	0 / 43
To Be Determined	5 / 12	1 / 10	3 / 10		
Doctoral					
Pre-Professional Students					
Enrollment off-campus*					
Traverse City					
Grand Rapids					
Southwest					
Southeast					

*Use official count (7-day)

Capacity:

Estimate program capacity considering current number of faculty, laboratory capacity, current equipment, and current levels of S&E. 125 students

Financial

Expenditures*	FY 95	FY 96	FY 97	FY 98	FY 99
Supply & Expense	$ 14,833	$ 22,248	$ 15,552	$ 25,237	$ 33,907
Equipment					
Voc. Ed. Funds	$ -	$ -	$ 20,084	$ -	$ 25,000
General Fund	$ 500	$ 3,338	$ 13,475	$ 16,129	$ 5,043
In-Kind	$330,685	$ -	$ -	$173,995	$ 344,863
Non-General Fund		$ 2,703	$ 5,706	$ -	$ -
Revenues					
Clinic Income					
Scholarship Donations					
Gifts, Grants & Cash Donations	$ -	$ 4,059	$ 300	$ 2,533	$ 675

*Use end of fiscal year expenditures.

Other

	AY 94/95	AY 95/96	AY 96/97	AY 97/98	AY 98/99
Number of Graduates* - Total	8 / 27	2 / 17	4 / 20	3 / 21	3 / 23
- On campus	8 / 27	2 / 17	4 / 20	3 / 21	3 / 23
Certificates - Off campus					8
Placement of Graduates	100%	100%	100%	100%	100%
Average Salary	$26,971	$31,500	30,167	34,071	$36,200
Productivity - Academic Year Average	367	449	335	286	276
- Summer	200			162	113
Summer Enrollment				27	34

* Use total for academic year (S, F, W)

ADMINISTRATIVE PROGRAM REVIEW: 1999

1. a) Areas of Strength:

The program has very well qualified, dedicated, and experienced faculty. The students in the program are some of the best students on campus. The program is very well equipped in terms of the surveying equipment, GPS equipment, photogrammetry equipment and software. The program has national accreditation from Engineering Accreditation Commission (EAC) of Accreditation Board for Engineering and Technology (ABET). The program is a perfect fit for the mission of FSU, since the key words in the mission statement (career-oriented, technological, professional, and national leader) are all satisfied by the program.

b) Areas of Concern and Proposed Action to Address Them:

The program has been hiring a temporary faculty on semester by semester basis for over five years. This position needs to be converted to a tenure-track position to address the concerns expressed by the ABET team which recently visited the campus for reaccreditation. In addition, ABET requires that a program of our caliber needs to have a national and state-wide presence. In order to keep the faculty abreast with the developments in technology they need to attend national and state-wide conferences. However, there is limited funding available to perform such activities. Lack of funding for faculty development was a concern expressed by the ABET team. One more concern that was expressed by the ABET team was the condition of the lab in SWAN 204. Our computers are very old. They need to be replaced.

2. Future goals (please give time frame)

1. We would like to establish a GIS option which will help us fulfill the industry demand (Fall 2001)
2. We would like to expand our course offering in the Grand Rapids Area (Summer 2000)
3. Develop an aggressive recruitment program (Fall 1999)
4. Acquire more equipment (ongoing)
5. Revive the concept of the National Center of Excellence for Geomatic Information Science and Technology.
6. Complete program review (Fall 2000)

3. Other Recommendations: None

4. Does the program have an advisory committee?

a) If yes, when did it last meet? Yes. We met the last week of April, 1999.

b) If no, why not? By what other means do faculty receive advice from employers and outside professionals?

5. Does the program have an internship or other cooperative or experiential learning course? No

a) If yes, is the internship required or recommended?

b) If no, what is the reason for not requiring such an experience? We do not require an internship in our program for the following reasons:

1. Most of our students are transfer students and already have a knowledge of surveying.
2. All of our students are employed in the field of surveying during summers.
3. Some of our students already have a degree or diploma in other disciplines.
4. Employers, Michigan Licensing Board, and ABET have not asked for it.
5. Our graduates have 100% placement all the time.
6. Unlike other disciplines, our students do in the industry what they learn here. Even the instruments are the same in most cases.

For the above reasons, faculty, advisory board, and students have all felt that there is no need for an internship in the program.

6. Is this a program with national recognition? Yes.

a) If so, for what and by whom? It is accredited by ABET as stated above. It is also recognized by the Michigan Board of Licensing and just about all surveying licensing boards in the country. In addition, it is also recognized in many parts of the world.

b) If not, what are some strategies that could lead to national recognition?

Graduate Survey Data

B

January 20, 2000

Dear Alumnus:

Ferris State University is dedicated to keep its curriculum strong and current In order to accomplish that goal, all programs at Ferris must undergo periodic review. This year, the Surveying Program is undertaking this study and we are asking for your input. Enclosed is an alumni survey that we would like you to complete and return to us in the enclosed envelope. Your input is very important to us in this self-evaluation process.

Many of you helped last year when the program underwent review for accreditation by ABET. We thank you for your responses then and hope that you will help us now. We would appreciate it if you could take a few minutes from your busy schedule and complete the survey **TODAY.**

Thank you very much for your time and for the support that you have given to us in the past.

Sincerely,

K. Thapa, Ph. D.
Professor and Surveying Engineering Program Coordinator.

SURVEYING ENGINEERING

FERRIS STATE UNIVERSITY

PROGRAM REVIEW ALUMNI SURVEY

1. What year did you graduate from Ferris State University? ____________________
2. What degree(s) did you earn from Ferris State University?____AAS ____BS
3. Are you currently employed in the surveying profession? ____Yes ____No
4. Which arena? ____Government ____Academia ____Private Practice
5. What is your job title?____
6. Where is your office located?

   City______________ State________________ Country______________
7. Check all credentials that you hold.

   ____SIT ____PS ____EIT ____PE
8. What is your annual salary range?

   ____Less than $30,000 ____$40,000 to $50,000 ____Over $100,000

   ____$30,000 to $35,000 ____$50,000 to $75,000

   ____$35,000 to $40,000 ____$75,000 to $100,000
9. What is the size of your firm (including branch offices) in personnel?

   ____Less than 5 ____10 to 25 ____over 50

   ____5 to 10 ____25 to 50
10. Activities in which your firm is involved (check all that apply).

- ❑ Land surveying which is the surveying of an area for its correct determination or description for its conveyance, or for the establishment or re-establishment or a land boundary or the designing or design coordination of the plotting of land and the subdivision of land.
- ❑ Geodetic surveying which includes surveying for determination of the size and shape of the earth both horizontally and vertically and the precise positioning for points on the earth utilizing angular and linear measurements through spatially oriented spherical geometry. (include GPS)
- ❑ Utilizing and managing land information systems through establishment of datums and local coordinate systems and points of reference.
- ❑ Engineering and architectural surveying for design and construction layout of infrastructure.
- ❑ Cartographic surveying for the making of maps, including topographic and hydrographic mapping.

11. Please rate the importance of the following for your current job based on the rating scale below by marking the appropriate box.

5=critical 4=very important 3=important 2=not very important 1=irrelevant

Skill	5	4	3	2	1
Leadership					
Teamwork					
Communication					
Problem Solving					

12. Please rate the degree to which your education at Ferris prepared you for those skills identified in question 11 by marking the appropriate box.

5=excellent 4=very good 3=good 2=not very good 1=not at all

Skill	5	4	3	2	1
Leadership					
Teamwork					
Communication					
Problem Solving					

13. Please rank the relative importance of the following subject areas **to your practice** by checking the appropriate box.

5=critical 4=very importance 3=important 2=not very important 1=irrelevant

Subject	5	4	3	2	1
Legal Aspects/Land Boundaries					
Business Aspects					
Geodesy/GPS					
Photogrammetry/Remote Sensing					
Data Analysis					
Route Surveying/Traverse/Cogo					
GIS/LIS					
CAD/Computer Applications					
Map Projections/Coordinate Systems					
Leveling					
Land Use Design					
Automated Data Collection and Processing					
Soils/Drainage/Hydrology					

14. Please rate the degree to which your education at Ferris prepared you for **those subjects identified as critical, very important or important in question 13.**

5=excellent 4=very good 3=good 2=not very good 1=not at all

Subject	5	4	3	2	1
Legal Aspects/Land Boundaries					
Business Aspects					
Geodesy/GPS					
Photogrammetry/Remote Sensing					
Data Analysis					
Route Surveying/Traverse/Cogo					
GIS/LIS					
CAD/Computer Applications					
Map Projections/Coordinate Systems					
Leveling					
Land Use Design					
Automated Data Collection and Processing					
Soils/Drainage/Hydrology					

15. Do you have a graduate degree? ____ Yes ____No

16. Are you interested in earning a graduate degree? ____ Yes ____No

17. If you have a graduate degree or are interested in earning a graduate degree please identify type and discipline.

Type:______________ (M.S., M.B.A., J.D., PhD, etc.)

Discipline:____

18. If you have a graduate degree, or are actively pursuing a graduate degree, how well did your FSU studies prepare you for advanced study? (Circle one).

5. Exceptionally well
4. Well
3. Adequately
2. Poorly
1. Not at all

Not applicable

19. What do you perceive to be the most critical need in surveying education in the next five years?

____

____

20. Please provide comments on areas not included in the survey that you feel are relevant.

SURVEYING TECHNOLOGY

FERRIS STATE UNIVERSITY

PROGRAM REVIEW ALUMNI SURVEY

1. What year did you graduate from Ferris State University? ______________________
2. What other degrees do you hold? Degree ______ Discipline ______________
3. Are you currently employed in the surveying profession? ______Yes ______No
4. Which arena? ______Government ______Academia ______Private Practice
5. What is your job title?____
6. Where is your office located?

   City__________________________ State__________________________

   Country__________________________
7. Check any of the credentials listed below that you hold.

   ______SIT ______PS ______EIT ______PE
8. What is your annual salary range?

   ______Less than $30,000 ______$40,000 to $50,000 ______Over $100,000

   ______$30,000 to $35,000 ______$50,000 to $75,000

   ______$35,000 to $40,000 ______$75,000 to $100,000
9. What is the size of your firm (including branch offices) in personnel?

   ______Less than 5 ______10 to 25 ______over 50

   ______5 to 10 ______25 to 50
10. Activities in which your firm is involved (check all that apply).

- ☐ Land surveying which is the surveying of an area for its correct determination or description for its conveyance, or for the establishment or re-establishment or a land boundary or the designing or design coordination of the plotting of land and the subdivision of land.
- ☐ Geodetic surveying which includes surveying for determination of the size and shape of the earth both horizontally and vertically and the precise positioning for points on the earth utilizing angular and linear measurements through spatially oriented spherical geometry. (include GPS)
- ☐ Utilizing and managing land information systems through establishment of datums and local coordinate systems and points of reference.
- ☐ Engineering and architectural surveying for design and construction layout of infrastructure.
- ☐ Cartographic surveying for the making of maps, including topographic and hydrographic mapping.

11. Please rate the importance of the following for your current job based on the rating scale below by marking the appropriate box.

5=critical   4=very important   3=important   2=not very important   1=irrelevant

Skill	5	4	3	2	1
Leadership					
Teamwork					
Communication					
Problem Solving					

12. Please rate the degree to which your education at Ferris prepared you for those skills identified in question 11 by marking the appropriate box.

5=excellent   4=very good   3=good   2=not very good   1=not at all

Skill	5	4	3	2	1
Leadership					
Teamwork					
Communication					
Problem Solving					

13. Please rank the relative importance of the following subject areas **to your practice** by checking the appropriate box.

5=critical   4=very importance   3=important   2=not very important   1=irrelevant

Subject	5	4	3	2	1
Legal Aspects/Land Boundaries					
Business Aspects					
Geodesy/GPS					
Photogrammetry/Remote Sensing					
Data Analysis					
Route Surveying/Traverse/COGO					
GIS/LIS					
CAD/Computer Applications					
Map Projections/Coordinate Systems					
Leveling					
Land Use Design					
Automated Data Collection and Processing					
Soils/Drainage/Hydrology					

14. Please rate the degree to which your education at Ferris prepared you in the following subjects.

5=excellent   4=very good   3=good   2=not very good   1=not at all

Subject	5	4	3	2	1
Legal Aspects/Land Boundaries					
Leveling					
Route Surveying/Traverse/COGO					
CAD/Computer Applications					
Automated Data Collection and Processing					

15. What do you perceive to be the most critical need in surveying education in the next five years?

16. Please provide comments on areas not included in the survey that you feel are relevant.

Alumni Survey, Surveying Engineering
Comments

001
18. Number of graduates in GIS, GPS, computer skills
19. Ferris was a good <u>start</u> of my education

002
18. n/g n/g not/given
19. n/g

003
18. n/g
19. n/g

004
18. Keeping up with the computer applications and advances in technology related to the surveying profession.
19. I believe there should be more focus on business management in the curriculum. Most graduates which go on in the profession spend more time managing people than performing project work.

005
18. Trying to teach the students the importance of evidence found at property corners. Calculating the boundary corners is good, but finding and proving the existing evidence is better. Need to express the need to comply with the laws as established by the state.
19. Need to express that research is important.

007
18. Placing enough emphasis on elementary surveying techniques such as taping so that a graduate knows how to properly use a tape, and luring people into the surveying profession.
19. n/g

008
18. Competent use of modern equipment; legal aspects of surveying; efficient and aesthetic use of land; protection of natural resources.
19. n/g

009
18. Keeping up with changing technology.
19. n/g

010
18. Hands-on training in surveying equipment and procedures, including GPS and data collection.
19. Being in the surveying profession, outside of college for 2 years now, I believe there is a need for more hands-on training to better prepare students to "hit the ground running." The legal classes, and classes related to coordinate systems have been the most useful to me, and with more hands-on experiences for students, I believe this program will continue to be the best.

011
18. n/g
19. n/g

012
18. Keeping the traditional surveying services and new related services in the surveyors hands!
19. n/g

013
18. Technical experience and business practices.
19. n/g

014
18. n/g
19. n/g

017
18. Getting students interested in the profession; Integration of GPS into land surveying and GIS/LIS.
19. n/g

018
18. Construction staking and highway design.
19. n/g

019
18. n/g
19. n/g

020
18. Keeping up with the ever-changing technology while realizing the importance of surveying history especially GLO retracement.

19. I feel that Ferris needs a practical application course in completing a section breakdown. A complete boundary survey should be done starting with doing the proper research, determining the validity of the section corners, performing the fieldwork, and performing the calculations. This is very lacking in the surveying program at FSU.

021
18. n/g
19. n/g

023
18. How to work as a business, use GPS, establish a GIS
19. n/g

025
18. Data collection, CAD, GPS
19. n/g

026
18. n/g
19. n/g

027 (NOT CURRENTLY EMPLOYED IN THE PROFESSION)
18. Accuracy, communication with other trades, being prepared. Keeping your guys, men up to date on what's going on. The more they know the better the results. Happy customers!!
19. I still use my surveying skills to establish bench marks to establish elevations, or running sewer pipe, drain pipe to make we have enough grade and maintain it.

028
18. More than ever, providing a well-educated individual in all surveying subjects in order to communicate, problem solve, and apply advancing technologies to their work.
19. n/g

029
18. n/g
19. n/g

030
18. GPS and GIS along with boundary analysis and communication skills.
19. n/g

031
18. Continue to stress the importance of retracements and their components (research locations/ method, corner recovery and I.D., acceptance/ rejection criteria for found monumentation, etc.)
19. n/g

032
18. GPS, GIS, business aspects, professionalism.
19. n/g

033
18. Learning more about GPS and GIS.
19. Most surveyors are not business oriented. I believe more business classes should be mandatory. Most graduating students have no idea about the early history of surveying- what are GLO notes? What does a section corner look like? With today's technology, surveyors need more emphasis should be on GIS, GLS, etc. More groups of people are doing this that are not surveyors. Writing and relating skills. A surveyor has to be an archeologist, historian, mediator, mathematician, businessman and salesperson.

034
18. Proper land management. We need to educate students on how to use land wisely, to help urban sprawl while still employing ourselves.
19. n/g

035
18. n/g
19. n/g

036
18. GPS
19. I would have liked more GPS training and hands-on work with GPS equipment. A great project would be to use the different modes of fast static and RTK to bring in horizontal and vertical control to a site. Another lab idea would be to break down a section around school. Have the students go down to the register of deeds to look up the LCRC's, etc and then go into the field to locate the corners. Then break down the section with total stations and next with RTK GPS and compare results.

037
18. People skills along with technology advances.
19. Much of the college course work was on an individual effort when I attended. Teams and people skills have been difficult over the years since. More coursework in teaming and people skill teaching should be viewed as a necessity in the curriculum.

038
18. n/g
19. n/g

039
18. Business management, people skills, communication, GPS, GIS.
19. Ferris should add additional classes regarding communication, business administration, and interpersonal relationships. As a manger of people from clerical to technicians, crew chiefs, and professional, my degree did not prepare me for managing people.

040
18. Interpretation of regulations on the local, county, state and national levels.
19. n/g

041
18. Coordinate systems, GPs, accuracy of available data.
19. n/g

042
18. CAD/ computer applications, GIS/LIS, business/accounting, and construction management.
19. Get the four-year degree, add more civil engineering.

043
18. GPS- proper uses and data processing analysis.
19. n/g

044
18. Understanding electronic equipment and checking your results.
19. n/g

047
18. Recruit high school students to meet high demand for surveyors in private practice.
19. n/g

048
14. GPS; data collection; geodesy; CAD; DTM; COGO; land development; basics such as leveling; traverse; adjustment of data.
15. There is an incredible shortage of qualified survey help. One side says it's great for raising rates and getting better pay. However, even if we pay higher wages, there just are not enough qualified help out there. What you get are button pushers that don't understand the theory and analysis of measuring. We need two-year people for survey help and technicians. Yes, these people won't be able to get their license because most states require a four-year degree, but they can still make a very good living. If you could tap into the high school or junior college program, that would be great. Also, you should

require a summer survey camp for the four-year degree program. This camp should pull together in the field and office- the basic surveying concepts: leveling, traverse, field note/ data collection reductions, etc.

049
18. More business applications
19. n/g

050
18. Computer aided surveying, design, etc.
19. Ferris tends to graduate surveyors with too much programming (computer). This area is beneficial to a computer science major or programmer. When I attended Ferris, this was the mainstream emphasis. I thoroughly believe that a "productive graduate" is one who can step into a surveying firm with a lot of Microstation or CAD background. Leave the programming to programmers. I understand that this is now happening at Ferris and I'm glad to see this. Another area that needs to be addressed is in graduates going right into supervisory roles with little or no experience behind them. I watched, after I graduated from Ferris in 1992, my fellow surveyors (some) go into supervisory roles too quickly. All of them failed and ran for cover with a new company. This position of supervisor is the chief surveyor position and not as assistant party chief or party chief. These graduates went right to the top too quickly and none of them remained. I believe that Ferris needs to nurture leadership and promote it, yet leave the student with a healthy perspective on the added value of experience and hard work that leads into the job title of supervisor or chief surveyor. I would also like to see more practical field experience in our graduates. Some graduates who were in my classes could not even set up instruments and targets of perform boundary work of any kind. Ferris has gone away from this since that late 1970's. Another item to address is the very high rate of attrition that will happen in the next 5 to 10 years. With almost 900 registered surveyors in this state, there is quite an age gap in experienced land surveyors, i.e. a large proportion of our licensed surveyors are at retirement age. This implies that there will be: (1) a large decline in R.L.S., (2) significant opportunities for up and coming graduates and S.I.T.'s (3) a significant experience and knowledge gap (4) a very large deficit of surveyor as a whole. As a result of this, I feel that more good surveyors are needed and we need to promote and encourage the experienced surveyors who haven't had the opportunity to get licensed due to families and financial commitment to get licensed. There is a very large core of these people who are "key contributors" to surveying engineering firms. I would much rather see these people obtain their degrees and licenses, than the average 8-year-old with lack of direction. We need to provide more opportunity for education and licensing to this key group of professionals.

051
18. Training in: (1) GIS, (2) use of robotic instruments, and (3) CAD systems.
19. n/g

052
18. n/g
19. n/g

053
18. Boundary, construction, GPS, and business.
19. n/g

054
18. n/g
19. n/g

055
18. n/g
19. n/g

056
18. Knowing the business end.
19. n/g

057
18. n/g
19. n/g

058
18. Business management (accounting classes, marketing classes, employee management classes).
19. The trend of the academic community towards the changing of "surveying" to "geomatics" is disturbing the public which does not understand surveying, it would be very counterproductive to confuse them further. Changing the degree title to geomatics will limit graduates' opportunities. I will not hire anyone with a geomatics degree. Nor will I support an institution with a geomatics degree, even if I am an alumna. The apparent change in the program structure is not doing the students any good. The students need a strict environment. The days of requiring programming skills taught valuable analytical skills. Make the degree something they are proud of. The equipment and lab facilities at Ferris are the best there is. Keep it up.

060
18. Marketing, business, web sites technical, professional advancement.
19. n/g

061
18. Learning and using new technology
19. n/g

062
18. Teach the basics. Create an internship program where each student must work for a surveying engineering firm for college credit in the summers in order to graduate.
19. The current surveying engineering program should back off on its standard for the need of two GIS classes and two photogrammetry classes. The program should add more classes on G.L.O. and boundary surveying. More classes on legal aspects of surveying along with classes dealing with situational surveying- what to do when- what's the most correct, legal way of doing it.

064
18. GPS, GIS, data collection, and boundary analysis.
19. n/g

065
18. Business aptitude and education in mainly surveying, second engineering, and third architectural.
19. n/g

066
18. Autocadd with COGO and contouring, electronic data collection, layout. GPS, static and RTK.
19. n/g

067
18. Better understanding how to decide where boundary lines go. Construction staking. GPS, Autocadd/ Softdesk.
19. n/g

068
18. The focus should be diverted more towards GPS technology
19. GPS, GPS, GPS, and geodesy (strong). Please put enough emphasis to teach the students technology and its growing demand because of its capability to perform the enormous work with less manpower but more accuracy. I predict, five years from now, surveyor will be using GPS technology to perform any kind of survey in higher proportion (70 vs. 30) than now comparing to the conventional technique.

069
18. Maintain the highest standards in the advanced surveying courses.
19. n/g

070
18. A strong emphasis on GIS/LIS and the lead role surveyors can play in the development of these systems as the experts in mapping and measurement.
19. n/g

071
18. n/g
19. Require greater emphasis on business aspects of surveying and engineering.

072 (OTHER FORM)
14. To teach students hands on geodetic applications and evaluating the data they collect.
15. My company deals with almost every survey company in Colorado. There is a tremendous lack of qualified surveyors entering the profession. The majority of surveying firms in Colorado have added GPS to their company but the majority of these surveying firms lack the knowledge to effectively use this equipment. What the Colorado surveying community needs is a good education on geodetic application and a thorough understanding of geodesy. Also, there is a tremendous shortage of incoming surveyors because of the small amount of money surveyors are offered and the lack of mentoring from older surveyors who see surveying graduates as a threat instead of as a student under them. GPS specialists and geodesists are in high demand here. I charge $85.00 per hour for my GPS training and consulting and have more work than I can handle. Emphasize geodetic applications more in the curriculum and you will make many graduates both financially and professionally successful.

073
18. Business management.
19. n/g

074
18. Computer, CAD, surveying software (i.e. EaglePoint, etc.), and writing skills.
19. In my two plus years since graduation I have been mainly appointed to the office side of surveying and engineering. I see this is becoming a trend as of late. The majority of my colleagues currently hold indoor positions an opposed to field crew leaders, etc. I think this is because of the well-rounded education received at FSU dealing with surveying as will as engineering. There seems to be a shortage of experienced graduates with good AutoCAD knowledge and background. The hydrology/hydraulics class required at Ferris has been of great assistance in my practice. More time spent with pipe plow, open-channel flow, and site drainage calculations could only benefit those students preparing to graduate. The legal courses have also been of great importance so far in my career. More time could be spent discussing the GLO notes and how most sections were run in certain area of Michigan. These classes should be sure to cover extensively random lines, closing corners, standard corners, and discussions on how the notes were kept and what they look like and mean. All of this information is useful when completing the remonumentation projects.

075 (OTHER FORM)
14. A complete understanding of the theory of measurement and associated errors. Continued focus on t5he importance of implementation of GPS systems.
15. The program at Ferris does an excellent job in covering the diverse knowledge needed for a surveyor. Equally important, and often understressed, is the importance of apprenticeship of experience. Students should be required to work summers in the

surveying field. This experience is essential to their careers and without it they will not be able to perform to their employer's standards upon graduation. Finally, not enough can be said about the need for excellent communication skill. Once graduates reach a position of management, they will use these skills more than their surveying knowledge. In order to run our office, approximately one-half to two-thirds of my time is spent on non-surveying related activities.

076

18. Move GPS and civil engineering options. Many of us do residential development and septic sanitary and water system design would help us greatly.
19. We take engineering courses so we gain knowledge that our employers want to use. Allow future grads to take classes that help them in area they plan to practice. We are very valuable to firms in land development and increasing knowledge will also increase confidence in the program and ourselves.

077

18. Legal aspects.
19. n/g

Alumni Survey, Surveying Technology
Comments

501
14. Lack of understanding of boundary retracement.
15. n/g   n/g = not/given

502
14. Business/ management training- personal organization skills
15. n/g

503
14. Education for the profession must always base its roots on the fundamentals while staying current with advancing technology.
15. n/g

504
14. Understanding laws pertaining to surveying.
15. n/g

505
14. GIS applications
15. More emphasis needs to be placed on the business and legal aspects of our profession. The University is training grounds for our profession and needs to work on the professional aspects as well as the technical.

506
14. Legal aspects, GIS, project management.
15. Public Speaking, Communications-- These are two areas in which you have to have a command in order to progress beyond the entry level.

507
14. Legal aspects, boundary law.
15. It is important for future surveyors to know what they are qualified to do and what they are not qualified to do. A couple of times a month I receive request to do surveys for title companies that require the surveyor to certify to things he is not qualified. Things such as show all utilities (including buried), certify to legal ingress/ egress which is a legal conclusion, that no grave sites exist on site, that no ordinances are being broken, etc. Surveyors need to be taught they can negotiate such certifications and that they don't have to sign everything some lawyer or title company tells them to do.

508
14. GPS training, boundary disputes, land division.
15. Wish Ferris had better prepared me for writing proposals and reading/writing contracts, cost estimates, etc. Also, more on ALTA survey requirements, bluebooking

horizontal and vertical control monuments, transferring state plane coordinates to ground coordinates, Microstation training, CAICE training, EaglePoint training.

509
14. Relational data automation and GIS
15. Graduates must have very good writing skills. I've supervised many surveyors who are poor writers. Technically very good, but have great difficulties with writing a simple letter or preparing testimony. Also the ability to speak in public. Surveyors are often called upon to speak at planning meetings or to make presentations for important clients. I work for the D.O.I., B.L.M.. We are responsible for surveying public lands in Alaska. We are currently constructing a relational geographic coordinate database to serve as the foundation of the BLM's GIS. This includes the automation of 10,000 rectangular plats, 30,000 special survey plats and 2,000,000 pages of field notes. The numbers grow everyday. Also, 25,000 land status maps. A huge undertaking! Graduates need to be ready! It's a very exciting time and I wouldn't be part of it without my FSU surveying education. Thanks.

510
14. GPS
15. n/g

511
14. Legal aspects/ land boundaries and communication skills.
15. I think that it would be very beneficial to develop a coop/mentorship program with firms that would be willing to sponsor a student.

512
14. Applying GPS in a variety of situations. State plane coordinates.
15. n/g

513
14. Attracting enough students to fill open positions with qualified applicants.
15. I suspect that a vast minority of respondents will be involved in GIS and photogrammetry/ remote sensing. Yet these areas were given a high priority when I attended FSU. I feel that if as much emphasis had been placed on GPS (how to use it, not how it works) and government surveys (GLO, retracements, etc.), I would be in a much stronger position today.

514
14. Data collection, GIS, LIS.
15. n/g

515
14. GPS, least squares analysis of GPS data.

15. n/g

516
14. Developing students who understand the old as well as the new technology and are willing to step in and get their hands dirty.
15. n/g

517
14. Legal aspects, land boundaries, computers- GPS, GIS
15. I am involved in may metrology and optical tooling operations which are not specifically covered with the FSU curriculum. Laser trackers, hammer laser, technology, V-stars i.e., video photogrammetry, main frame computers, data collection, total stations, GPS, GIS were all things I had to pick up post-FSU, but the underlying fundamentals developed as FSU served my well.

518
14. Need more people qualified to run equipment and make decisions.
15. n/g

519
14. Keeping on top of new technology pertaining to data collection/drafting; correlating GIS systems with everyday surveying.
15. More time needs to be spent on applications of photogrammetry; less on the mechanics of old methods. More outdoor labs would also be beneficial. Maybe some type of co-op experience should be required for graduation.

520
14. GPS use in all aspects of survey, and the development of GIS.
15. n/g

521
14. Proper field techniques, analysis of data, determination of boundary lines.
15. I feel that the surveyor is providing a legal service (in most cases) for which he is extending a great degree of liability in return for a mere potance (?). When property is bought/sold, everyone involved, with the exception of the surveyor limits his liability down to nothing. The lawyer charges his fee and people gladly pay. The realtor takes his 7%, the title insurance company charges for the title insurance (which basically insures nothing in question), then there is the surveyor, generally getting less than 1% of the property cost. This is what the purchaser complains about. Sometimes the title insurance company unscrupulously (and illegally) uses an old survey or tax map copy. Having purchased 2 houses and sold one, I can also say lawyers and banks don't seem to have a clue on the whole process and a lot of the time the lawyer doesn't let their client know they need a survey. Until its very late in the process. So the real problem is that lawyers and title insurance companies need to be better educated the process of surveying. And something needs to be done regarding the cost of surveys. As I said, realtors get 7%, why shouldn't surveyors get at least that much?

522
14. n/g
15. n/g

523
14. Understanding GPS and GIS.
15. n/g

524
14. GPS, construction staking procedures
15. n/g

525
14. n/g
15. n/g

526
14. As a result of modern technology, it is most important that we teach the basics.
15. Spend more time on real boundary issues. Although you can not teach all aspects of surveying with detail. More on boundary resolution is needed. I think a class on the BLM manual would complete the program.

527
14. To make the technology and professional programs available on the "local" level- at community colleges- for people beginning their education.
15. It is very important to stress the historical aspect in all land survey work. Too often I have seen boundary and right-of-way surveys completed without researching early records. In many cases the purpose is to retrace earlier surveys, especially on the interior of sections and older subdivision plats. Research, then go search! Also, it is important to really understand the equipment being used in the survey. All too often I have seen proper procedure sacrificed because a desired result or product was needed within unrealistic time frames. With the prevalent use of computerized equipment, it is far too easy to manipulate or "adjust" data for a desired effect. While some of these modern tools are wonderful innovations, too the poorly trained or the practitioner cutting corners to beat a competitor, these tools can be dangerous. Know your equipment, what it can do, what it can't do, and stick to proper procedures.

528
14. I believe that the survey education needs to be up to date on new techniques in the field.
15. n/g

529
14. Note keeping, communication skills.
15. n/g

530
14. I believe that surveyors should be very comfortable using GPS and GIS technologies.
15. If the Ferris Surveying program isn't already doing this, I believe there could be some effort put forth to train students in the area of industrial metrology. This could provide many additional opportunities for surveying graduates and the firms they are employed by. The Ferris Surveying program provided me with an excellent background to enter the marketplace.

531
14. Educate to evaluate survey field data, as it relates to information in the public records- boundary law.
15. n/g

532
14. Keeping up with changing technology.
15. (1.) Eliminate the time wasted on writing computer programs. (2.) Office operations and research of records.

533
14. I think in addition to the fundamentals of surveying students need more communication and business skills to be competitive.
15. n/g

534 (Blank)

535
14. GIS/LIS- surveyors seem to be missing the boat on tapping into this part of the business.
15. n/g

536 (Blank)

537
14. n/g
15. While I am not engaged in this occupation, I do dabble on weekends with a friend who is a PE and RLS so I stay a little tuned in to the many changes that technology has brought over the past 20 years. I am amazed that many students and grads cannot slope stake, stake for construction unless they have the printed instructions for a total station- then they are mere instrument people only doing what is puked out by a computer. In one case, I was the "rodman" and told the crew chief this doesn't look right- he should not recognize the mistake because he only did what the printout said. He wasn't a Ferris grad- It made me wonder if like most things today, we have lost the basic concept and foundation- I hope not. As to your question about leadership/ problem solving teams; my firm spent in excess of $150,000 training and educating our employees in these very topics- listening and conflict resolution are very important social skills.

538
14. Thorough understanding of legal principles and LIS/GIS applications can bring with planning.
15. Ferris provided a very good education for surveying. The questions regarding leadership and teamwork, and communication are difficult to translate to education- these are characteristics not readily obtained through formal education. Mr. Hashimi has been the single best influence regarding problem solving and analytical thinking. He is core to the Ferris program-even though most students are "troubled" by him during their coursework. He has provided an excellent education in the scientific methods of surveying. The weak points when I was at Ferris were in legal aspects, hydrology, and soils science as applied to surveying (pore tests, septic design, etc.).

539
18. n/g
19. n/g

540
18. Data collection- dumping and data adjustment; GPS
19. n/g

541
14. GIS/LIS and GPS technology with stress on the business management aspects.
15. n/g

542
15. Time should not be wasted writing computer programs.

543
18. Quality field personnel
19. n/g

544
18. CAD/ GPS/ data collection
19. For the time of my education (81-83) I was very well prepared for the work field. I proceeded to continue my education by taking CAD classes to keep up with the times.

545
18. n/g
19. n/g

546
18. GPS and CAD
19. n/g

547

18. Integrate sound surveying techniques with GIS applications.
19. n/g

Employer Survey Data

C

January 20, 2000

Dear Employer:

Ferris State University is dedicated to keep its curriculum strong and current In order to accomplish that goal, all programs at Ferris must undergo periodic review. This year, the Surveying Program is undertaking this study and we are asking for your input. Enclosed are employer surveys that we would like you to complete and return to us in the enclosed envelope. Your input is very important to us in this self-evaluation process.

Many of you helped last year when the program underwent review for accreditation by ABET. We thank you for your responses then and hope that you will help us now. We would appreciate it if you could take a few minutes from your busy schedule and complete the survey **TODAY.**

Please note that we have sent two forms: one for two year graduates and the other for four year graduates. Please fill in the appropriate form(s).

Thank you very much for your time and for the support that you have given to us in the past.

Sincerely,

K. Thapa, Ph. D.
Professor and Surveying Engineering Program Coordinator.

SURVEYING ENGINEERING PROGRAM

COLLEGE OF
TECHNOLOGY
Ferris State University
EXCELLENCE•HERITAGE•QUALITY•SERVICE•COMMITMENT

GRADUATE EMPLOYER SURVEY
(4-Year Graduates Only)

Please evaluate the overall quality and performance of all the Ferris State University Surveying Engineering (4-year) students you have employed for the areas listed below.

Please use the rating scale of to 5 (strongly agree) to 1 (strongly disagree) or not applicable.

		5	4	3	2	1	N/A
1.	The graduates have adequate theoretical knowledge.						
2.	The graduates have adequate technical skills.						
3.	The graduates have ability to apply knowledge in practical situations.						
4.	The graduates were prepared to assume entry level duties.						
5.	The graduates exhibit willingness to learn and apply new experiences.						
6.	The graduates are competent in problem solving.						
7.	The graduates have grown and developed since hired.						
8.	The graduates are prompt in arriving for appointments.						
9.	The graduates are prompt in completing assignments.						
10.	The graduates exhibit an adequate level of ethical behavior.						
11.	The graduates demonstrate an adequate level of enthusiasm for the assigned tasks.						
12.	The graduates effectively communicate orally with others.						
13.	The graduates use written communication effectively.						
14.	The graduates possess adequate computer competency.						
15.	The graduates recognize teamwork and work well in a team.						
16.	The graduates demonstrate leadership.						

over⇒

17. If the opportunity arose, please indicate your willingness to hire another Ferris graduate to work in your organization. Please explain your answer.

☐ HIGH ☐ MODERATE ☐ LOW

18. Are there competencies in any specialty areas you feel a Ferris graduate should possess?

19. Based on today's surveying and mapping demands, are there any particular areas you feel Ferris should emphasize in the curriculum?

20. What do you see as the emerging issues in the field of surveying and mapping?

21. Are there any other areas not included in the survey that you would like to comment on?

SURVEYING ENGINEERING PROGRAM

COLLEGE OF
TECHNOLOGY
Ferris State University
EXCELLENCE • HERITAGE • QUALITY • SERVICE • COMMITMENT

GRADUATE EMPLOYER SURVEY

(2-Year Graduates Only)

Please evaluate the overall quality and performance of all the Ferris State University Surveying Technology (2-year) students you have employed for the areas listed below.

Please use the rating scale of to 5 (strongly agree) to 1 (strongly disagree) or not applicable.

		5	4	3	2	1	N/A
1.	The graduates have adequate theoretical knowledge.						
2.	The graduates have adequate technical skills.						
3.	The graduates have ability to apply knowledge in practical situations.						
4.	The graduates were prepared to assume entry level duties.						
5.	The graduates exhibit willingness to learn and apply new experiences.						
6.	The graduates are competent in problem solving.						
7.	The graduates have grown and developed since hired.						
8.	The graduates are prompt in arriving for appointments.						
9.	The graduates are prompt in completing assignments.						
10.	The graduates exhibit an adequate level of ethical behavior.						
11.	The graduates demonstrate an adequate level of enthusiasm for the assigned tasks.						
12.	The graduates effectively communicate orally with others.						
13.	The graduates use written communication effectively.						
14.	The graduates possess adequate computer competency.						
15.	The graduates recognize teamwork and work well in a team.						
16.	The graduates demonstrate leadership.						

over⇒

17. If the opportunity arose, please indicate your willingness to hire another Ferris graduate to work in your organization. Please explain your answer.

☐ HIGH ☐ MODERATE ☐ LOW

18. Are there competencies in any specialty areas you feel a Ferris graduate should possess?

19. Based on today's surveying and mapping demands, are there any particular areas you feel Ferris should emphasize in the curriculum?

20. What do you see as the emerging issues in the field of surveying and mapping?

21. Are there any other areas not included in the survey that you would like to comment on?

Student Survey Data D

STUDENT SURVEY
FOR THE FERRIS STATE UNIVERSITY
SURVEYING ENGINEERING PROGRAM

Please circle the appropriate response.	5 = Strongly Agree 4 = Agree 3 = Neutral				2 = Disagree 1 = Strongly Disagree N/A = Not Applicable	
						N/A
COURSES IN THE SURVEYING PROGRAM ARE:						
1. Challenging and intellectually inspiring	5	4	3	2	1	0
2. Based on realistic prerequisites	5	4	3	2	1	0
3. Help me prepare for my future in the profession	5	4	3	2	1	0
WRITTEN OBJECTIVES FOR COURSES IN SURVEYING						
4. Are available to the students	5	4	3	2	1	0
5. Describe what you will learn in the course	5	4	3	2	1	0
6. Are used by the instructor to keep you aware of your progress	5	4	3	2	1	0
TEACHING METHODS, PROCEDURES AND COURSE CONTENT:						
7. Meet your projected career needs, interest, and objectives	5	4	3	2	1	0
8. Provide for adequate supervised activities, such as laboratory time, for developing methods and skills found in the work place	5	4	3	2	1	0
9. There is appropriate monitoring and evaluation of student progress with sufficient tests, homework, and laboratory exercises	5	4	3	2	1	0
SURVEYING FACULTY:						
10. Know the subject matter and professional requirements	5	4	3	2	1	0
11. Provide adequate academic advising	5	4	3	2	1	0
12. Are available to students for help in courses when problems are encountered	5	4	3	2	1	0
13. Faculty provide instruction which is interesting and understandable	5	4	3	2	1	0
RELATED COURSES AND FACULTY (i.e., English, Geology, Mathematics, etc.):						
15. Faculty are knowledgeable about the subject matter they teach	5	4	3	2	1	0
16. Faculty are available to provide help when needed	5	4	3	2	1	0
17. Faculty provide instruction which is interesting and understandable	5	4	3	2	1	0
18. Required related courses are relevant to the surveying program	5	4	3	2	1	0
SURVEYING LABORATORIES (computer, photogrammetry, mapping, etc.):						
19. Provide adequate lighting, ventilation, etc.	5	4	3	2	1	0
20. Include enough work stations for students enrolled in course	5	4	3	2	1	0
21. Computer hardware is sufficient for students to complete assignments in a timely fashion	5	4	3	2	1	0
22. Computer software is maintained and generally functions as it is supposed to	5	4	3	2	1	0
23. Are safe, functional, and well maintained	5	4	3	2	1	0
24. Are open for sufficient hours each semester	5	4	3	2	1	0
OTHER LABORATORIES (science, soils, concrete, geology, physics, etc.):						
25. Provide adequate lighting, ventilation, etc.	5	4	3	2	1	0
26. Include enough work stations for students enrolled in course	5	4	3	2	1	0
27. Are safe, functional, and well maintained	5	4	3	2	1	0
28. Are open for sufficient hours each semester	5	4	3	2	1	0

SURVEYING AND MAPPING INSTRUMENTS AND ACCESSORIES ARE:						
29. Current and representative of the surveying profession	5	4	3	2	1	0
30. In sufficient quantity to avoid long delays in use	5	4	3	2	1	0
31. Safe and in good operating condition	5	4	3	2	1	0
INSTRUCTIONAL MATERIALS (i.e., textbooks, reference books, etc.):						
32. Are current and meaningful to the subject	5	4	3	2	1	0
33. Are easily obtainable through the bookstore, library, or other sources	5	4	3	2	1	0
INSTITUTIONAL SUPPORT SERVICES (classrooms, tutoring, library, etc.):						
34. Are available to meet your needs and interests.	5	4	3	2	1	0
35. Are provided by knowledgeable, friendly and interested staff members	5	4	3	2	1	0
36. University library holdings are current and sufficient	5	4	3	2	1	0
37. Classrooms provide adequate lighting, ventilation, etc.	5	4	3	2	1	0
38. Class rooms contain enough seats and tables for all students	5	4	3	2	1	0
39. Program faculty encourage students to avail themselves of support services like the library, tutorial services, etc.	5	4	3	2	1	0
40. In general, the University is safe, functional, and well maintained	5	4	3	2	1	0
ABOUT YOUR CHOSEN CAREER						
41. I am satisfied and proud to have choosen surveying as a profession	5	4	3	2	1	0
42. I am satisfied and proud to have choosen Ferris' surveying program	5	4	3	2	1	0
43. Program faculty encourage students to participate in professional activities outside of the classroom	5	4	3	2	1	0

Are there any areas which are not within this survey that you would like to comment on? If so, use the space below.

STUDENT SURVEY WRITTEN COMMENTS

There should be more quizzes and preparation for exams.

I feel that there needs to be improvement in the laboratory section of the second GIS course and the second geodesy course. I did not learn what I should have in the second GIS course. We did not design an actual functioning system in the course which I find upsetting. There were similar problems with the second geodesy course. The labs did not make use of the GPS equipment. Out of the entire semester, only two GPS labs were completed. I feel that a group project would have been a better option than what was offered. A semester long project that incorporates all aspects of geodesy and the use of GPS equipment. I am happy with the legal, computational, and the lower level 200-300 courses. I feel that they are structured well and place the correct amount of emphasis on mathematical, computer use, and field procedures. I feel that the GIS, second geodesy course, and photogrammetry courses should be audited and revised.

It is nice to have state of the art surveying and mapping instruments, total stations, GPS, etc., but the instructors don't know how to use them, and expect us to work with them.

I disagree with the department's policy of placing instructors with limited English communication skills in positions of teaching complex mathematical subjects. The associated values of cultural diversity should be left to less complex (i.e., humanities, English and social course work) studies.

I have found some faculty lectures difficult to understand. I am able to go to other faculty members for assistance, making it possible to learn the information. In general this is a well-organized program.

For some courses, it seems like "what did he expect for this assignment?" and "do we have to turn this in, or is it for practice?" are perpetual questions. It would be nice if all instructors would be clear on what they expect from students.

Really only the status of the computers in the labs, maybe hire some full-time support.

For the most part I am finding my time at Ferris very well spent, with the exception of a couple of classes. I feel that GEOMATICS (Fortran programming) is a complete waste of time. It is not applicable to the surveying work force, and not to mention out of date as well. Everything we struggle to learn in that class can be easily done with a calculator. Perhaps we should have more courses that deal directly with the major such as wetlands identification.

Too many credits in the program and when half of them require labs it doubles the time for instruction in a week. I feel like Physics II, GIS II, Photo II should be electives for those students who choose a career in one of those specific fields.

New computer lab!!

I would like to say that this really is quite a good program. The BIGGEST problem is the computer lab situation. Just ask any faculty member or student involved in the program. I would also like to say that the professors (in general) are really there for the students. They help us with future job choices, academic support. They really go the extra mile for us. I know that I for one am very appreciative of their efforts.

I am disappointed SURE 272 does not have a lab. I feel it needs one with its course content. Also, I feel the computer lab needs a tech (full time) to make sure the lab functions properly.

The surveying computer lab should be open later at night. It closes at about 6:00 P.M. if nobody is in there. Then you have to chase down the janitor and he gets mad when he has to open the door. Just please leave it open. It's such a hassle to come up here at 7:00 P.M. and use the facility.

The classrooms are often cold. Not all, but some of the labs such as GIS, are not focused on the real subject matter.

Need more GPS receivers.

Fix up the computer lab.

Computers must be improved!!! Students are sick of promises with no action!!!

Would like to see tutoring available for classes.

If a text is required for the course it would be wise to make sure it is still in print. The computer room is the worst I have seen out of the many computer labs I have been to in other universities. You need to hire a better network administrator and use better security programs.

Snow removal is horrible, not safe! Some classes require out of print textbooks or not at all. This is not helpful and usually is a hindrance. The use of MathCAD in upper level classes, especially 372 & 373, is confusing and wastes our time. Most of us were not trained in the use of MathCAD!

The parking for commuting students is very poor. If you want commuter students to come to FSU then you need more parking.

Staff should understand the weather conditions and reduce the amount of labs in SURE 110 because we are always in a hurry and under pressure.

How can you hire faculty like Burtch who are not even surveyors and can't even set up a total station and shoot distances and angles?

Faculty Survey Data

E

SURVEYING ENGINEERING
FACULTY PERCEPTIONS

INSTRUCTIONS TO RESPONDENTS

On the following pages , you are asked to give your perceptions of your occupational program (such as registered nursing, automotive technology, secretarial science). The items you are asked to rate are grouped into the major components of the Program Review in Occupational Education (PROE) system, namely:

- Goals
- Processes
- Resources

Rate each item by checking your best judgment on a five point scale ranging from poor to excellent. Only check one answer per item. A "Don't Know" column has been provided in the event you really don't have sufficient information to rate an item. Space has been provided for you to note comments that may help to clarify your rating or to indicate modifications of a standard to make it more relevant for your program.

Criteria for excellent and poor ratings are provided for each item. *Excellent* represents a nearly ideal or exemplary situation; *poor*, one of serious inadequacy. As a guide, ratings may be made with the following in mind:

EXCELLENT means ideal, top 5 to 10%
GOOD is a strong rating, top 1/3
ACCEPTABLE is average, the middle 1/3
BELOW EXPECTATIONS is only fair, bottom 1/3
POOR is seriously inadequate, bottom 5 to 10%

	Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
GOALS AND OBJECTIVES 1. Participation in Development of the Curriculum *Excellent* – Administrators and/or other supervisory personnel involved in developing and revising the curriculum for this program, seek and respond to faculty, student, and community input. *Poor* – Development of the plan for this program in basically the work of one or two persons in the college.							
2. Program Goals *Excellent* – Written goals for this program state realistic outcomes (such as recruiting, retention, placements, licensing pass rate) and are used as one measure of program effectiveness. *Poor* – No written goals exist for this program.							
3. Course Objectives *Excellent* – Written measurable objectives have been developed for all courses in this program and are used to plan and organize instruction. *Poor* – No written objectives have been developed for courses in this program.							

	Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
4. Use of Information on Labor Market Needs *Excellent* – Current data on labor market needs and emerging trends in job openings are systematically used in developing and evaluating this program. *Poor* – Labor market data is not used in planning or evaluation.							
5. Use of Information on Job Performance Requirements *Excellent* – Current data on job performance requirements and trends are systematically used in developing and evaluating this program and content of its courses. *Poor* – Job performance requirements information has not been collected for use in planning and evaluating.							
6. Use of Profession/Industry Standards *Excellent* – Profession/industry standards (such as licensing, certification, accreditation) are consistently used in planning and evaluaing this program and content of its courses. *Poor* – Little or no recognition is given to specific profession/industry standards in planning and evaluating this program.							
7. Use of Student Follow-Up Information *Excellent* – Current follow-up data on completers and leavers (students with marketable skills) are consistently and systematically used in evaluating this program. *Poor* – Student follow-up information has not been collected for use in evaluating this program.							
PROCESSES 8. Adaptation of Instruction *Excellent* – Instruction in all courses required for this program recognizes and responds to individual student interests, learning styles, skills, and abilities through a variety of instructional methods (such as small group or individualized instruction, laboratory or "hands-on" experiences, open entry/open exit, credit by examination). *Poor* – Instructional approaches in this program do not consider individual student differences.							
9. Relevance of Supportive Courses *Excellent* – Applicable support courses (such as mathematics, physical science, or English) are closely coordinated with this program, and are kept relevant to program goals and current to the needs of students. *Poor* – Supportive course content reflects no planned approach to meeting needs of students in this program.							

		Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
10.	Coordination with Other Community Agencies and Educational Programs *Excellent* – Effective liaison is maintained with other programs and educational agencies and institutions (such as high schools, other community colleges, four year colleges) to assure a coordinated approach and to avoid duplication in meeting occupational needs of the area or community. *Poor* – College activities reflect a disinterest in coordination with other programs and agencies having impact on this program.							
11.	Program Availability and Accessibility *Excellent* – Students and potential students desiring enrollment in this program are identified through recruitment activities, treated equally in enrollment selection, and not discouraged by unrealistic prerequisites. The program is readily available and accessible at convenient times and locations. *Poor* – This program is not available or accessible to most students seeking enrollment. Discriminatory selection procedures are practiced.							
12.	Provision for the Disadvantaged *Excellent* – Support services are provided for disadvantaged (such as socioeconomic, cultural, linguistic, academic) students enrolled in this program. Services are coordinated with occupational instruction and results are assessed continuously. *Poor* – No support services are provided for disadvantaged students enrolled in this program.							
13.	Provision for the Handicapped *Excellent* – Support services are provided for handicapped (physical, mental, emotional, and other health impairing handicaps) students enrolled in this program. Facilities and equipment adaptations are made as needed. Services and facilities modifications are coordinated with occupational instruction and results are assessed continuously. *Poor* – No support services or facilities and equipment modifications are available for handicapped students enrolled in this program.							
14.	Efforts to Achieve Gender Equity *Excellent* – Emphasis is given to eliminating sex bias and sex stereotyping in this program: staffing, student recruitment, program advisement, and career counseling; access to and acceptance in programs; selection of curricular materials; instruction; job development and placement. *Poor* – Almost no attention is directed toward achieving sex equity in this program.							

	Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
15. Provision for Program Advisement *Excellent* – Instructors or other qualified personnel advise students (day, evening, weekend) on program and course selection. Registration procedures facilitate course selection and sequencing. *Poor* – Instructors make no provision for advising students on course and program selection.							
16. Provision for Career Planning and Guidance *Excellent* – Day, evening, and weekend students in this program have ready access to career planning and guidance services. *Poor* – Little or no provision is made for career planning and guidance services for students enrolled in this program.							
17. Adequacy of Career Planning and Guidance *Excellent* – Instructors or other qualified personnel providing career planning and guidance services have current and relevant occupational knowledge and use a variety of resources (such as printed materials, audiovisuals, job observation) to meet individual student career objectives. *Poor* – Career planning and guidance services are ineffective and staffed with personnel who have little occupational knowledge.							
18. Provision for Employability Information *Excellent* – This program includes information which is valuable to students as employees (on such topics as employment opportunities and future potential, starting salary, benefits, responsibilities and rights). *Poor* – almost no emphasis is placed on providing information important to students as employees.							
19. Placement Effectiveness for Students in this Program *Excellent* – The college has an effectively functioning system for locating jobs and coordinating placement for students in this program. *Poor* – The college has no system or an ineffective system for locating jobs and coordinating placement for occupational students enrolled in this program.							
20. Student Follow-Up System *Excellent* – Success and failure of program leavers and completers are assessed through periodic follow-up studies. Information learned is made available to instructors, students, advisory committee members, and others concerned (such as counselors) and is used to modify this program. *Poor* – No effort is made to follow up former students of this program.							

	Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
21. Promotion of this Occupational Program *Excellent* – An active and organized effort is made to inform the public and its representatives (such as news media, legislators, board, business community) of the importance of providing effective and comprehensive occupational education, and specific training for this occupation to gain community support. *Poor* – There is no organized public information effort for this program.							
RESOURCES 22. Provision for Leadership and Coordination *Excellent* – Responsibility, authority, and accountability for this program are clearly identified and assigned. Administrative effectiveness is achieved in planning, managing, and evaluating this program. *Poor* – There are no clearly defined lines of responsibility, authority, and accountability for this program.							
23. Qualifications of Administrators and/or Supervisors *Excellent* – All persons responsible for directing and coordinating this program demonstrate a high level of administrative ability. They are knowledgeable in and committed to occupational education. *Poor* – Persons responsible for directing and coordinating this program have little administrative training, education, and experience.							
24. Instructional Staffing *Excellent* – Instructional staffing for this program is sufficient to permit optimum program effectiveness (such as through enabling instructors to meet individual student needs, providing liaison with advisory committees, and assisting with placement and follow-up activities). *Poor* – Staffing is inadequate to meet the needs of this program effectively.							
25. Qualifications of Instructional Staff *Excellent* – Instructors in this program have two or more years in relevant employment experience, have kept current in their field, and have developed and maintained a high level of teaching competence. *Poor* – Few instructors in this program have relevant employment experience or current competence in their field.							
26. Professional Development Opportunities *Excellent* – The college encourages and supports the continuing professional development of faculty through such opportunities as conference attendance, curriculum development, work experience. *Poor* – The college does not encourage or support professional development of faculty.							

	Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
27. Use of Instructional Support Staff *Excellent* – Paraprofessionals (such as aides, laboratory assistants) are used when appropriate to provide classroom help to students and to ensure maximum effectiveness of instructors in the program. *Poor* – Little use is made of instructional support staff in this program.							
28. Use of Clerical Support Staff *Excellent* – Office and clerical assistance is available to instructors in this program and used to ensure maximum effectiveness of instructors. *Poor* – Little or no office and clerical assistance is available to instructors; ineffective use is made of clerical support staff.							
29. Adequacy and Availability of Instructional Equipment *Excellent* – Equipment used on or off campus for this program is current, representative of that used on jobs for which students are being trained, and in sufficient supply to meet the needs of students. *Poor* – Equipment for this program is outmoded and in insufficient quantity to support quality instruction.							
30. Maintenance and Safety of Instructional Equipment *Excellent* – Equipment used for this program is operational, safe, and well maintained. *Poor* – Equipment used for this program is often not operable and is unsafe.							
31. Adequacy of Instructional Facilities *Excellent* – Instructional facilities (excluding equipment) meet the program objectives and student needs, are functional, and provide maximum flexibility and safe working conditions. *Poor* – Facilities for this program generally are restrictive, dysfunctional, or overcrowded.							
32. Scheduling of Instructional Facilities *Excellent* – Scheduling of facilities and equipment for this program is planned to maximize use and be consistent with quality instruction. *Poor* – Facilities and equipment for this program are significantly under- or overscheduled.							
33. Adequacy and Availability of Instructional Materials and Supplies *Excellent* – Instructional materials and supplies are readily available and in sufficient quantity to support quality instruction. *Poor* – Materials and supplies in this program are limited in amount, generally outdated, and lack relevance to program and student needs.							

		Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
34.	Adequacy and Availability of Learning Resources *Excellent* – Learning resources for this program are available and accessible to students, current and relevant to the occupation, and selected to avoid sex bias and stereotyping. *Poor* – Learning resources for this program are outdated, limited in quantity, and lack of relevance to the occupation.							
35.	Use of Advisory Committee *Excellent* – The advisory committee for this program is active and representative of the occupation. *Poor* – The advisory committee for this program is not representative of the occupation and rarely meets.							
36.	Provisions in Current Operating Budget *Excellent* – Adequate funds are allocated in the college operating budget to support achievement of approved program objectives. Allocations are planned to consider instructor budget input. *Poor* – Funds provided are seriously inadequate in relation to approved objectives for this program.							
37.	Provisions in Capital Outlay Budget for Equipment *Excellent* – Funds are allocated in a planned effort to provide for needed new equipment and for equipment replacement and repair, consistent with the objectives for this program, and based on instructor input. *Poor* – Equipment needs in this program are almost totally unmet in the capital outlay budget.							

FACULTY PERCEPTIONS OF PROGRAMS

Please answer the following: (use back of page and extra sheets if necessary).

1. What are the chief strengths of your program?

2. What are the major needs for improvement in your program, and what action is required to achieve these improvements?

3. Is/are there any area(s) which were not covered by the survey instrument that you would like to comment on?

SURVEYING ENGINEERING
FACULTY PERCEPTIONS

INSTRUCTIONS TO RESPONDENTS

On the following pages , you are asked to give your perceptions of your occupational program (such as registered nursing, automotive technology, secretarial science). The items you are asked to rate are grouped into the major components of the Program Review in Occupational Education (PROE) system, namely:

- Goals
- Processes
- Resources

Rate each item by checking your best judgment on a five point scale ranging from poor to excellent. Only check one answer per item. A "Don't Know" column has been provided in the event you really don't have sufficient information to rate an item. Space has been provided for you to note comments that may help to clarify your rating or to indicate modifications of a standard to make it more relevant for your program.

Criteria for excellent and poor ratings are provided for each item. *Excellent* represents a nearly ideal or exemplary situation; *poor*, one of serious inadequacy. As a guide, ratings may be made with the following in mind:

EXCELLENT means ideal, top 5 to 10%
GOOD is a strong rating, top 1/3
ACCEPTABLE is average, the middle 1/3
BELOW EXPECTATIONS is only fair, bottom 1/3
POOR is seriously inadequate, bottom 5 to 10%

	Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
GOALS AND OBJECTIVES							
1. Participation in Development of the Curriculum *Excellent* – Administrators and/or other supervisory personnel involved in developing and revising the curriculum for this program, seek and respond to faculty, student, and community input. *Poor* – Development of the plan for this program in basically the work of one or two persons in the college.			★ 3.67				
2. Program Goals *Excellent* – Written goals for this program state realistic outcomes (such as recruiting, retention, placements, licensing pass rate) and are used as one measure of program effectiveness. *Poor* – No written goals exist for this program.				★ 4.33			
3. Course Objectives *Excellent* – Written measurable objectives have been developed for all courses in this program and are used to plan and organize instruction. *Poor* – No written objectives have been developed for courses in this program.			★ 3.67				

	Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
4. Use of Information on Labor Market Needs *Excellent* – Current data on labor market needs and emerging trends in job openings are systematically used in developing and evaluating this program. *Poor* – Labor market data is not used in planning or evaluation.			3.67				
5. Use of Information on Job Performance Requirements *Excellent* – Current data on job performance requirements and trends are systematically used in developing and evaluating this program and content of its courses. *Poor* – Job performance requirements information has not been collected for use in planning and evaluating.				4.00			
6. Use of Profession/Industry Standards *Excellent* – Profession/industry standards (such as licensing, certification, accreditation) are consistently used in planning and evaluaing this program and content of its courses. *Poor* – Little or no recognition is given to specific profession/industry standards in planning and evaluating this program.				4.33			
7. Use of Student Follow-Up Information *Excellent* – Current follow-up data on completers and leavers (students with marketable skills) are consistently and systematically used in evaluating this program. *Poor* – Student follow-up information has not been collected for use in evaluating this program.			3.00				**Comment: "Not for long enough period."**
PROCESSES							
8. Adaptation of Instruction *Excellent* – Instruction in all courses required for this program recognizes and responds to individual student interests, learning styles, skills, and abilities through a variety of instructional methods (such as small group or individualized instruction, laboratory or "hands-on" experiences, open entry/open exit, credit by examination). *Poor* – Instructional approaches in this program do not consider individual student differences.			3.33				
9. Relevance of Supportive Courses *Excellent* – Applicable support courses (such as mathematics, physical science, or English) are closely coordinated with this program, and are kept relevant to program goals and current to the needs of students. *Poor* – Supportive course content reflects no planned approach to meeting needs of students in this program.				4.00			

		Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
10.	**Coordination with Other Community Agencies and Educational Programs** *Excellent* – Effective liaison is maintained with other programs and educational agencies and institutions (such as high schools, other community colleges, four year colleges) to assure a coordinated approach and to avoid duplication in meeting occupational needs of the area or community. *Poor* – College activities reflect a disinterest in coordination with other programs and agencies having impact on this program.			3.00				
11.	**Program Availability and Accessibility** *Excellent* – Students and potential students desiring enrollment in this program are identified through recruitment activities, treated equally in enrollment selection, and not discouraged by unrealistic prerequisites. The program is readily available and accessible at convenient times and locations. *Poor* – This program is not available or accessible to most students seeking enrollment. Discriminatory selection procedures are practiced.				4.00			
12.	**Provision for the Disadvantaged** *Excellent* – Support services are provided for disadvantaged (such as socioeconomic, cultural, linguistic, academic) students enrolled in this program. Services are coordinated with occupational instruction and results are assessed continuously. *Poor* – No support services are provided for disadvantaged students enrolled in this program.		2.67					
13.	**Provision for the Handicapped** *Excellent* – Support services are provided for handicapped (physical, mental, emotional, and other health impairing handicaps) students enrolled in this program. Facilities and equipment adaptations are made as needed. Services and facilities modifications are coordinated with occupational instruction and results are assessed continuously. *Poor* – No support services or facilities and equipment modifications are available for handicapped students enrolled in this program.		2.67					
14.	**Efforts to Achieve Gender Equity** *Excellent* – Emphasis is given to eliminating sex bias and sex stereotyping in this program: staffing, student recruitment, program advisement, and career counseling; access to and acceptance in programs; selection of curricular materials; instruction; job development and placement. *Poor* – Almost no attention is directed toward achieving sex equity in this program.				4.00			

	Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
15. **Provision for Program Advisement** *Excellent* – Instructors or other qualified personnel advise students (day, evening, weekend) on program and course selection. Registration procedures facilitate course selection and sequencing. *Poor* – Instructors make no provision for advising students on course and program selection.				4.33			
16. **Provision for Career Planning and Guidance** *Excellent* – Day, evening, and weekend students in this program have ready access to career planning and guidance services. *Poor* – Little or no provision is made for career planning and guidance services for students enrolled in this program.				4.00			
17. **Adequacy of Career Planning and Guidance** *Excellent* – Instructors or other qualified personnel providing career planning and guidance services have current and relevant occupational knowledge and use a variety of resources (such as printed materials, audiovisuals, job observation) to meet individual student career objectives. *Poor* – Career planning and guidance services are ineffective and staffed with personnel who have little occupational knowledge.				4.00			
18. **Provision for Employability Information** *Excellent* – This program includes information which is valuable to students as employees (on such topics as employment opportunities and future potential, starting salary, benefits, responsibilities and rights). *Poor* – almost no emphasis is placed on providing information important to students as employees.					5.00		
19. **Placement Effectiveness for Students in this Program** *Excellent* – The college has an effectively functioning system for locating jobs and coordinating placement for students in this program. *Poor* – The college has no system or an ineffective system for locating jobs and coordinating placement for occupational students enrolled in this program.				4.67			**Comment: "The pgm. is almost solely involved in student placement. No college program."**
20. **Student Follow-Up System** *Excellent* – Success and failure of program leavers and completers are assessed through periodic follow-up studies. Information learned is made available to instructors, students, advisory committee members, and others concerned (such as counselors) and is used to modify this program. *Poor* – No effort is made to follow up former students of this program.			3.33				

	Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
21. Promotion of this Occupational Program *Excellent* – An active and organized effort is made to inform the public and its representatives (such as news media, legislators, board, business community) of the importance of providing effective and comprehensive occupational education, and specific training for this occupation to gain community support. *Poor* – There is no organized public information effort for this program.		2.67					
RESOURCES **22.** Provision for Leadership and Coordination *Excellent* – Responsibility, authority, and accountability for this program are clearly identified and assigned. Administrative effectiveness is achieved in planning, managing, and evaluating this program. *Poor* – There are no clearly defined lines of responsibility, authority, and accountability for this program.			3.33				
23. Qualifications of Administrators and/or Supervisors *Excellent* – All persons responsible for directing and coordinating this program demonstrate a high level of administrative ability. They are knowledgeable in and committed to occupational education. *Poor* – Persons responsible for directing and coordinating this program have little administrative training, education, and experience.			3.33				**Comment: "Not all, but some."**
24. Instructional Staffing *Excellent* – Instructional staffing for this program is sufficient to permit optimum program effectiveness (such as through enabling instructors to meet individual student needs, providing liaison with advisory committees, and assisting with placement and follow-up activities). *Poor* – Staffing is inadequate to meet the needs of this program effectively.		2.00					
25. Qualifications of Instructional Staff *Excellent* – Instructors in this program have two or more years in relevant employment experience, have kept current in their field, and have developed and maintained a high level of teaching competence. *Poor* – Few instructors in this program have relevant employment experience or current competence in their field.				4.33			
26. Professional Development Opportunities *Excellent* – The college encourages and supports the continuing professional development of faculty through such opportunities as conference attendance, curriculum development, work experience. *Poor* – The college does not encourage or support professional development of faculty.		2.00					

		Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
27.	Use of Instructional Support Staff *Excellent* – Paraprofessionals (such as aides, laboratory assistants) are used when appropriate to provide classroom help to students and to ensure maximum effectiveness of instructors in the program. *Poor* – Little use is made of instructional support staff in this program.	1.33						**Comment: "Don't have any."**
28.	Use of Clerical Support Staff *Excellent* – Office and clerical assistance is available to instructors in this program and used to ensure maximum effectiveness of instructors. *Poor* – Little or no office and clerical assistance is available to instructors; ineffective use is made of clerical support staff.	1.67						**Comment: "Very good @ Dept. level. Poor at Program level."**
29.	Adequacy and Availability of Instructional Equipment *Excellent* – Equipment used on or off campus for this program is current, representative of that used on jobs for which students are being trained, and in sufficient supply to meet the needs of students. *Poor* – Equipment for this program is outmoded and in insufficient quantity to support quality instruction.			3.33				**Comment: "All equip. is excellent except the computers which are totally inadequate."**
30.	Maintenance and Safety of Instructional Equipment *Excellent* – Equipment used for this program is operational, safe, and well maintained. *Poor* – Equipment used for this program is often not operable and is unsafe.			3.67				
31.	Adequacy of Instructional Facilities *Excellent* – Instructional facilities (excluding equipment) meet the program objectives and student needs, are functional, and provide maximum flexibility and safe working conditions. *Poor* – Facilities for this program generally are restrictive, dysfunctional, or overcrowded.			3.67				
32.	Scheduling of Instructional Facilities *Excellent* – Scheduling of facilities and equipment for this program is planned to maximize use and be consistent with quality instruction. *Poor* – Facilities and equipment for this program are significantly under- or overscheduled.				4.00			
33.	Adequacy and Availability of Instructional Materials and Supplies *Excellent* – Instructional materials and supplies are readily available and in sufficient quantity to support quality instruction. *Poor* – Materials and supplies in this program are limited in amount, generally outdated, and lack relevance to program and student needs.			3.67				

		Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
34.	Adequacy and Availability of Learning Resources *Excellent* – Learning resources for this program are available and accessible to students, current and relevant to the occupation, and selected to avoid sex bias and stereotyping. *Poor* – Learning resources for this program are outdated, limited in quantity, and lack of relevance to the occupation.		2.00					**Comment: "Computer lab needs current hardware, software, and more importantly, Tech. Support."**
35.	Use of Advisory Committee *Excellent* – The advisory committee for this program is active and representative of the occupation. *Poor* – The advisory committee for this program is not representative of the occupation and rarely meets.				4.00			
36.	Provisions in Current Operating Budget *Excellent* – Adequate funds are allocated in the college operating budget to support achievement of approved program objectives. Allocations are planned to consider instructor budget input. *Poor* – Funds provided are seriously inadequate in relation to approved objectives for this program.		2.33					
37.	Provisions in Capital Outlay Budget for Equipment *Excellent* – Funds are allocated in a planned effort to provide for needed new equipment and for equipment replacement and repair, consistent with the objectives for this program, and based on instructor input. *Poor* – Equipment needs in this program are almost totally unmet in the capital outlay budget.		2.00					

UNIT MEANS:

GOALS AND OBJECTIVES: 3.81

PROCESSES: 3.69

RESOURCES: 2.91

OVERALL MEAN: 3.38

FACULTY PERCEPTIONS OF PROGRAMS

Please answer the following: (use back of page and extra sheets if necessary).

1. What are the chief strengths of your program?

2. What are the major needs for improvement in your program, and what action is required to achieve these improvements?

3. Is/are there any area(s) which were not covered by the survey instrument that you would like to comment on?

Surveying Engineering

Responses to Open-Ended Questions

Please answer the following:

1. **What are the chief strengths of your program?**

"This is a nationally well-known program. 100% Placement every year. Perfectly matches with FSU Vision. Has high academic standards."
"Well established and recognized within the profession. The only "engineering" program at FSU and the only one in MI. Only 5 or so nationally."
"Faculty are generally dedicated and work hard in providing good educational experiences to students. The equipment represents what one would find in industry today. Students are dedicated and professional. They represent the profession and our program very well. Faculty backgrounds are diverse and well-rounded which adds to the quality of instruction. They are all professionally involved and participate in professional development "

Comment from Recently Retired Faculty Member:
"The chief strength lies in a dedicated faculty that appreciate the need for an academically rigorous curriculum. The program is fortunate that dedicated and mature students seek surveying education. Few such programs exist in the U.S., therefore there is a high demand for the Ferris program."

2. **What are the major needs for improvement in your program, and what action is required to achieve these improvements?**

"Need to increase enrollments. Computer labs need upgrade."
"Fill "temp" faculty with a tenure track position. Must focus on establishing the GIS "option." We have been talking about this for almost two years. It is time the administration provide positive support"
"The computer system needs to be discarded and completely revamped. Band-Aide solutions are not adequate while problems hemorrhage. The program needs to attract more students. I believe that a 30% increase in enrollment is possible with an effective recruitment campaign. One faculty member should be given the task of recruitment and given 50% release time to undertake this task. Give that individual 3 years to achieve this goal and then re-evaluate. The program needs to develop a mission statement that will define actual action items to guide the program over the next 3 years. A facilitator should be brought in at a 2 day faculty retreat just to develop the mission and goals, putting out fires and addressing problems on an Ad Hoc basis are not adequate."
Comment from Recently Retired Faculty Member:
"Definitely a recognition , or respect, for the value of this program by upper levels of the Ferris administration. There seems to be a lack of care (or respect) for the

academic and professional value of this program. Classes are too populated, budget cut, occurs every and each year."

3. **Is/are there any area(s) which were not covered by the survey instrument that you would like to comment on?**

"This program deserves higher level of support than it is currently provided." "Current administrative structure of the college, department does not provide for and does not encourage academic excellence in teaching. As an example, I recently solicited a donor to establish a $15,500+ endowment for a scholarship and sent a note informing the department head and the Dean about it. I did not even receive an acknowledgment from either. "Department" does not have a clear focus or plan for the emergence of the new technologies."

SURVEYING TECHNOLOGY
FACULTY PERCEPTIONS

INSTRUCTIONS TO RESPONDENTS

On the following pages , you are asked to give your perceptions of your occupational program (such as registered nursing, automotive technology, secretarial science). The items you are asked to rate are grouped into the major components of the Program Review in Occupational Education (PROE) system, namely:

- Goals
- Processes
- Resources

Rate each item by checking your best judgment on a five point scale ranging from poor to excellent. Only check one answer per item. A "Don't Know" column has been provided in the event you really don't have sufficient information to rate an item. Space has been provided for you to note comments that may help to clarify your rating or to indicate modifications of a standard to make it more relevant for your program.

Criteria for excellent and poor ratings are provided for each item. *Excellent* represents a nearly ideal or exemplary situation; *poor*, one of serious inadequacy. As a guide, ratings may be made with the following in mind:

EXCELLENT means ideal, top 5 to 10%
GOOD is a strong rating, top 1/3
ACCEPTABLE is average, the middle 1/3
BELOW EXPECTATIONS is only fair, bottom 1/3
POOR is seriously inadequate, bottom 5 to 10%

	Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
GOALS AND OBJECTIVES 1. Participation in Development of the Curriculum *Excellent* – Administrators and/or other supervisory personnel involved in developing and revising the curriculum for this program, seek and respond to faculty, student, and community input. *Poor* – Development of the plan for this program in basically the work of one or two persons in the college.							
2. Program Goals *Excellent* – Written goals for this program state realistic outcomes (such as recruiting, retention, placements, licensing pass rate) and are used as one measure of program effectiveness. *Poor* – No written goals exist for this program.							
3. Course Objectives *Excellent* – Written measurable objectives have been developed for all courses in this program and are used to plan and organize instruction. *Poor* – No written objectives have been developed for courses in this program.							

	Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
4. Use of Information on Labor Market Needs *Excellent* – Current data on labor market needs and emerging trends in job openings are systematically used in developing and evaluating this program. *Poor* – Labor market data is not used in planning or evaluation.							
5. Use of Information on Job Performance Requirements *Excellent* – Current data on job performance requirements and trends are systematically used in developing and evaluating this program and content of its courses. *Poor* – Job performance requirements information has not been collected for use in planning and evaluating.							
6. Use of Profession/Industry Standards *Excellent* – Profession/industry standards (such as licensing, certification, accreditation) are consistently used in planning and evaluaing this program and content of its courses. *Poor* – Little or no recognition is given to specific profession/industry standards in planning and evaluating this program.							
7. Use of Student Follow-Up Information *Excellent* – Current follow-up data on completers and leavers (students with marketable skills) are consistently and systematically used in evaluating this program. *Poor* – Student follow-up information has not been collected for use in evaluating this program.							
PROCESSES 8. Adaptation of Instruction *Excellent* – Instruction in all courses required for this program recognizes and responds to individual student interests, learning styles, skills, and abilities through a variety of instructional methods (such as small group or individualized instruction, laboratory or "hands-on" experiences, open entry/open exit, credit by examination). *Poor* – Instructional approaches in this program do not consider individual student differences.							
9. Relevance of Supportive Courses *Excellent* – Applicable support courses (such as mathematics, physical science, or English) are closely coordinated with this program, and are kept relevant to program goals and current to the needs of students. *Poor* – Supportive course content reflects no planned approach to meeting needs of students in this program.							

		Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
10.	Coordination with Other Community Agencies and Educational Programs *Excellent* – Effective liaison is maintained with other programs and educational agencies and institutions (such as high schools, other community colleges, four year colleges) to assure a coordinated approach and to avoid duplication in meeting occupational needs of the area or community. *Poor* – College activities reflect a disinterest in coordination with other programs and agencies having impact on this program.							
11.	Program Availability and Accessibility *Excellent* – Students and potential students desiring enrollment in this program are identified through recruitment activities, treated equally in enrollment selection, and not discouraged by unrealistic prerequisites. The program is readily available and accessible at convenient times and locations. *Poor* – This program is not available or accessible to most students seeking enrollment. Discriminatory selection procedures are practiced.							
12.	Provision for the Disadvantaged *Excellent* – Support services are provided for disadvantaged (such as socioeconomic, cultural, linguistic, academic) students enrolled in this program. Services are coordinated with occupational instruction and results are assessed continuously. *Poor* – No support services are provided for disadvantaged students enrolled in this program.							
13.	Provision for the Handicapped *Excellent* – Support services are provided for handicapped (physical, mental, emotional, and other health impairing handicaps) students enrolled in this program. Facilities and equipment adaptations are made as needed. Services and facilities modifications are coordinated with occupational instruction and results are assessed continuously. *Poor* – No support services or facilities and equipment modifications are available for handicapped students enrolled in this program.							
14.	Efforts to Achieve Gender Equity *Excellent* – Emphasis is given to eliminating sex bias and sex stereotyping in this program: staffing, student recruitment, program advisement, and career counseling; access to and acceptance in programs; selection of curricular materials; instruction; job development and placement. *Poor* – Almost no attention is directed toward achieving sex equity in this program.							

	Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
15. Provision for Program Advisement *Excellent* – Instructors or other qualified personnel advise students (day, evening, weekend) on program and course selection. Registration procedures facilitate course selection and sequencing. *Poor* – Instructors make no provision for advising students on course and program selection.							
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18. Provision for Employability Information *Excellent* – This program includes information which is valuable to students as employees (on such topics as employment opportunities and future potential, starting salary, benefits, responsibilities and rights). *Poor* – almost no emphasis is placed on providing information important to students as employees.							
19. Placement Effectiveness for Students in this Program *Excellent* – The college has an effectively functioning system for locating jobs and coordinating placement for students in this program. *Poor* – The college has no system or an ineffective system for locating jobs and coordinating placement for occupational students enrolled in this program.							
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RESOURCES 22. Provision for Leadership and Coordination *Excellent* – Responsibility, authority, and accountability for this program are clearly identified and assigned. Administrative effectiveness is achieved in planning, managing, and evaluating this program. *Poor* – There are no clearly defined lines of responsibility, authority, and accountability for this program.							
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36. Provisions in Current Operating Budget *Excellent* – Adequate funds are allocated in the college operating budget to support achievement of approved program objectives. Allocations are planned to consider instructor budget input. *Poor* – Funds provided are seriously inadequate in relation to approved objectives for this program.							
37. Provisions in Capital Outlay Budget for Equipment *Excellent* – Funds are allocated in a planned effort to provide for needed new equipment and for equipment replacement and repair, consistent with the objectives for this program, and based on instructor input. *Poor* – Equipment needs in this program are almost totally unmet in the capital outlay budget.							

FACULTY PERCEPTIONS OF PROGRAMS

Please answer the following: (use back of page and extra sheets if necessary).

1. What are the chief strengths of your program?

2. What are the major needs for improvement in your program, and what action is required to achieve these improvements?

3. Is/are there any area(s) which were not covered by the survey instrument that you would like to comment on?

SURVEYING TECHNOLOGY
FACULTY PERCEPTIONS

INSTRUCTIONS TO RESPONDENTS

On the following pages , you are asked to give your perceptions of your occupational program (such as registered nursing, automotive technology, secretarial science). The items you are asked to rate are grouped into the major components of the Program Review in Occupational Education (PROE) system, namely:

- Goals
- Processes
- Resources

Rate each item by checking your best judgment on a five point scale ranging from poor to excellent. Only check one answer per item. A "Don't Know" column has been provided in the event you really don't have sufficient information to rate an item. Space has been provided for you to note comments that may help to clarify your rating or to indicate modifications of a standard to make it more relevant for your program.

Criteria for excellent and poor ratings are provided for each item. *Excellent* represents a nearly ideal or exemplary situation; *poor*, one of serious inadequacy. As a guide, ratings may be made with the following in mind:

EXCELLENT means ideal, top 5 to 10%
GOOD is a strong rating, top 1/3
ACCEPTABLE is average, the middle 1/3
BELOW EXPECTATIONS is only fair, bottom 1/3
POOR is seriously inadequate, bottom 5 to 10%

	Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
GOALS AND OBJECTIVES							
1. Participation in Development of the Curriculum *Excellent* – Administrators and/or other supervisory personnel involved in developing and revising the curriculum for this program, seek and respond to faculty, student, and community input. *Poor* – Development of the plan for this program in basically the work of one or two persons in the college.			3.00				
2. Program Goals *Excellent* – Written goals for this program state realistic outcomes (such as recruiting, retention, placements, licensing pass rate) and are used as one measure of program effectiveness. *Poor* – No written goals exist for this program.			3.33				
3. Course Objectives *Excellent* – Written measurable objectives have been developed for all courses in this program and are used to plan and organize instruction. *Poor* – No written objectives have been developed for courses in this program.			3.67				

	Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
4. Use of Information on Labor Market Needs *Excellent* – Current data on labor market needs and emerging trends in job openings are systematically used in developing and evaluating this program. *Poor* – Labor market data is not used in planning or evaluation.			★ 3.33				
5. Use of Information on Job Performance Requirements *Excellent* – Current data on job performance requirements and trends are systematically used in developing and evaluating this program and content of its courses. *Poor* – Job performance requirements information has not been collected for use in planning and evaluating.			★ 3.00				
6. Use of Profession/Industry Standards *Excellent* – Profession/industry standards (such as licensing, certification, accreditation) are consistently used in planning and evaluaing this program and content of its courses. *Poor* – Little or no recognition is given to specific profession/industry standards in planning and evaluating this program.			★ 3.33				
7. Use of Student Follow-Up Information *Excellent* – Current follow-up data on completers and leavers (students with marketable skills) are consistently and systematically used in evaluating this program. *Poor* – Student follow-up information has not been collected for use in evaluating this program.			★ 3.33				
PROCESSES **8.** Adaptation of Instruction *Excellent* – Instruction in all courses required for this program recognizes and responds to individual student interests, learning styles, skills, and abilities through a variety of instructional methods (such as small group or individualized instruction, laboratory or "hands-on" experiences, open entry/open exit, credit by examination). *Poor* – Instructional approaches in this program do not consider individual student differences.			★ 3.33				
9. Relevance of Supportive Courses *Excellent* – Applicable support courses (such as mathematics, physical science, or English) are closely coordinated with this program, and are kept relevant to program goals and current to the needs of students. *Poor* – Supportive course content reflects no planned approach to meeting needs of students in this program.				★ 4.00			

		Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
10.	Coordination with Other Community Agencies and Educational Programs *Excellent* – Effective liaison is maintained with other programs and educational agencies and institutions (such as high schools, other community colleges, four year colleges) to assure a coordinated approach and to avoid duplication in meeting occupational needs of the area or community. *Poor* – College activities reflect a disinterest in coordination with other programs and agencies having impact on this program.		2.67					
11.	Program Availability and Accessibility *Excellent* – Students and potential students desiring enrollment in this program are identified through recruitment activities, treated equally in enrollment selection, and not discouraged by unrealistic prerequisites. The program is readily available and accessible at convenient times and locations. *Poor* – This program is not available or accessible to most students seeking enrollment. Discriminatory selection procedures are practiced.				4.00			
12.	Provision for the Disadvantaged *Excellent* – Support services are provided for disadvantaged (such as socioeconomic, cultural, linguistic, academic) students enrolled in this program. Services are coordinated with occupational instruction and results are assessed continuously. *Poor* – No support services are provided for disadvantaged students enrolled in this program.		2.67					
13.	Provision for the Handicapped *Excellent* – Support services are provided for handicapped (physical, mental, emotional, and other health impairing handicaps) students enrolled in this program. Facilities and equipment adaptations are made as needed. Services and facilities modifications are coordinated with occupational instruction and results are assessed continuously. *Poor* – No support services or facilities and equipment modifications are available for handicapped students enrolled in this program.		2.67					
14.	Efforts to Achieve Gender Equity *Excellent* – Emphasis is given to eliminating sex bias and sex stereotyping in this program: staffing, student recruitment, program advisement, and career counseling; access to and acceptance in programs; selection of curricular materials; instruction; job development and placement. *Poor* – Almost no attention is directed toward achieving sex equity in this program.			3.00				

	Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
15. Provision for Program Advisement *Excellent* – Instructors or other qualified personnel advise students (day, evening, weekend) on program and course selection. Registration procedures facilitate course selection and sequencing. *Poor* – Instructors make no provision for advising students on course and program selection.				4.00			
16. Provision for Career Planning and Guidance *Excellent* – Day, evening, and weekend students in this program have ready access to career planning and guidance services. *Poor* – Little or no provision is made for career planning and guidance services for students enrolled in this program.			3.33				
17. Adequacy of Career Planning and Guidance *Excellent* – Instructors or other qualified personnel providing career planning and guidance services have current and relevant occupational knowledge and use a variety of resources (such as printed materials, audiovisuals, job observation) to meet individual student career objectives. *Poor* – Career planning and guidance services are ineffective and staffed with personnel who have little occupational knowledge.			3.67				
18. Provision for Employability Information *Excellent* – This program includes information which is valuable to students as employees (on such topics as employment opportunities and future potential, starting salary, benefits, responsibilities and rights). *Poor* – almost no emphasis is placed on providing information important to students as employees.					5.00		
19. Placement Effectiveness for Students in this Program *Excellent* – The college has an effectively functioning system for locating jobs and coordinating placement for students in this program. *Poor* – The college has no system or an ineffective system for locating jobs and coordinating placement for occupational students enrolled in this program.				4.67			
20. Student Follow-Up System *Excellent* – Success and failure of program leavers and completers are assessed through periodic follow-up studies. Information learned is made available to instructors, students, advisory committee members, and others concerned (such as counselors) and is used to modify this program. *Poor* – No effort is made to follow up former students of this program.

	Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
21. Promotion of this Occupational Program *Excellent* – An active and organized effort is made to inform the public and its representatives (such as news media, legislators, board, business community) of the importance of providing effective and comprehensive occupational education, and specific training for this occupation to gain community support. *Poor* – There is no organized public information effort for this program.		2.67					
RESOURCES 22. Provision for Leadership and Coordination *Excellent* – Responsibility, authority, and accountability for this program are clearly identified and assigned. Administrative effectiveness is achieved in planning, managing, and evaluating this program. *Poor* – There are no clearly defined lines of responsibility, authority, and accountability for this program.			3.00				
23. Qualifications of Administrators and/or Supervisors *Excellent* – All persons responsible for directing and coordinating this program demonstrate a high level of administrative ability. They are knowledgeable in and committed to occupational education. *Poor* – Persons responsible for directing and coordinating this program have little administrative training, education, and experience.			3.33				
24. Instructional Staffing *Excellent* – Instructional staffing for this program is sufficient to permit optimum program effectiveness (such as through enabling instructors to meet individual student needs, providing liaison with advisory committees, and assisting with placement and follow-up activities). *Poor* – Staffing is inadequate to meet the needs of this program effectively.		2.00					
25. Qualifications of Instructional Staff *Excellent* – Instructors in this program have two or more years in relevant employment experience, have kept current in their field, and have developed and maintained a high level of teaching competence. *Poor* – Few instructors in this program have relevant employment experience or current competence in their field.				4.33			
26. Professional Development Opportunities *Excellent* – The college encourages and supports the continuing professional development of faculty through such opportunities as conference attendance, curriculum development, work experience. *Poor* – The college does not encourage or support professional development of faculty.		2.33					

	Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
27. **Use of Instructional Support Staff** *Excellent* – Paraprofessionals (such as aides, laboratory assistants) are used when appropriate to provide classroom help to students and to ensure maximum effectiveness of instructors in the program. *Poor* – Little use is made of instructional support staff in this program.	★ 1.67						
28. **Use of Clerical Support Staff** *Excellent* – Office and clerical assistance is available to instructors in this program and used to ensure maximum effectiveness of instructors. *Poor* – Little or no office and clerical assistance is available to instructors; ineffective use is made of clerical support staff.	★ 1.67						
29. **Adequacy and Availability of Instructional Equipment** *Excellent* – Equipment used on or off campus for this program is current, representative of that used on jobs for which students are being trained, and in sufficient supply to meet the needs of students. *Poor* – Equipment for this program is outmoded and in insufficient quantity to support quality instruction.			★ 3.33				
30. **Maintenance and Safety of Instructional Equipment** *Excellent* – Equipment used for this program is operational, safe, and well maintained. *Poor* – Equipment used for this program is often not operable and is unsafe.			★ 3.67				
31. **Adequacy of Instructional Facilities** *Excellent* – Instructional facilities (excluding equipment) meet the program objectives and student needs, are functional, and provide maximum flexibility and safe working conditions. *Poor* – Facilities for this program generally are restrictive, dysfunctional, or overcrowded.			★ 3.33				
32. **Scheduling of Instructional Facilities** *Excellent* – Scheduling of facilities and equipment for this program is planned to maximize use and be consistent with quality instruction. *Poor* – Facilities and equipment for this program are significantly under- or over-scheduled.				★ 4.00			
33. **Adequacy and Availability of Instructional Materials and Supplies** *Excellent* – Instructional materials and supplies are readily available and in sufficient quantity to support quality instruction. *Poor* – Materials and supplies in this program are limited in amount, generally outdated, and lack relevance to program and student needs.			★ 3.67				

	Poor 1	Below Expectations 2	Acceptable 3	Good 4	Excellent 5	Don't Know	Comments
34. Adequacy and Availability of Learning Resources *Excellent* – Learning resources for this program are available and accessible to students, current and relevant to the occupation, and selected to avoid sex bias and stereotyping. *Poor* – Learning resources for this program are outdated, limited in quantity, and lack of relevance to the occupation.	1.67						
35. Use of Advisory Committee *Excellent* – The advisory committee for this program is active and representative of the occupation. *Poor* – The advisory committee for this program is not representative of the occupation and rarely meets.			3.67				
36. Provisions in Current Operating Budget *Excellent* – Adequate funds are allocated in the college operating budget to support achievement of approved program objectives. Allocations are planned to consider instructor budget input. *Poor* – Funds provided are seriously inadequate in relation to approved objectives for this program.	1.00						
37. Provisions in Capital Outlay Budget for Equipment *Excellent* – Funds are allocated in a planned effort to provide for needed new equipment and for equipment replacement and repair, consistent with the objectives for this program, and based on instructor input. *Poor* – Equipment needs in this program are almost totally unmet in the capital outlay budget.	1.00						

UNIT MEANS:

GOALS AND OBJECTIVES: 3.28

PROCESSES: 3.50

RESOURCES: 2.73

OVERALL MEAN: 3.13

FACULTY PERCEPTIONS OF PROGRAMS

Please answer the following: (use back of page and extra sheets if necessary).

1. What are the chief strengths of your program?

2. What are the major needs for improvement in your program, and what action is required to achieve these improvements?

3. Is/are there any area(s) which were not covered by the survey instrument that you would like to comment on?

Surveying Technology

Responses to Open-Ended Questions

Please answer the following:

1. **What are the chief strengths of your program?**

   "Faculty are generally dedicated and work hard in providing good educational experiences to students."
   "Excellent program which satisfies the demands of the industry"
   "100% Placement"
   "High Demand"
   "See comment on surveying Engineering"
   Comment from Recently Retired Faculty Member:
   "The chief strength lies in a dedicated faculty that appreciate the need for an academically rigorous curriculum. The program is fortunate that dedicated and mature students seek surveying education. Few such programs exist in the U.S., therefore there is a high demand for the Ferris program."

2. **What are the major needs for improvement in your program, and what action is required to achieve these improvements?**

   "The Surveying Technology program has little support. Decisions in programming of curricular issues and acquisition of equipment are based on the BS Surveying program. There is no faculty advocate to speak to the unique needs of this program. The surveying Technology program is basically a holding platform for students who want to enter the Surveying Engineering program but are deficient (usually based on mathematics) in the prerequisites. If this program is to thrive, it needs an advocate who will look after its needs."
   "Needs to .....(unreadable)"
   Comment from Recently Retired Faculty Member:
   "Definitely a recognition , or respect, for the value of this program by upper levels of the Ferris administration. There seems to be a lack of care (or respect) for the academic and professional value of this program. Classes are too populated, budget cut, occurs every and each year."

3. **Is/are there any area(s) which were not covered by the survey instrument that you would like to comment on?**

Advisory Committee Survey Data F

January 25, 2000

Dear Advisory committee Member:

Enclosed are two surveys: for AAS degree in surveying Technology and for surveying engineering degree. These questionnaires were specifically developed for the two different degrees to be filled in by the advisory committee members of the Surveying Program at Ferris State University. We are conducting this survey as part of the routine program evaluation process developed by the university. This kind of survey helps us to determine the effectiveness of our curriculum.

Please complete both questionnaires and mail them back to us in the enclosed envelope. Your input is important in keeping our curriculum up-to-date. We greatly appreciate your service and the contributions to the program and to the profession.

We would appreciate it if you could take a few minutes from your busy schedule and complete the survey **TODAY**.

Thank you very much for your time.

Sincerely,

K. Thapa, Ph. D.
Professor and Surveying Engineering Program Coordinator.

FERRIS STATE UNIVERSITY

SURVEYING ENGINEERING

ADVISORY COMMITTEE SURVEY

This survey is designed to assist the Surveying Engineering Program at Ferris State University in its routine review of the curriculum.

Please circle the appropriate response, with a score of "5" as strongly agree, and "1" as strongly disagree. If a question is not applicable, or you don't know the answer, please respond "N/A".

		STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE	N/A
1.	The program provides the knowledge and expertise needed by the profession.	5	4	3	2	1	N/A
2.	There is a high demand for students from this program.	5	4	3	2	1	N/A
3.	Your company would hire a student from this program.	5	4	3	2	1	N/A
4.	The program has played vital role in the profession by producing competent graduates.	5	4	3	2	1	N/A
5.	The program has sufficient physical facilities such as computers and survey equipment.	5	4	3	2	1	N/A
6.	The program's curriculum meets the needs of the profession.	5	4	3	2	1	N/A
7.	The program has an adequate number of full time tenure-track faculty.	5	4	3	2	1	N/A
8.	The program's faculty have adequate academic credentials and experience.	5	4	3	2	1	N/A
9.	The program's faculty are given enough financial support to engage in professional development and continuing education.	5	4	3	2	1	N/A
10.	The graduates of the program are technically prepared to go to work.	5	4	3	2	1	N/A
11.	The graduates of the program are prepared to competitive with graduates of similar programs.	5	4	3	2	1	N/A
12.	The program receives adequate financial support from the university.	5	4	3	2	1	N/A
13.	Surveying Engineering Program should expand its curricula to include GIS option.	5	4	3	2	1	N/A
14.	Surveying Engineering Program should expand its curricula to include business option.	5	4	3	2	1	N/A
15.	Are there any other areas not included in the survey you would like to comment?						

Thank you for participating in our survey

FERRIS STATE UNIVERSITY

SURVEYING TECHNOLOGY

ADVISORY COMMITTEE SURVEY

This survey is designed to assist the Surveying Engineering Program at Ferris State University in its routine review of the curriculum.

Please circle the appropriate response, with a score of "5" as strongly agree, and "1" as strongly disagree. If a question is not applicable, or you don't know the answer, please respond "N/A".

		STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE	N/A
1.	The program provides the knowledge and expertise needed by a technician.	5	4	3	2	1	N/A
2.	There is a high demand for students from this program.	5	4	3	2	1	N/A
3.	Your company would hire a student from this program.	5	4	3	2	1	N/A
4.	The program has played vital role in the profession by producing competent survey technicians.	5	4	3	2	1	N/A
5.	The program has sufficient physical facilities such as computers and survey equipment.	5	4	3	2	1	N/A
6.	The program's curriculum meets the needs of the profession.	5	4	3	2	1	N/A
7.	The program has an adequate number of full time tenure-track faculty.	5	4	3	2	1	N/A
8.	The program's faculty have adequate academic credentials and experience.	5	4	3	2	1	N/A
9.	The program's faculty are given enough financial support to engage in professional development and continuing education.	5	4	3	2	1	N/A
10.	The graduates of the program are technically prepared to go to work.	5	4	3	2	1	N/A
11.	The graduates of the program are prepared to competitive with graduates of similar programs.	5	4	3	2	1	N/A
12.	The program receives adequate financial support from the university.	5	4	3	2	1	N/A
13.	Are there any other areas not included in the survey you would like to comment?						

Thank you for participating in our survey

FERRIS STATE UNIVERSITY

SURVEYING ENGINEERING

ADVISORY COMMITTEE SURVEY (Raw Scores)

This survey is designed to assist the Surveying Engineering Program at Ferris State University in its routine review of the curriculum.

Please circle the appropriate response, with a score of "5" as strongly agree, and "1" as strongly disagree. If a question is not applicable, or you don't know the answer, please respond "N/A".

		STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE	N/A
1.	The program provides the knowledge and expertise needed by the profession.	2	4				N/A
2.	There is a high demand for students from this program.	6					N/A
3.	Your company would hire a student from this program.	4	1				1
4.	The program has played vital role in the profession by producing competent graduates.	6					N/A
5.	The program has sufficient physical facilities such as computers and survey equipment.	2	3		1		N/A
6.	The program's curriculum meets the needs of the profession.	1	4	1			N/A
7.	The program has an adequate number of full time tenure-track faculty.		3	3	2		N/A
8.	The program's faculty have adequate academic credentials and experience.	2	4				N/A
9.	The program's faculty are given enough financial support to engage in professional development and continuing education.		2	2			2
10.	The graduates of the program are technically prepared to go to work.	3	3				N/A
11.	The graduates of the program are prepared to competitive with graduates of similar programs.	4	2				N/A
12.	The program receives adequate financial support from the university.		1	2	2		1
13.	Surveying Engineering Program should expand its curricula to include GIS option.	2	2	1	1		N/A
14.	Surveying Engineering Program should expand its curricula to include business option.	3	2		1		N/A
15.	Are there any other areas not included in the survey you would like to comment?						

Thank you for participating in our survey

FERRIS STATE UNIVERSITY

SURVEYING ENGINEERING

ADVISORY COMMITTEE SURVEY (Percentage)

This survey is designed to assist the Surveying Engineering Program at Ferris State University in its routine review of the curriculum.

Please circle the appropriate response, with a score of "5" as strongly agree, and "1" as strongly disagree. If a question is not applicable, or you don't know the answer, please respond "N/A".

		STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE	N/A
1.	The program provides the knowledge and expertise needed by the profession.	33%	67%				N/A
2.	There is a high demand for students from this program.	100%					N/A
3.	Your company would hire a student from this program.	67%	17%				16
4.	The program has played vital role in the profession by producing competent graduates.	100%					N/A
5.	The program has sufficient physical facilities such as computers and survey equipment.	33%	50%		17%		N/A
6.	The program's curriculum meets the needs of the profession.	17%	67%	17%			N/A
7.	The program has an adequate number of full time tenure-track faculty.		33%	33%	34%		N/A
8.	The program's faculty have adequate academic credentials and experience.	33%	67%				N/A
9.	The program's faculty are given enough financial support to engage in professional development and continuing education.		33%	34%			33 %
10.	The graduates of the program are technically prepared to go to work.	50%	50%				N/A
11.	The graduates of the program are prepared to competitive with graduates of similar programs.	67%	33%				N/A
12.	The program receives adequate financial support from the university.		17%	33%	33%		17 %
13.	Surveying Engineering Program should expand its curricula to include GIS option.	33%	33%	17%	17%		N/A
14.	Surveying Engineering Program should expand its curricula to include business option.	50%	33%		17%		N/A
15.	Are there any other areas not included in the survey you would like to comment?						

Thank you for participating in our survey

FERRIS STATE UNIVERSITY

SURVEYING TECHNOLOGY

ADVISORY COMMITTEE SURVEY (Raw Scores)

This survey is designed to assist the Surveying Engineering Program at Ferris State University in its routine review of the curriculum.

Please circle the appropriate response, with a score of "5" as strongly agree, and "1" as strongly disagree. If a question is not applicable, or you don't know the answer, please respond "N/A".

		STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE	N/A
1.	The program provides the knowledge and expertise needed by a technician.	1	5	1			
2.	There is a high demand for students from this program.	6	1				
3.	Your company would hire a student from this program.	5	1				1
4.	The program has played vital role in the profession by producing competent survey technicians.	4	2	1			
5.	The program has sufficient physical facilities such as computers and survey equipment.	2	2	2	1		
6.	The program's curriculum meets the needs of the profession.	1	5	1			
7.	The program has an adequate number of full time tenure-track faculty.	2	2	1	2		
8.	The program's faculty have adequate academic credentials and experience.	4	3				
9.	The program's faculty are given enough financial support to engage in professional development and continuing education.		2	4			1
10.	The graduates of the program are technically prepared to go to work.	3	4				
11.	The graduates of the program are prepared to be competitive with graduates of similar programs.	3	4				
12.	The program receives adequate financial support from the university.		1	2	3		1
13.	Are there any other areas not included in the survey you would like to comment?						

Thank you for participating in our survey

FERRIS STATE UNIVERSITY

SURVEYING TECHNOLOGY

ADVISORY COMMITTEE SURVEY (Percentage)

This survey is designed to assist the Surveying Engineering Program at Ferris State University in its routine review of the curriculum.

Please circle the appropriate response, with a score of "5" as strongly agree, and "1" as strongly disagree. If a question is not applicable, or you don't know the answer, please respond "N/A".

		STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE	N/A
1.	The program provides the knowledge and expertise needed by a technician.	15%	71%	14%			
2.	There is a high demand for students from this program.	86%	14%				
3.	Your company would hire a student from this program.	71%	15%				14 %
4.	The program has played vital role in the profession by producing competent survey technicians.	57%	28%	15%			
5.	The program has sufficient physical facilities such as computers and survey equipment.	28%	28%	28%	16%		
6.	The program's curriculum meets the needs of the profession.	15%	71%	14%			
7.	The program has an adequate number of full time tenure-track faculty.	28%	28%	16%	28%		
8.	The program's faculty have adequate academic credentials and experience.	57%	43%				
9.	The program's faculty are given enough financial support to engage in professional development and continuing education.		28%	57%			15 %
10.	The graduates of the program are technically prepared to go to work.	43%	57%				
11.	The graduates of the program are prepared to be competitive with graduates of similar programs.	43%	57%				
12.	The program receives adequate financial support from the university.		14%	28%	43%		15 %
13.	Are there any other areas not included in the survey you would like to comment?						

Thank you for participating in our survey

Advisory Survey Comments

Surveying Engineering

Need to emphasize ETHICS & COMMUNICATION

- #10 Employers should be advised that graduates need a mentoring program and students should be told to seek out employers who will give them an opportunity to get a broad experience record. Employers should not expect that a graduate can step into a surveying position immediately. But needs to be given an experience background that will enable the student to apply the technical skills he/she has learned at the university.

Surveying Technology

Business needs to be incorporated in the program

I am not fully knowledgeable of the Technology Program. But there is a real need for graduates of this program. I highly recommend that the university persue development of the program and encourage employers to support the graduates.

Program Check Sheets G

SURVEYING ENGINEERING
BACHELOR OF SCIENCE DEGREE
FALL SEMESTER
Curriculum Guide Sheet

NAME OF STUDENT____________________ STUDENT I.D.________________

Total semester hours required for graduation: 137

NOTE: Meeting requirements for graduation indicated on this sheet is the responsibility of the student. Compliance with this agreement will assure the student completion of the program in the time frame indicated. Your advisor is available to assist you.

FIRST YEAR - FALL SEMESTER			CREDITS/GRADE
SURE	110	Fundamentals of Surveying (MATH 120)	4 ______
MATH	130	College Algebra (MATH 120)	4 ______
ENGL	150	English 1	3 ______
SURE	115	Introduction of Computer Mapping OR SURE 116 Intro to Microstation	2 ______
______	____	Cultural Enrichment Elective**	3 ______
			(16)

FIRST YEAR - WINTER SEMESTER			
SURE	116	Introduction to Microstation OR SURE 115 Intro of Computer Mapping	2 ______
MATH	220	Analytical Geometry & Calculus 1 (MATH 130)	5 ______
CONM	121	Materials Properties & Testing (MATH 116 or 120) OR SURE 215 Surveying Computations (SURE 110)	3 ______
CHEM	121	General Chemistry (CHEM 103, MATH 115)	5 ______
ENGL	250	English 2 (ENGL 150)	3 ______
			(18)

SECOND YEAR - FALL SEMESTER			
SURE	220	Engineering Surveying (SURE 110) OR SURE 230 Advanced Surveying (SURE 110, 115)	4 ______
SURE	215	Surveying Computations (SURE 110) OR CONM 121 Mat'ls Properties & Testing (MATH 116 or 120)	3 ______
MATH	230	Analytical Geometry & Calculus 2 (MATH 220)	5 ______
PHYS	241	General Physics 1 (MATH 220 C or better)	5 ______
			(17)

SECOND YEAR - WINTER SEMESTER			
SURE	230	Advanced Surveying (SURE 110, SURE 115) OR SURE 220 Engineering Surveying (SURE 110)	4 ______
SURE	272	Geomatics Computations (SURE 215, MATH 130)	3 ______
PHYS	242	General Physics 2 (PHYS 241, MATH 230 C or better)	5 ______
CONM	221	Stat. and Strength of Matl. (MATH 130/126, PHYS 241/211)	3 ______
BLAW	221	Elementary Business Law	3 ______
			(18)

SURVEYING ENGINEERING
BACHELOR OF SCIENCE DEGREE
Curriculum Guide Sheet

THIRD YEAR - FALL SEMESTER			CREDIT/GRADE
SURE	365	Legal Aspects of Surveying 1* (SURE 110)	3______
SURE	372	Advanced Surv. Comp. (SURE 230, MATH 230, SURE 272)	3______
SURE	329	Modern Cartography	3______
		OR	
SURE	339	Remote Sensing (PHYS 241/242)	3______
GEOL	131	Geology and Land-Use Management	3______
COMM	121	Fundamentals of Public Speaking	3______
______	___	Social Awareness Elective***	3______
			(18)
THIRD YEAR - WINTER SEMESTER			
SURE	340	Photogrammetry (SURE 110)	3______
SURE	325	Principles of GIS	3______
SURE	373	Adjustment Computations (SURE 372, SURE 272)	3______
SURE	452	Geodesy 1 (SURE 230, SURE 272, SURE 372)	4______
SURE	331/HUMN 331	Ethics & Professionalism in Engineering & Technology	3______
			(16)
FOURTH YEAR - FALL SEMESTER			
SURE	453	Geodesy 2 (SURE 373, SURE 452)	4______
SURE	425	Technical Issues in GIS (SURE 325)	3______
SURE	440	Analytical Photogrammetry (SURE 340, SURE 373)	3______
SURE	420	Prof. Practice of Surveying 2* (SURE 230)	3______
______	___	Cultural Enrichment Elective**	3______
			(16)
FOURTH YEAR - WINTER SEMESTER			
SURE	421	Soils Engineering (CONM 121, MATH 220)	4______
SURE	321	Hydraulics Engineering (PHYS 242, MATH 230)	4______
SURE	465	Legal Aspects of Surveying 2* (SURE 365, SURE 215)	4______
SURE	435	The Urban Environment (Senior Standing)	3______
______	___	Social Awareness Elective***	3______
			(18)

The student is responsible for meeting all FSU General Education requirements, including global consciousness and race/ethnicity and/or gender, as outlined in the current university catalog. The upper level communications competence requirement will be fulfilled by completing SURE 365, SURE 420 and SURE 465 which are Writing Intensive Courses.

*Writing Intensive Courses

** Must be in at least two different subject areas, at least one course must be a 200 level or higher, and no more than 5 credits in music activities courses.

***Must be in at least two different subject areas, one Social Awareness Foundations Course, one course dealing with issues of race/ethnicity and/or gender, and one course at the 300 level or higher.

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FERRIS STATE UNIVERSITY
COLLEGE OF TECHNOLOGY

SURVEYING TECHNOLOGY
ASSOCIATE IN APPLIED SCIENCE DEGREE
Curriculum Program Guide

NAME OF STUDENT____________________ STUDENT I.D. __________

Total hours required for graduation: 60 semester hours

Meeting the requirements for graduation indicated on this sheet is the responsibility of the student. Compliance with this agreement will assure the student completion of the program in the time frame indicated. Your advisor is available to assist you.

FIRST YEAR - FALL SEMESTER			CREDITS	COMMENTS/GRADE
MATH	115	Intermediate Algebra	3	
ENGL	150	English I	3	
SURE	115	Introduction to Computer Mapping	2	
____	___	Cultural Enrichment Elective	3	
____	___	Social Awareness Elective	3	
			(14)	
FIRST YEAR - WINTER SEMESTER				
SURE	110	Fundamentals of Surveying (MATH 120 or 116)	4	
CONM	121	Material Properties & Testing (MATH 120 or 116)	3	
SURE	116	Introduction to Microstation	2	
MATH	120	Trigonometry (MATH 115)	3	
ENGL	211	Industrial and Career Writing (ENGL 150)	3	
			(15)	
SECOND YEAR - FALL SEMESTER				
SURE	215	Surveying Computation (SURE 110)	3	
SURE	220	Engineering Surveying (SURE 110)	4	
SURE	365	Legal Aspects of Surveying I (SURE 110)	3	
MATH	130	Advanced Algebra and Analytical Trigonometry (MATH 120)	4	
BLAW	221	Elementary Business Law	3	
			(17)	
SECOND YEAR - WINTER SEMESTER				
SURE	230	Advanced Surveying (SURE 110, SURE 115)	4	
____	___	Technical Elective*	3	
CONM	212	Soils and Foundations	3	
PHYS	211	Introductory Physics (MATH 115)	4	
			(14)	

NOTE: Some of the courses may not transfer to the Baccalaureate program in Sureveying Engineering. For further details, consult your advisor.

*SURE 325, SURE 329, SURE 339, or SURE 340

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FERRIS STATE UNIVERSITY
COLLEGE OF TECHNOLOGY

CURRICULUM REQUIREMENTS
SURVEYING TECHNOLOGY
ASSOCIATE IN APPLIED SCIENCE DEGREE
FALL SEMESTER

TECHNICAL			CREDIT HOURS
SURE	110	Fund. of Surveying	4
SURE	115	Intro to Computer Mapping	2
SURE	116	Intro to Microstation	2
SURE	215	Surveying Computation	3
SURE	220	Engineering Surveying	4
SURE	230	Advanced Surveying	4
SURE	365	Legal Aspects of Surveying I	3
Technical Elective			3
Related			
BLAW	221	Elementary Business Law	3
CONM	121	Material Properties & Testing	3
CONM	212	Soils and Foundations	3

GENERAL EDUCATION			CREDIT HOURS
Communication Competence			
ENGL	150	English I	3
ENGL	211	Industrial & Career Writing	3
Scientific Understanding			
PHYS	211	Intro Physics	4
Quantitative Skills			
MATH	115	Intermediate Algebra	3
MATH	120	Trigonometry	3
MATH	130	Adv. Algebra & Anal. Trig	4
Cultural Enrichment			
Elective			3
Social Awareness			
Elective			3

A.A.S. Degre Minimum General Educational Requirements in Semester Hours:

Cultural Enrichment Credits - 3 | Social Awareness Credits - 3
Communications Credits - 6 | Scientific Understanding Credits - 3-4

10/99
pm/cksh99f/surt

(OVER)

Report from ABET H

ACCREDITATION BOARD FOR ENGINEERING AND TECHNOLOGY, INC.

Engineering Accreditation Commission
Technology Accreditation Commission
Related Accreditation Commission

Daniel B. Hodge, Ph.D., P.E.
Accreditation Director

August 15, 2000

George P. Waldheim
Dean
College of Technology
Ferris State University
Johnson Hall 200, 1009 Campus Drive
Big Rapids MI 49307

Dear Dr. Waldheim:

The Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET) recently held its 2000 Summer Meeting to act on the program evaluations conducted during the 1999-00 academic year. Each evaluation was summarized in a report to the Commission and was considered by the full Commission before a vote was taken on the accreditation action. The results of the evaluation for Ferris State University follow*:

Accredit to September 30, 2006. A request to ABET by January 31, 2005 will be required to initiate a reaccreditation evaluation visit. The reaccreditation evaluation will be a comprehensive general review.

Surveying Engineering b

The final statement to your institution that discusses the findings on which the action was based is enclosed.

The policy of ABET is to grant accreditation for a limited number of years, not to exceed six, in all cases. The period of accreditation is not an indication of program quality. Any restriction of the period of accreditation is based upon observed or reported conditions indicating that compliance with the applicable accreditation criteria must be strengthened. Continuation of accreditation beyond the time specified requires a reevaluation of the program at the request of the institution as noted in the accreditation action cited above. ABET policy prohibits disclosure of the period for which a program is accredited. For further guidance, please refer to the enclosed copy of ABET's Public Release Policy.

A list of accredited programs is published annually by ABET. In compliance with the regulations of the U.S. Department of Education, it is ABET policy to provide the Secretary of Education with the list of accredited programs and final accreditation actions. Information about ABET accredited programs at your institution will also be

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accreditation@abet.org • http://www.abet.org

continued

listed in the forthcoming ABET Accreditation Yearbook and on the ABET web site (www.abet.org).

It is the obligation of the officer responsible for ABET accredited programs at your institution to notify ABET of any significant changes in program title, personnel, curriculum, or other factors which could affect the accreditation status of a program during the period of accreditation.

Please note that appeals are allowed only in the case of *not to accredit* actions. Also, appeals may be based only on the conditions stated in the first paragraph of the enclosed Appeals Policy.

Sincerely,

Joseph L Sussman

Joseph L. Sussman, Chair
Engineering Accreditation Commission

Enclosures: Final Statement
Public Release Policy
Policy for Appeals, Reconsiderations and Immediate Revisits

cc: William A. Sederburg, President
Khagendra Thapa, Program Coordinator Surveying Engineering, College of Technology
William E. Murphy, Visit Team Chair

* The following codes identify the type of program accredited:

a -	associate degree program	d -	day program
b -	baccalaureate degree program	e -	evening program
m -	master's degree program, basic level	w -	weekend program
M -	master's degree program, advanced level	C -	co-op

Accreditation Board for Engineering and Technology
ENGINEERING ACCREDITATION COMMISSION

FERRIS STATE UNIVERSITY
Big Rapids, MI

FINAL STATEMENT
Evaluation under Engineering Criteria 2000
Dates of Visit: October 24-26, 1999

Introduction

The Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET) has evaluated the surveying engineering program of Ferris State University (FSU). The statement that follows consists of two parts: the first dealing with the overall institution and its engineering operation, and the second dealing with the program in surveying engineering.

Ferris State University has a long history of providing educational opportunities in technological areas, dating back to its founding in 1884 as an institute to train out-of-work lumberjacks. A large percentage of its graduates earn either associate or bachelor's degrees from the College of Technology. Many of its students are the first in their families to attend college or are in the process of changing careers. The administration and faculty of FSU have a clear understanding of the importance of education in improving the economic conditions of their students. They take considerable pride in turning out graduates that are in high demand in the work force.

While FSU has many engineering technology degree programs, its surveying engineering program is the only engineering program that is offered. There are no graduate programs in engineering on the campus. Consequently, there is less expectation for faculty research activity, and more is expected from their classroom effort than at campuses with graduate programs.

Campus support programs appeared to be very adequate.

Institutional Strengths

1. Since there is only one engineering program, it receives considerable attention from the university administration. Being a state institution without major research funding, its budget is very dependent on the state legislature. At the time of the visit, the good economy in Michigan resulted in stable and generally increasing campus budgets. University leadership appeared to be stable, with a new dean of technology just coming on board after an earlier dean retired. The new dean had been dean of technology colleges at two smaller schools, with 17 years as an industrial plant manager, and was being well received.

2. In recent years, there have been generally good relations between the union and the university. Faculty members at FSU belong to the union, so salaries are negotiated.

3. The FSU administration appears to view surveying engineering as one of the university's premier programs because it is their only engineering program. It is in a highly visible field, and its graduates are in extremely high demand nationwide. The previous accreditation visit in 1993 came at a time when a campus-restructuring plan was being developed. There was some concern about how such plans may impact the financial support for the surveying engineering program. The surveying engineering program came through those changes with its financial support intact.

4. A new state-of-the-art library presently under construction is scheduled for occupancy in 2001.

5. The campus Career Services office appeared to be particularly effective, resulting in virtually all surveying engineering students and graduates receiving summer and permanent jobs as their interests dictated.

Surveying Engineering
Program

Introduction

The College of Technology has more than 25 different degree programs in technology or management. The surveying engineering program is the only engineering program offered at FSU. There are five full-time tenure-track and one full-time adjunct faculty members in the Department of Surveying Engineering. All have at least a master's degree, and five of the six are licensed surveyors. There are 95 students in the program.

Surveying engineering is a relatively unique program, with fewer than a dozen accredited baccalaureate degree programs nationwide. However, it is a rapidly changing field as the introduction of global positioning systems and satellite mapping have added to the more traditional transit and tape surveys that are used with property transfers, roadways, and rights-of-way. The use of technology has particularly impacted this profession, as computerized surveying equipment now performs many of the calculations that were laboriously performed by hand just a couple of decades ago.

Program Strengths

1. Overall, the students in the FSU surveying engineering program had quite impressive credentials and were very career oriented. Many had opportunities to attend either the University of Michigan or Michigan State engineering programs, but chose to attend FSU either because of

the Surveying Engineering opportunities or for the small town environment. The students were proud of the program and highly complimentary of the faculty, staff, and facilities.

2. The program educational objectives are clearly stated in brochures sent to prospective students and on the university web page.

3. All requirements for mathematics, basic sciences, and humanities appeared to be adequately met. Ethical, social, and safety issues are integrated into the curriculum. The program conforms to all program criteria for surveying engineering.

4. The faculty members are highly qualified and most are active in their profession, with some holding positions with various state and national surveying organizations. Students gave high praise for faculty teaching performance.

5. Facilities for use by the surveying engineering students were generally impressive. A wide range of surveying tools was available for check out for class and lab assignments. These included traditional manual and optical instruments as well as computerized and laser instruments. Many of the more specialized items were on loan from equipment manufacturers and so had not been purchased by FSU. Such arrangements were usually made through relationships with various faculty members. Complex instruments for analyzing aerial surveys, i.e., photogrammetry, and other state-of-the-art surveying instruments were purchased with matching funds from NSF. In general, the program has been quite innovative in being able to keep current surveying instruments in the hands of the students and has done a good job in maintaining this equipment.

6. Overall, the institution was very supportive of the surveying engineering program within the limits of their state-supported budget

Program Concerns

A concern indicates that a criterion is currently satisfied; however, the potential exists for this situation to change in the near future such that the criterion may not be satisfied. Therefore, positive action is required to ensure continued full compliance with the criteria.

1. Criterion 2: Program Educational Objectives. The program outcomes and assessment plans appeared to be well thought out. However, they had only recently been implemented. The program has not yet "closed the loop" by demonstrating the use of results of ongoing evaluation to improve the effectiveness of the program. However, plans are in place and progress has been made in this area.

2. Criterion 3: Program Outcomes and Assessment. The planned frequency of surveys used to assess outcomes is a concern. More frequent surveys appear to be needed. There was little evidence of any changes that have been made as a result of earlier surveys.

- The due process response from the university indicated that the faculty had decided to conduct their surveys every two years. Such actions would resolve this concern.

3. Criterion 5: Faculty. There is concern about the number and potential stability of the faculty. While the teaching loads are high, they are consistent with other predominantly teaching institutions. Six faculty members are adequate to meet the program objectives. However, one

faculty position has been continuously filled by a full-time adjunct for the past five years. The department has had to arrange for a series of reappointments because of administrative time limits for temporary faculty.

- The due process response from the university indicated that the program has in place plans to convert the full-time temporary faculty position into a permanent tenure-track position, subject to allocation of resources within the university. A conversion of this faculty line would resolve this concern.

There was also concern about the qualifications of a part-time adjunct faculty hired to replace a faculty member on sabbatical leave. No information was provided about this person.

- In the 14-day response, the department indicated the institution at the time of the visit did not employ the faculty member. A copy of the resume was provided.

- This concern is resolved

4. Criterion 6. Facilities. The department has its own computer laboratory that all students use in their surveying courses. Some department computers are more than five years old and have been upgraded with new hard drives and zip drives, but are still only marginally capable of running some of the software needed by the students. In addition, system server malfunctions are apparently fairly common. There is also no departmental computer network analyst. Campus computer technicians can be slow in responding to such outages, sometimes resulting in

long delays where classes cannot continue or students are prevented from working on class assignments.

Program Observation

An observation is a comment or suggestion that does not relate directly to the criteria being used for evaluation but is offered to assist the institution in its continuing efforts to improve the program.

1. The degree of interest and involvement of faculty in professional activities appears to vary considerably. It was not determined whether this was a result of limited funding from the department and university or whether it was simply a result of a lack of personal interest.

Construction & Facilities Department

COLLEGE OF

TECHNOLOGY

Ferris State University

EXCELLENCE • HERITAGE • QUALITY • SERVICE • COMMITMENT

Self-Study for review of the

Baccalaureate Program in

Surveying Engineering

Prepared for the
EAC/ABET ACCREDITATION SITE VISIT

July 1, 1999

Table of Contents

Appendix II – Institutional Profile **78**

Program Self-Study Report
for Surveying Engineering

A. Background Information

1. Degree Titles

Surveying Engineering

2. Program Modes

Conventional Day Classes.

3. Actions to Correct Previous Deficiencies

At the time the ABET team visited the campus in 1993, the University had just released a fiscal restructuring plan which proposed drastic cuts in various programs. However, the proposed plan did not affect the Surveying Engineering program. In response to the fiscal restructuring plan the ABET report stated "The atmosphere and morale on campus was very suspenseful because of the release of the proposed fiscal restructuring plan. The faculty of the Surveying Engineering program appeared not as concerned as other faculty, as administration assured everyone that the program was important to the university and would be adequately supported. It is imperative that the fiscal restructuring plan not cut the financial support for the program as the present support is minimal at best. It is also important that the present faculty and technician support be maintained at or above the present level. If the present increasing enrollment trend continues, additional faculty and financial support will be necessary. In addition, the teaching load needs to be evenly distributed in subsequent semesters".

After the ABET visit one of the program faculty members, David Henry, was given a buyout, and no replacement was hired for a year. However, after lobbying by the program faculty, Carl Shangraw was hired as a replacement for that position. The fact that a new faculty member was hired in the program is significant because according to the restructuring plan, buyout positions were not to be replaced. The above statement from ABET played a role in filling the faculty position.

The instrument room manager is still being supported since this position is very crucial for the program. Proper dispensing and cleaning of the equipment is very important. In addition to Surveying Engineering, Construction Technology and Management students also use this equipment. The status of the equipment repair technician has been in a state of flux. In 1993, this position was 50% dedicated to the Surveying Engineering program, and that workload was approximately 80% equipment maintenance and 20% computer support. From 1993 to 1996, that workload slowly evolved into about 30% equipment maintenance and 70% computer support. In 1996, computer support services were consolidated at College of Technology level, and the dedicated surveying equipment repair technician became part of the college's consolidated computer support services organization. Although it was agreed that the technician would spend 20% of his time on surveying equipment repair and maintenance, the demands of computer support all but eliminated this.

In 1999, the university president formed a series of computer support consortia, and the College of Technology now receives such support from the Business and Technology Computer Support Consortium, under the direction of the Dean, College of Business and an oversight committee that includes the Dean, College of Technology. The effectiveness of this new organization has yet to be determined, since it is not yet fully operational. As part of this reorganization, the College of Technology recovered the former equipment support technician position. As of May, 1999, this position supports the Surveying Engineering and the Electronics/CNS programs (which include the TAC/ABET accredited BS, Electrical/Electronics Engineering Technology program). While there is very little current experience with this new alignment, overall support to the Surveying Engineering program is estimated to be at roughly the same level as it was in the period 1993-1996, but with an increased emphasis on equipment support (as opposed to computer support). The incumbent technician is the same employee who has been associated with the surveying program since 1980. The consortium now performs the routine computer support services formerly performed by this position. The technician does become involved in computer support issues insofar as software directly tied to surveying hardware is concerned. The faculty have been deeply concerned about both equipment and computer support, especially the loss of the position 50% dedicated to and under the control of the program, but it is hoped that this new organization will prove to be adequate.

Faculty loads vary from semester to semester depending on the type of classes being taught and other responsibilities of the faculty. For example, Professor Burtch had been given 25% release time because he is the editor of the Surveying Engineering Journal. Professor Hashimi was the Program Director/Coordinator prior to Fall 1998. Therefore, he was only teaching half time. Similarly, Professor Thapa is only teaching half time or less since he is currently the program coordinator. The distribution of the faculty loads for the last five years is given in Table 1.1.

Table 1.1: Program Faculty Teaching Load Distribution

Faculty	Courses Taught	Credit Hour	Contact Hour
Fall Semester 94/95			
Robert Burtch	SURE 330 & SURE 425	7	11
Sayed Hashimi	On Leave of Absence		
Jens Rick	SURE 230 & SURE 425	8	16
Khagendra Thapa	SURE 110, SURE 372, & SURE 497	11	11
Marvin Myers*	SURE 220 & CONM 122	8	16
Winter Semester 94/95			
Robert Burtch	SURE 325 & SURE 453	8	14
Sayed Hashimi	On Leave of Absence		
Jens Rick	SURE 115, SURE 340 & SURE 373	10	18
Khagendra Thapa	Sabbatical Leave	0	0
Marvin Myers*	SURE 230 & SURE 420	9	17
Fall Semester 95/96			
Robert Burtch	SURE 330, SURE 452 & SURE 440	11	17
Sayed Hashimi	SURE 115 & SURE 215	5	8
Jens Rick	SURE 230 & SURE 110	8	16
Carl Shangraw	CONM 122 & SURE 365	8	14
Khagendra Thapa	SURE 372, & SURE 425	7	11
Marvin Myers*	SURE 220	6	14
Winter Semester 95/96			
Robert Burtch	SURE 325 & SURE 453	8	14
Sayed Hashimi	SURE 215	3	4
Jens Rick	SURE 230, SURE 340 & SURE 373	11	19
Carl Shangraw	SURE 420, SURE 465 & CONM 122	12	16
Khagendra Thapa	SURE 116, SURE 110 & SURE 331	11	19.5
Marvin Myers*	SURE 220 & SURE 435	8	16
Fall Semester 96/97			
Robert Burtch	SURE 339 & SURE 372	7	11
Sayed Hashimi	SURE 115 & SURE 215	5	8
Jens Rick	SURE 230 & SURE 440	8	16
Carl Shangraw	CONM 122 SURE 115 & SURE 365	10	18
Khagendra Thapa	SURE 297, SURE 453 & SURE 425	10	14
Marvin Myers*	SURE 220 & SURE 110	8	16

Winter Semester 96/97			
Robert Burtch	SURE 325 & SURE 340	8	16
Sayed Hashimi	SURE 230	4	8
Jens Rick	SURE 110, SURE 215 & SURE 373	10	15
Carl Shangraw	SURE 420, SURE 465 & CONM 122	11	16
Khagendra Thapa	SURE 116, SURE 452 & SURE 331	10	16
Marvin Myers*	SURE 220 & SURE 435	8	16
Fall Semester 97/98			
Robert Burtch	SURE 329 & SURE 372	7	11
Sayed Hashimi	SURE 230	4	8
Jens Rick	SURE 440, SURE 215 & SURE 115	9	16
Carl Shangraw	CONM 122 & SURE 365	8	14
Khagendra Thapa	SURE116, SURE 453 & SURE 425	10	18
Marvin Myers*	SURE 110 & SURE 220	8	16
Winter Semester 97/98			
Robert Burtch	SURE 325 & SURE 452	8	14
Sayed Hashimi	SURE 215 & SURE 272	6	7
Jens Rick	SURE 230, SURE 340 & SURE 373	11	19
Carl Shangraw	SURE 420, SURE 465 & CONM 122	12	16
Khagendra Thapa	SURE 115,SURE 116, SURE 110 & SURE 331	11	19.5
Marvin Myers*	SURE 220 & SURE 435	8	16
Fall Semester 98/99			
Robert Burtch	SURE 339 & SURE 425	8	16
Sayed Hashimi	SURE 115 SURE 116 SURE 215 S372	10	15
Jens Rick	SURE 230 & SURE 440	8	16
Carl Shangraw	CONM 122 & SURE 365	8	14
Khagendra Thapa	SURE453	4	6
Marvin Myers*	SURE 110 & SURE 220	8	16
Winter Semester 98/99			
Robert Burtch	SURE 215, SURE 325 & SURE 452	11	18
Sayed Hashimi	Sabbatical Leave	0	0
Jens Rick	SURE 230, SURE 340 & SURE 373	11	19
Carl Shangraw	SURE 420, SURE 465 , SURE 115& SURE272	12	15
Khagendra Thapa	SURE 116, SURE 331 & SURE 452	5	6
Marvin Myers*	SURE 220 & SURE 435	8	16

*adjunct faculty

Regarding the library the team stated "Library use by students is heavy. Because of limited seating, some problems have arisen. When the current library was opened in 1967, the university had an enrollment of 4,000. Today it is over 11,000. Planning for the future includes a science technology branch library that would house the collections for the physical sciences, engineering and applied technology. Because of the tight fiscal constraints, this may not be a reality in the near future." Today, a new 185,000 square foot library is under construction at a cost of about fifty million dollars. Moreover, the new library will have 1310 seating spaces, four times more than the current library. In addition, the crowding problem in the library has subsided because of two factors. First, enrollment has declined down to 9,000 students and second, more and more students are using the Internet to obtain information.

Regarding the secretarial and technical support the 1993 ABET final report states "..secretarial and technician support are minimal, but adequate. The technical support is particularly important for this program both in the area of computer systems management and in surveying and photogrammetry hardware maintenance. Any diminution of the support would be a serious detriment to the program." Secretarial support is routinely provided to the program coordinator. Secretarial support is provided to faculty as approved by the department head. Technician support has been discussed in detail earlier in this document.

Major developments have taken place in the Surveying Engineering program since the previous visit. In 1996, Ralph Shields retired as department head. Charles Matrosic is now the department head and an assistant dean of the College of Technology. In addition, Sayed Hashimi stepped down from the Surveying Engineering Program Coordinator position in 1998. Dr. Khagendra Thapa has been the program coordinator since Fall 1998. David Henry retired from the university in 1994, and Carl Shangraw was hired as an assistant professor starting in Fall 1995.

The following course changes were made to improve the quality of the program:

New Course	Replaced Old Course
SURE331/Humn 331 Ethics and Professionalism in Engineering and Technology	Replaced a Humanities Course
SURE 116 Introduction to Microstation	EGRG 123 Engineering Graphics
SURE 272 Geomatics Computation	CPSC 205 Computer Science I
SURE 329 Modern Cartography SURE 339 Remote Sensing	SURE 330 Cartography and Remote Sensing

The following scholarships for surveying engineering students were established:

Scholarship	Amount
John Fenn Scholarship	$1000
Joseph Bishop Scholarship	$500
Khagendra Thapa Scholarship	$500
Lewis and Lewis Scholarship	$500
Mary Feindt Scholarship	$500
Richard Lomax Scholarship	$500
Robert C. Burtch Scholarship	$500
Rought Scholarship	$500
Rowe Engineering Scholarship	$1000

At the recommendation of the program faculty, the following individuals who have played a significant role in the field of surveying and mapping have been honored by the university with honorary doctoral degrees:

Dr. Jack Dangermond, Founder and President of the Environmental Systems Research Institute of Redlands, California, 1994.

Dr. Charles Trimble, Founder and President of Trimble Navigation Ltd. Of Sunnyvale, California, 1995.

Dr. Larry Ayers, Vice President of Intergraph Corporation, Huntsville, Alabama, 1996.

Mary Feindt, a veteran surveyor and owner of Charlevoix Geomatics, 1999.

Dr. Thapa received the 1996 Michigan Association of Governing Boards Distinguished Faculty Award for his contributions to the university and the community. In addition, he also received the Provost's Award for Excellence in 1997.

Professor Burtch continues to play a vital role in the Michigan Society of Professional Surveyors (MSPS). He has been the member of the Executive Board of MSPS for several years, currently serving as secretary. He also serves with the Michigan Museum of Surveying. Professor Hashimi has been very active as a member of the Michigan Licensing Board for Professional Surveyors, currently serving as the Board Vice Chairman. In addition, he is also active with the National Council of Examiners for Engineering and Surveying.

The program has acquired significant equipment, hardware, and software since the last ABET visit. In the fall of 1998, five new LEICA CA1100 total stations were purchased. In addition, in 1997 three computers with large overhead monitors were purchased. These are helpful in instructing students on how to use software. Two

TOPCON digital levels were purchased in 1998.

The consignment of five total stations and a digital level from Topcon Corporation still continues. This program was initiated by Dr. Thapa and Topcon Corporation seven years ago. Topcon is committed to continue the program.

In 1996 Intergraph Corporation of Huntsville, Alabama, donated MGE GIS software, Microstation, and other related software valued at over $450,000. In 1997, Intergraph loaned an Image Station along with the associated software with a market value of about $200,000.

In 1995 Environmental Systems Research Institute (ESRI) donated ARC/INFO PC software and ARC/CAD PC software with a market value of $60,000. In 1998, ESRI donated ARC/INFO NT along with ArcView software which has market value of $220,000. In addition, in 1995 John Chance and Associates donated a fathometer (echosounder) with a market value of $5,000.

In 1997, the program purchased four ProXR GPS receivers. In addition, in 1997 Trimble Navigation loaned us two SSTI GPS receivers which can be used for real-time kinematic surveying.

B. Accreditation Summary

1. Students

Criterion 1 relates to the process of student and graduate evaluation, advising, and performance monitoring. All students at Ferris State University are assigned an academic adviser. In the College of Technology each tenure track faculty has advisees. In the Surveying Engineering program, faculty advise only those students who are enrolled in the program. Students are provided with the official curriculum and program check sheet prior to or at first enrollment in the program. They are expected to be aware of all published graduation requirements. The advisers are there to help students to orderly complete the requirements of the program. However, it is the responsibility of the students to ensure that they successfully complete all the requirements of the program. They will not be allowed to graduate unless they complete all the requirements of the program. They must also maintain a minimum cumulative grade point average (GPA) of 2.0. Any student who has a GPA less than 2.0 will not be permitted to graduate even though they have fulfilled all other requirements.

Before a student can register for any semester, he/she must have an "Early Registration Clearance" form signed by his/her adviser. No student is allowed to register without first completing the form. The fact that a student has to see his/her adviser each semester allows each adviser to monitor the progress of the student and his/her performance in the previous semester. If the adviser sees that a student is having difficulty, he/she may advise the student to take lower level courses. On occasion, an adviser may ask the student to repeat a course. Students may not take more that 18 credits without the permission of the adviser. In addition, those students who are on academic probation (e.g. with GPA less than 2.00) must also have approval from the academic adviser before they are allowed to take more than 13 credit hours in a semester. A student may not drop a currently enrolled course without the approval of the academic adviser.

A student may not graduate from the program unless he/she submits an application for graduation. The academic adviser in the program must sign this form. The application for graduation will not be accepted by the College of Technology Dean's Office unless it is accompanied by the program curriculum check sheet which accounts for each course grade if taken at Ferris and proper transfer documents for courses transferred from another institution.

Each adviser may access copies of student schedules shortly after registration and has the opportunity to check the schedule using the Student Information System (SIS). At the end of each semester, an adviser may check the grades for each student he/she advises using SIS. This also helps the faculty adviser to monitor the progress of the student.

The evaluation of students is done in the form of assignments, laboratory exercises, field work, quizzes, tests, term papers, oral presentations, and final examinations. The evaluation components vary depending on the course material and faculty involved. For example, surveying engineering courses such as SURE110 (Fundamentals of Surveying), SURE 220 (Engineering Surveying), SURE230 (Advanced Surveying), SURE 340 (Photogrammetry), SURE 452 (Geodesy I), and others have a significant field work component. These courses usually require completion of projects such as the completion of a topographic map in SURE 110. On the other hand, COMM 121 (Fundamentals of Speech) requires delivering speeches in the classroom.

Substitution for the required courses are relatively rare and are granted only by the department head upon the recommendation of the surveying engineering faculty adviser. A request for course substitution which may be critical or controversial with regard to the student's progress will be referred to the entire program faculty for consensus.

Transfer credit is accepted if the content and level of the course can be verified as an equivalent course in the curriculum. Courses transferred from other Michigan colleges and universities may have an established equivalency. Non-technical courses are transferred only after the recommendation of the department concerned. For example, English courses are transferred only after consultation with the department head of Languages and Literature. Surveying Engineering courses are transferred after the evaluation of equivalent course work by the program faculty and/or program coordinator. Review of course descriptions and on-site visitations have also been used to evaluate course content. In some instances, proficiency examinations developed by the faculty are used to grant credit for program courses. Block transfers in which a student with an associate degree is automatically placed at junior level are not permitted in the Surveying Engineering program. Furthermore, the College of Technology's graduation requirements states that:

a. A minimum of 30 credits must be earned at Ferris for any A.A.S. or B.S. degree.

b. No more than 67 credits may be transferred from a two-year institution.

It should be noted that it is very unusual for students to transfer courses equivalent to Surveying Engineering courses except perhaps at the 100 and 200 level. In other words, the transfer of 300 and 400 level equivalent courses into the program is rare.

The above explanation clearly shows that Surveying Engineering program is serious about student advising, evaluation, and monitoring. The transfer credits are carefully evaluated.

Evidence that will be available to show acceptable achievement of this criterion will include the following:

1. Forms used for student advisement.

2. Student Surveys.
3. Interviews with students.
4. Course materials that illustrate evaluation of student performance.

2. Program Educational Objectives

VISION:

The vision of the Surveying Engineering program is to provide quality education to our students. The program is designed to achieve the following program goals:

- Educate a new generation of surveying engineers to meet the challenges of the future.
- Promote a sense of scholarship, leadership, and service to the community.
- Disseminate new knowledge.
- Play a leadership role in fostering interdisciplinary education which could help to solve the complex problems facing the modern society.

The Surveying Engineering program is designed to meet the demands of our students, employers, and society. The educational objectives associated with the program, a list of outcomes, and a description of assessment methods used to determine how well the outcomes are being satisfied are given below:

EDUCATIONAL OBJECTIVES:

1. Provide an educational experience that prepares our students for the challenges of the surveying profession that they will encounter during their professional life.

2. Provide opportunities for our students to exhibit creativity, leadership and team-building abilities, cultural appreciation, global understanding, and social issues.

3. Employ state-of-the-art technologies in the surveying engineering curriculum.

4. Incorporate interdisciplinary concepts and problem solving exercises in the program.

5. Provide a broad educational experience including communications skills, mathematics and basic science, preparing students for life-long learning.

THE MISSION OF FERRIS STATE UNIVERSITY:

"Ferris State University will be a national leader in providing opportunities for innovative teaching and learning in career-oriented, technological and professional education."

Keywords in this mission statement are: national leader, career-oriented, technological and professional education. Surveying Engineering is certainly a program which satisfies all the keywords of the mission of the university. Ferris

State University is considered a national leader in undergraduate surveying engineering education. Further, it is highly technical and uses state-of-the-art technology such as Global Positioning Systems (GPS), digital mapping, Geographic Information Systems (GIS), and electronic methods of surveying. The program is professional because its graduates can attain licensure as a professional surveyor once they pass the appropriate tests and gain the required experience. The administration and faculty believe that the program is very relevant and appropriate to the mission of the university. Other professional programs in the university include Pharmacy and Optometry.

SIGNIFICANT CONSTITUENCIES OF THE PROGRAM:

The following groups are considered to be the constituencies of the program:

1. The employers of the graduates of the program.

2. Alumni of the program.

3. Students of the program.

4. Advisory Board of the program.

5. Faculty of the program.

The Surveying Engineering program has a very active advisory committee consisting of leaders of the profession, alumni, a representative from the Michigan Society of Professional Surveyors, a representative from the Michigan Society of Professional Engineers, and a representative from the Michigan Licensing Board for Professional Surveyors. The committee meets at least once a year. The input from the committee is seriously considered and program upgrades and revisions are performed regularly to reflect the views of the members of the committee. In addition, the College of Technology regularly performs alumni surveys. Input from the alumni is also incorporated in any revision of the curriculum. The above processes have been in place for many years. Since the introduction of ABET Engineering Criteria 2000, the following assessment tools have been developed and will be incorporated into future assessments:

1. Employer survey.

2. Student survey.

3. Alumni survey.

4. Advisory committee survey.

5. Faculty survey.

The program is critically looking at the above five surveys and will incorporate

Excellent employment opportunities exist for the graduates and all students enrolled in the program. Many employers from all over the country actively look for graduates for full time employment and students for summer jobs. Unfortunately, there are never enough graduates or students to fulfill the demands from the employers. This year alone the program had more then 300 requests. There is hardly a day when we do not receive calls, faxes or letters from employers looking for graduates or students.

In order to ensure that the program educational objectives are continually met, the university and the program use four different processes: academic program reviews conducted every six years by the university, ABET evaluations, licensing examination results, and the constituent surveys mentioned above. Our constituency surveys were very good. Ferris State University graduates had the highest percentage of success in the licensing examination in 1997-98. Good results indicate that the program is achieving its objectives. Detailed explanations on program outcomes and assessment and the above four processes with supporting data are given in section 3 below.

Evidence that will be available to show acceptable achievement of this criterion will include the following:

1. Published educational objectives
2. Interview with students
3. Interview with advisory committee members
4. Description of the curriculum and of the courses that meet achievement of these objectives
5. Course evaluation procedure and feedback to faculty
6. Professional service activities for students
7. Interview with faculty

3. Program Outcomes and Assessment

I. The desired outcomes of the Surveying Engineering program are:

Outcome 1. Students will obtain a broad education necessary to understand the impact of surveying engineering solutions in a global, societal, and environmental context consistent with the principles of sustainable development.

Outcome 2. Students will acquire an ability to solve surveying engineering problems in practice by applying fundamental knowledge of mathematics, science and engineering and by using modern surveying techniques, skills and tools particularly recognizing the role that computers play in engineering.

Outcome 3. Students will be able to obtain an ability to identify, formulate and solve surveying engineering problems as they relate to establishing horizontal and vertical control, land use design, boundary determination, mapping and field layout of infrastructure that meet standards of accuracy and precision, cost, time, safety and quality.

Outcome 4. Students will develop an ability to design and conduct experiments and to analyze and interpret data.

Outcome 5. Students will attain an ability to function and communicate effectively both as individuals and as members of teams.

Outcome 6. Students will acquire a solid understanding of professional and ethical responsibility and a recognition of the need for and ability to engage in lifelong learning.

II. Table 3-1 shows the relationships between program outcomes and outcome requirements of Criterion 3.

Table 3-1.
Relationship Between Program Outcomes and Outcome Requirements

Criterion	Outcome 1	Outcome 2	Outcome 3	Outcome 4	Outcome 5	Outcome 6
3a.	X	X	X	X		
3b.	X			X		
3c.	X	X	X			
3d.			X		X	
3e.		X	X			
3f.	X					X
3g.					X	
3h.	X					X
3i.	X					X
3j.	X				X	
3k.		X	X			

Criterion 3a. **An ability to apply knowledge of mathematics, science and engineering appropriate to the discipline.**

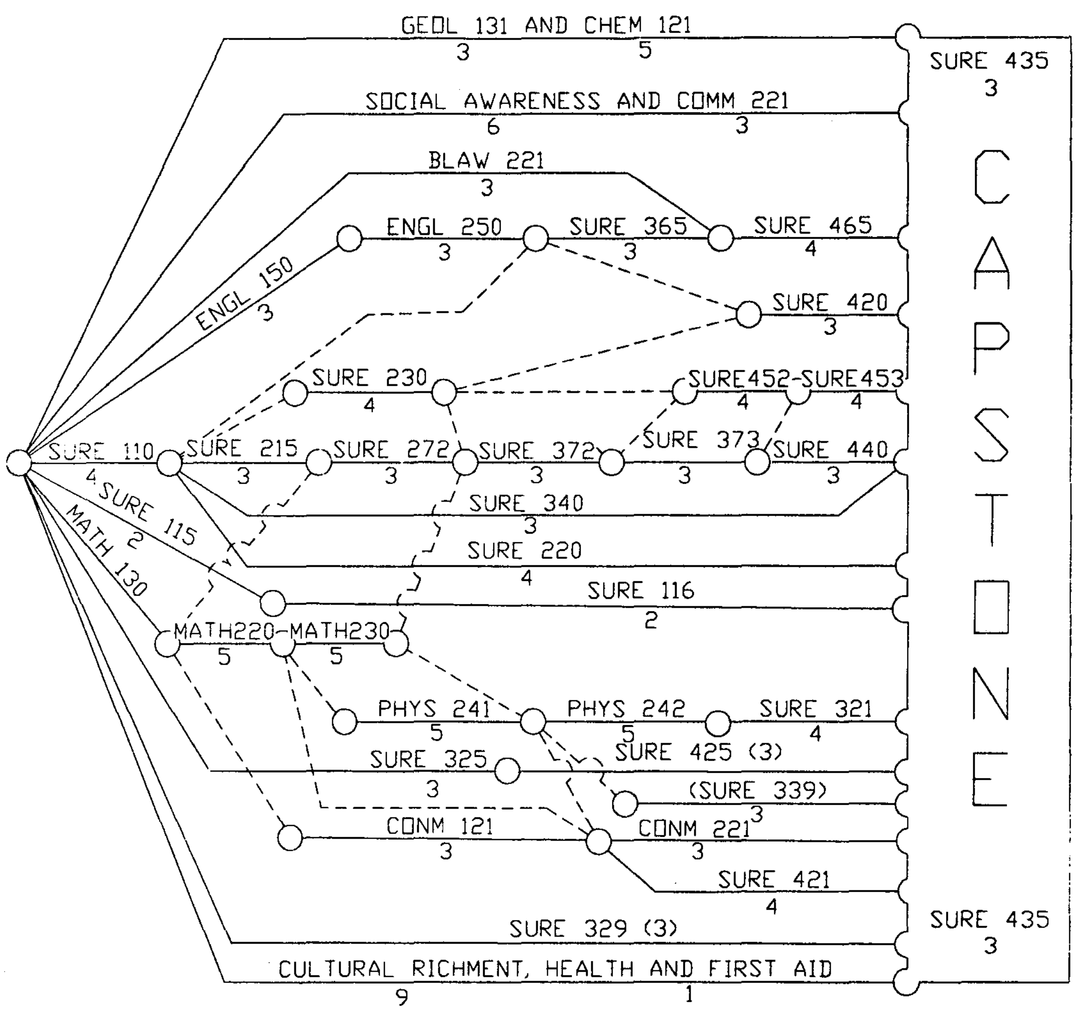
- Program course requirements that meet this criterion by definition are:

Mathematics	Science	Engineering	
MATH 130	CHEM 121	CONM 121	SURE 329/339
MATH 220	GEOL 131	CONM 221	SURE 321
MATH 230	PHYS 241	SURE 110	SURE 325
SURE 372	PHYS 242	SURE 215	SURE 340
SURE 373*		SURE 220	SURE 421
SURE 215		SURE 230	SURE 440
		SURE 425	SURE 453
		SURE 452	
		SURE 435	

*2 credits Mathematics, 1 credit Engineering.

- The sequence of courses students pursue develops the capacity to use mathematics and science in upper level engineering courses. Figure 3-1 describes the course sequence and relationships culminating in a capstone course, SURE 435.

Figure 3-1.
Course Sequence and Relationships



Criterion 3b. An ability to design and conduct experiments, analyze and interpret data.

- An ability to design and conduct experiments is an integral part of selected general education science courses, specifically CHEM 121, PHYS 241 and PHYS 242. These courses set the stage for discipline specific experimental opportunities in SURE 321 and SURE 421.

- The analysis and interpretation of statistical data are integrated into most SURE courses. Beginning with SURE 110 students are taught the relationships between surveying engineering operations and the quality of those operations as determined by rigorous numerical analysis. Each succeeding course builds upon the last, culminating in SURE 373, Adjustment Computations, which forms the cornerstone of higher level geodesy and photogrammetry courses. Students are taught that each surveying operation, whether establishing control, determining boundaries or designing a Geographic Information System, requires identifying standards to be met, developing specifications to meet those standards, then analyzing the results to insure compliance.

- Assessments are part of the normal course evaluations. These assessments include student participation, reports and examinations leading to a course grade.

Criterion 3c and 3e. An ability to design a system, component, or process to meet desired needs. An ability to identify, formulate and solve engineering problems.

- Design of safe, cost effective processes that will support predetermined survey standards and specifications is the core of the field course sequence of SURE 110, SURE 220 and SURE 230. SURE 272 introduces students to computer program design using a structured, high level language. Students are expected to produce executable routines capable of solving the more common surveying engineering problems.

- SURE 321 combines hydrology and hydraulics and includes gravity drainage and pressure water supply system design. SURE 421 explores soil classification systems, weight-volume relationships, permeability, flow nets, dams, lateral earth pressures, shear stresses, loads on buried conduits, slope stability and foundations.

- SURE 325 and SURE 425 explore the fundamental principles of Geographic Information Systems and focus upon system design. The photogrammetry course sequence of SURE 340 and SURE 440 coupled with either SURE 329 or SURE 339 combine theory and practice to the design of high level maps and mapping systems.

- SURE 452 and SURE 453 introduce students to geodesy and geodetic network design. Topics include determining the size and shape of the earth, exploration of dynamic physical forces such as gravity, a study of datum, map projections and coordinate systems, and extensive use of the Global Positioning System.

- SURE 365 and SURE 465 combine the design engineering aspects of surveying with the legal aspects, including description writing, interpretation, and determination of boundary location.

- The program of instruction culminates with SURE 435, The Urban Environment. This is the capstone course resulting in the design of a detailed land use plan integrating the principles of engineering design, environmental concerns, and social and psychological aspects within a framework of sustainable development.

Criterion 3d. An ability to function on multi-disciplinary teams.

- Students work in teams of two, three or four in all field courses.
- The Surveying Engineering program incorporates several subdisciplines including CAD, computer programming, business aspects, professional ethics, health and first aid, global consciousness, social awareness, and racial, ethnic and gender issues.
- SURE 331, Ethics and Professionalism in Engineering and Technology, is team taught by Surveying Engineering and Humanities instructors. This is a unique, collaborative endeavor between faculty from the Colleges of Technology and Arts and Sciences.

Criterion 3f. An understanding of professional and ethical responsibility.

- Honesty, loyalty and integrity are hallmarks of the Professional Surveyor and therefore these traits are expected of all students and faculty members in all aspects of the educational experience.
- SURE 331, Ethics and Professionalism in Engineering and Technology, deals specifically with codes of ethics adopted by surveying and engineering societies; explains the meaning and attributes of professionalism along with the ethical, moral and social responsibilities of engineers; and discusses standards, law, safety, risks, professional obligations, loyalty, client relationships, global awareness and intellectual property. John Matonich, president of Rowe, Inc., gave a lecture in SURE 331 in Winter 1999 on ethnical issues of surveying.
- SURE 365, Legal Aspects of Surveying 1, and SURE 465, Legal Aspects of Surveying 2, define the quasi-judicial role of the Professional Surveyor in society. SURE 420, The Professional Practice of Surveying, stresses the legal obligation to comply with contractual and statutory requirements along with the moral obligation to provide decent standards of living for the professional's family and employees.
- Membership and active participation in professional societies is encouraged. The Surveying Engineering program supports the Burt and Mullett student chapter affiliated with both the Michigan Society of Professional Surveyors (MSPS) and the American Congress on Surveying and Mapping (ACSM). Student attendance at the annual MSPS conference has been increasing each year since the last ABET report and this year the number of Ferris student participants exceeded 50. For each of the past three years there has been Ferris student representation at the annual ACSM conference. Students have actively participated in conferences sponsored by both organizations by staffing booths, acting as runners and assisting with presentations. A measure of student participation is the number of state and national scholarships awarded to Ferris students.

Criterion 3g. An ability to communicate effectively.

Communication is the essence of Professional Surveying. A map communicates features and relative locations. Stakes communicate alignment and grade. Monuments communicate the limits of property ownership. The Professional Surveyor must be able to communicate graphically, physically, orally and in writing to a variety of constituents be they clients, partners, superiors, subordinates, attorneys, contractors, business associates, government officials or the public at large. Students obtain the ability to communicate as individuals and as members of teams through the following means:

A. Graphically:

- At the lowest levels, students are required to take SURE 115 and SURE 116, introductory courses in Computer Assisted Drafting using AutoCad and Microstation respectively.

- Students are introduced to a variety of GIS and photogrammetric mapping software packages throughout their tenure.

- Students learn and use graphical systems such as those developed by Tripod Data Systems and Eagle Point in the 100- and 200-level field courses and in the capstone design course, and incidentally in virtually all of the remaining engineering design courses.

- Proper field note procedures are emphasized in the 100- and 200-level field courses. The value of field notes as evidence is emphasized in the legal aspects courses.

B. Physically:

- Proper placement and marking of stakes is stressed in the 100 and 200 level field courses.

- Field targeting strategies are discussed in photogrammetry and remote sensing courses.

- Requirements for monumentation are studied in geodetic control, legal aspects and urban design courses.

- Evaluation of monuments as evidence is a significant portion of the legal aspects courses.

C. Orally:

- All students are required to take COMM 121, Fundamentals of Public Speaking.
- Oral presentations are required in the geodesy and GIS courses.
- Students are encouraged to make public presentations as part of their professional activities.

D. In Writing:

- The two English courses, ENGL 150 and ENGL 250 form a sequence focusing on research and on organizing and developing papers for diverse audiences.
- Three Surveying Engineering courses, SURE 365, SURE 465 and SURE 420 are designated by the university as writing intensive. SURE 365 and SURE 465 both include writing fully documented essays about current legal topics relating to surveying, focusing on substance, organization, style and correctness. Students prepare a number of legal property descriptions in various formats. SURE 465 includes six legal case studies. SURE 420 requires essays on topics relating to the professional practice of surveying as well as the preparation of "point papers" where students are required to take a stand and defend a position. SURE 465 and SURE 420 require project reports. All three courses require extensive use of memoranda and formal business letters.
- Term papers are assigned in the GIS, geodesy, cartography and remote sensing courses.

Criterion 3h. The broad education necessary to understand the impact of engineering solutions in a societal context.

The Surveying Engineering program is committed to providing students with the broad education necessary to understand the impact of surveying engineering solutions in a global, societal, and environmental context consistent with the principles of sustainable development. Strong emphasis is placed on four areas: academics, professional development, practical experience and stewardship.

A. Academics

The Bachelor of Science Degree in Surveying Engineering is designed to incorporate the Professional Surveyor licensing requirements of the State of Michigan, the professional engineering and design requirements of the Accreditation Board of Engineering and Technology, and the cultural enrichment and social awareness requirements of Ferris State University. Key to successful integration is a focus on balance; balance of the theoretical with the practical, balance of the sciences with the arts, balance of the individual with the whole. Graduation from this program cornerstone of higher level geodesy and photogrammetry courses. Students are taught that each surveying operation, whether establishing control, determining boundaries or designing a Geographic Information System, requires identifying standards to be met, developing specifications to meet those standards, then analyzing the results to insure compliance.

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A. Academics

The Bachelor of Science Degree in Surveying Engineering is designed to incorporate the Professional Surveyor licensing requirements of the State of Michigan, the professional engineering and design requirements of the Accreditation Board of Engineering and Technology, and the cultural enrichment and social awareness requirements of Ferris State University. Key to successful integration is a focus on balance; balance of the theoretical with the practical, balance of the sciences with the arts, balance of the individual with the whole. Graduation from this program requires 138 semester hours with a minimum 2.0/4.0 grade point average. The course of study is long, rigorous and challenging and gives graduates a sense of pride and accomplishment along with the confidence and self-assurance that they will make their marks on the world.

B. Professional Development

Active student participation in professional societies has been discussed. Implicit in all courses and explicit in the legal aspects and professional practice courses is the fact that formal education for a Professional Surveyor does not end with a baccalaureate degree. Formal education as a Professional Surveyor begins with a baccalaureate degree. Since the last ABET evaluation, two Ferris graduates have enrolled in and will be graduating with Master of Science degrees in Surveying Engineering from Purdue University. A third is enrolled in a Master of Business Administration program at Walsh College.

Ferris graduates appear in substantial numbers at local, state and national surveying meetings and conferences. Ferris faculty play a significant role in providing seminars to practicing professionals and offer distance learning opportunities over the Internet and at remote locations such as Grand Rapids, Michigan and Traverse City, Michigan. Ferris faculty are preparing a survey manual to be used by all Michigan Department of Transportation employees and consultants throughout the state.

C. Practical Experience.

Ferris graduates must be ready to assume entry-level positions in a "hit the ground running" mode. No program, however, will ever provide all of the tools for all of the graduates to assume all of the roles demanded by all of the constituents. What this program can and does do is partner with government and industry to meld theory with practice and thus establish a framework within which the individual as well as the profession may grow.

This program makes every effort to provide students with employment in the profession during vacation periods in both the public and private sectors. Current demand for students far exceeds supply. Every student who seeks employment gets it. One recent graduate and one current student have interned with the Bureau of Land Management, Department of the Interior; three students are acting as interns for the REGIS project, a $13 million regional Geographic Information System being spearheaded by Kent County, Michigan; six students are spending summers with the Michigan Department of Transportation and the National Geodetic Survey observing a vertical control network to second order standards over a two hundred and twenty mile strip from Evart, Michigan to the Ohio border. There are numerous opportunities for part time and summer jobs for every student.

D. Stewardship

Surveying Engineering students are involved in a host of activities designed to afford the opportunity to give back to the community. Among the many activities that students volunteer to participate in are blood drives, the Big Brother/Big Sister Program, tutoring, assisting in the construction of "Playscape", volunteering to lay out Habitat for Humanity homes and Boy Scouts.

Criterion 3i. A recognition of the need for, and an ability to engage in life-long learning.

- The volume of writing and research requirements force students to look outside of class notes and textbooks in seeking answers to complex questions as will be required of them as practicing professionals.

- Students are strongly encouraged to find employment with surveying/engineering companies during vacation periods to meld theory with practice. Rapid technological change coupled with the increased size and scope of projects being undertaken by the private sector bring home the need for continual upgrading of knowledge and skills to remain competitive.

- Through active participation in professional societies, students learn the importance that practicing professionals put on continuing competence.

- Beginning with the Winter semester of 1999 a practicing surveyor, Mr. Daniel Pratt, PS, MBA, of Driesenga Associates, Holland Michigan, has addressed the SURE 420 class on the importance of a graduate degree.

- In August of 1999 two graduates of the Ferris State University Surveying Engineering program will graduate with MS degrees in Surveying Engineering from Purdue University. A third is pursuing a MBA from Walsh College.

Criterion 3j. A knowledge of contemporary issues.

- The university requires that from the mandatory cultural enrichment and social awareness courses one be a social foundations course, one be a global awareness course and one address racial, ethnicity and gender issues.

- The cause and effect relationship between society and engineering is stressed in the capstone course, the legal aspects courses and the professional practice course. Senior students subscribe to the *Wall Street Journal* and are required to prepare a series of position papers as part of SURE 420.

Criterion 3k. An ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

- Strong emphasis is placed on computer applications in all facets of the program
- Computer hardware and software are continually being upgraded.
- State-of-the-art field equipment is acquired on a regular basis.
- The curriculum is designed to provide integration and exposure to the major areas of surveying practice.

II. The relationships between Program Outcomes and Program Educational Objectives are shown in Table 3-2.

Table 3-2
Relationship of Program Objectives to Program Outcomes

Objective	Outcome 1	Outcome 2	Outcome 3	Outcome 4	Outcome 5	Outcome 6
1	X	X	X	X	X	X
2	X				X	X
3	X	X		X		
4	X			X	X	
5	X	X	X	X	X	X

Program Educational Objectives have been listed previously and are repeated here for convenience.

A. Educational Objective 1: Provide an educational experience that prepares our students for the challenges of the surveying profession that they will encounter during their professional lives.

All outcomes support this objective. The scope of the profession of surveying engineering continues to expand in both breadth and depth. Constituents demand both knowledge and creative ability. Each project encountered in practice brings with it a requirement for the right experience, the right theoretical knowledge and the right skills all in the right mix.

The first two years of the program focus upon fundamental knowledge of science, mathematics and engineering and hands on experience at the technical level. The upper division courses develop and integrate theory and practice at the professional level.

B. Educational Objective 2: Provide opportunities for our students to exhibit creativity, leadership and team building abilities, cultural appreciation, global understanding, and social issues.

Outcomes 1, 5 and 6 support this objective. Three cultural enrichment and two social awareness courses are required. To provide breadth, these courses must be taken in different areas. To provide depth, at least one cultural enrichment course must be taken at the 200 level and at least one social awareness course must be taken at the 300 level. Select courses are designated as addressing global awareness and social issues and must be integrated.

Team building is emphasized at all levels in the general science and field surveying and engineering courses. Students are divided into teams of two or more members. Positions on those teams are rotated to develop both leadership and support roles. Students learn quickly that their success will be measured to a great extent upon their creative ability to identify problems, develop solutions then execute those solutions as team members and as effective leaders.

The program contains two recognized student organizations, The Burt and Mullett Chapter of MSPS/ACSM and Lambda Sigma honors society. Both organizations are very active on campus, in the community and with the profession. No single person may hold an office simultaneously in both organizations, thus affording maximum opportunities for primary leadership roles. Numerous ad-hoc committees are formed fostering and nurturing team efforts.

C. Educational Objective 3: Employ state-of-the-art technologies in the surveying engineering curriculum.

Outcomes 1, 2 and 4 support this objective. A broad education must meld theory with application. This program receives unparalleled support from industry in the form of surveying equipment and computer software and hardware. Table 6 of Appendix I of this report details the inventory.

There is more to education, however, than button pushing. Technology provides a means to the desired end. It is not the end in itself. Focus is, therefore, on determining the desired end state and on matching the tools, methods and procedures to achieve that desired end state.

D. Educational Objective 4: Incorporate interdisciplinary concepts and problem solving exercises in the program.

Outcomes 1,4 and 5 support this objective. A broad education provides the concepts. Proper sequencing and integrated problem solving provides the relationship. The Capstone Course, SURE 435, puts it together in a global, societal, and environmentally sustainable context.

E. Educational Objective 5: Provide a broad educational experience including communication skills, mathematics, and basic science, enabling students for life-long learning.

All outcomes support this objective. The formal education of a professional surveyor begins with a baccalaureate degree integrating theory with practice, science with art, the individual with the community thus preparing the student for the critical social role the surveyor plays in land use, infrastructure design and environmental resource management. Surveyors are leaders and therefore must be able to form a vision, to communicate that vision, and to have the strength of character to implement that vision.

This program is designed for students to take the first step in their professional careers and to provide the foundation upon which further steps will be taken. Those further steps must include continuing competence integrating formal education, conferences and seminars, and professional practice. Graduate level education in the theoretical aspects of surveying engineering, management and business administration is not only becoming more common, but is being recognized as becoming more critical.

IV. The following processes are used to assure that graduates have achieved the program outcomes.

At Ferris State University, strategic planning based upon outcomes and assessment is conducted at all levels—university, college, department and program. The process is based upon this strategic planning model.

- Educational Objectives are formulated and related outcomes are developed.
- Future direction is assessed in light of the strategic vision.
- Educational enhancements and curriculum development initiatives are implemented.
- Feedback is sought on curriculum content and delivery from constituents including students, alumni, employers, faculty and the advisory committee.
- Future direction assessed in light of the strategic vision.

This section will focus upon process methods being used and developed to measure program outcomes.

" Ferris State University will be a national leader in providing opportunities in innovative teaching and learning in career-oriented, technological and professional education." This mission statement adopted by the Board of Trustees on February

22, 1997 sets the benchmark for each college, department and program. Each entity within has developed its own vision and mission statement supporting the university.

The assessment process developed and used by the Surveying Engineering program supports program objectives and outcomes. It consists of four pillars: university academic program review, ABET evaluations, licensing examination results and constituent surveys. From these four pillars, future direction is assessed and the strategic planning cycle evolves.

1. University Academic Program Review

All university programs undergo review on a six-year cycle. The university will review the Surveying Engineering program for the first time during the 1999-2000 academic year. Criteria are similar to those employed by ABET. Positive results reflect successful completion of objectives and outcomes.

2. ABET Evaluations

The State of Michigan Licensing Board for Professional Surveyors recognizes ABET accreditation as meeting the standards for the required baccalaureate degree. Most students enrolled in the program do so to become licensed professionals. The Surveying Engineering program at Ferris State University is one of five surveying engineering programs in the nation with EAC/ABET accreditation.

3. Licensing Examination Results

This is a key indicator of the relevance and quality of the Surveying Engineering program. Last year, Ferris graduates had the highest percentage of success from all universities/colleges in the country (considering only those programs with more than two test takers).

4. Constituent Surveys.

Constituent surveys have been expanded this academic year to include students, faculty, alumni, employers and members of the advisory committee. In the future, these surveys will be conducted on a four-year cycle.

V. Qualitative and quantitative data used on a continuing basis to demonstrate that graduates satisfy program outcomes includes discussed will be licensing examination results, placement surveys and constituent surveys.

A. Licensing Examination Results

The "pass" rate of Ferris State University students on the national Surveying Fundamentals examination for the past three academic years is shown in Table 3-3.

Prior to 1996-1997, pass rates by institution were not reported by the state licensing board.

Table 3-3

Percentage of FSU Graduates Passing Licensing Exams

Academic Year	% Pass NCEES Fundamentals of Land Surveying Exam	% Pass NCEES Professional Land Surveying Exam
1998-1999	70.4	77.8
1997-1998	87	100
1996-1997	88	92.3

Surveying Engineering graduates do very well in both the fundamentals and professional categories. The 1997-1998 pass rate for the Surveyor Fundamentals examination was the highest in the nation not counting those schools represented by only one or two individuals. This reflects a program well balanced between theory and practice.

Results of the NCEES professional exam are even higher. The State of Michigan requires a baccalaureate degree in surveying or surveying engineering, four years of increasingly responsible charge under the direct supervision of a licensed professional surveyor, and passing scores on both exams as the minimum requirements for licensure. The numbers speak for themselves. A Ferris Surveying Engineering degree coupled with practical experience under a competent licensed professional produces measurable results.

B. Placement Surveys

Placement surveys are conducted by the Ferris State University placement office to determine how many graduates have found employment in their areas of study and at what rate of compensation. The results of the past five years are reflected in Table 3-4.

Table 3-4

Placement Rates and Starting Salaries

FSU Surveying Engineering Graduates

Academic Year	Placement Rate	Starting Salary
1998-1999	100% (Projected)	$33,000 (Projected)
1997-1998	100%	$32,000
1996-1997	100%	$30,100
1995-1996	100%	$30,500
1994-1993	100%	$27,000

- Placement rates and salaries continue to be high reflecting the confidence the marketplace has in Ferris State University surveying engineering graduates and a strong economy.
- Starting salaries are rising reflecting a strong economy and a recognition of the value of a surveying engineering degree.

C. Constituent Surveys

1. Student Survey

Students are generally satisfied with the Surveying Engineering program.

- Scoring highest were the areas where courses were challenging and inspiring; written course objectives being clear and available; instruments and accessories being current, representative of those in use and in sufficient supply; faculty knowing the subject matter; satisfaction with career choice and with Ferris State University.
- Scoring lowest were the condition and availability of computer laboratory facilities. These areas also drew the most comments.

2. Alumni Survey

Judgment of relevance was correlated with type of work activities engaged in.

- Areas generally perceived as most relevant were legal aspects, control and layout, CAD and business aspects except for those alumni employed in photogrammetry.
- Areas perceived as least relevant were remote sensing, gravity and photogrammetry except for those working in the photogrammetric industry.
- Comments reflected strong technical competence but a need for further study in business and legal aspects.

3. Faculty Survey

Faculty gave the program relatively high scores.

- Scoring highest were the areas of faculty/student interaction, professional/industry standards being consistently used in program evaluation, coordination of supportive courses, and supply and condition of instruments and equipment.
- Scoring lowest were administrator or supervisory personnel involvement and support, support for continued faculty professional development, and the availability of paraprofessionals.
- Comments reflected lack of technical support and the need for an additional faculty position.
-

4. Employer Survey

Employers rated Ferris State University graduates from average to very strong in all categories.

- Areas receiving the most strong or very strong ratings were; applying knowledge of mathematics, science and surveying skills (88%), understanding professional and ethical responsibilities (69%), functioning well on interdisciplinary teams (59%), identifying, formulating and solving problems (58%).
- Areas receiving the most weak or very weak ratings were; designing and conducting surveys (20%), knowledge of contemporary surveying problems (20%), identifying, formulating and solving problems (15%).
- Comments reflected strong technical competence but lack of practical experience.

5. Advisory Board Survey

Advisory board members rated the program from average to excellent in all areas.

- Areas receiving the highest ratings were the program's providing the knowledge and expertise needed by the profession; the high demand for students from the program; the graduates of this program being comparable to graduates of other programs; the vital importance of ABET accreditation to the success of the program.
- The advisory board recognized a need for an additional faculty position.
- Like the employer survey, comments reflected strong technical competence but lack of practical experience.

VI. Processes by which assessment results are applied to further develop and improve the program vary depending upon the nature of the proposed improvement.

Improvements depending on significant capital outlays or creating new positions are identified and prioritized on Unit Action Plans. Implementation approval is delegated at various levels of authority.

Changes in curriculum or course content are proposed at the program level. Proposed changes require approval by department, college and university curriculum committees, the Academic Senate (in some instances), and the Office of the Vice President of Academic Affairs.

At the program level the strategic planning process involves the cycle of identifying needs, proposing recommendations, obtaining approvals, implementing changes, then re-identifying needs.

Input for identifying needs may come from a variety of sources, including proposed objectives and outcomes, constituent surveys, the market place, the advisory committee, an individual student or faculty member, etc. Before a recommendation is developed an evaluation of the effect of the proposed improvement is made. Topics of consideration may include:

- Required technological infrastructure needed to support the improvement.
- Additional personnel needed to support the improvement.
- Financial resources needed to support the improvement.
- Analysis of expected benefits relative to cost.
- Time that the proposed improvement will take to implement.
- Time that the proposed improvement will take from other areas of the program.

After consensus is reached by faculty members the proposed improvement may be implemented immediately if appropriate, identified on a Unit Action Plan, or submitted to the appropriate department, college or university committee.

When approval is granted and resourced, the improvement is implemented.

VII. Documentation of changes that have been implemented to further develop and improve the program and qualitative and quantitative data used to support these changes, includes:

A. Changes in curriculum and course content

- New CAD courses, SURE 115 and SURE 116
- Cartography and Remote Sensing split into two courses
- Computer programming course, SURE 272, developed and implemented
- Selected astronomy topics eliminated

- Three courses, SURE 365, SURE 465, SURE 420 designated as writing intensive.
- Ethics course, SURE 331 added to the program
- Oral presentations added to GIS and geodesy courses
- Flexibility in scheduling by offering certain courses (specifically SURE 110, SURE 220, SURE 230, SURE 115, SURE 116) more than once a year.

B. New Hardware Acquisitions

- Purchase of five new Leica Total Stations
- Acquisition of Image Station
- Purchase of three digital levels
- Acquisition of survey grade and GIS grade GPS receivers
- Continuing support from Topcon, Inc. with Total Stations and digital levels
- Yearly computer laboratory upgrades

C. New Software Acquisitions

- CAD: AutoCad 14, Eagle Point, Microstation
- Data Collection: Tripod Data Systems
- GIS: ArcInfo NT, ArcView, Pathfinder Office, Intergraph MGE
- Computer Programming: Lahey Fortran, MathCad
- Project Management: Microsoft Project
- Office Management (Word Processing, Spread Sheets, Data Base): Microsoft Office Suite
- GPS: Trimble Suite

D. Expansion of Program Advisory Committee

Since the last ABET accreditation visit the following individuals have been added to the Surveying Engineering program advisory committee.

Gary C. Bilow, PS, Director of Surveys, Michigan Department of Natural Resources

John C. Matonich, PS, PE, CEO, Rowe Engineering, Inc., Flint, Michigan

- Mr. Bilow provides expertise in the public sector, specifically state government.
- Mr. Matonich provides expertise with large, multidisciplinary engineering firms.
- Both provide extensive leadership and management acumen.

E. Formation of Lambda Sigma Honor Society

In the Spring of 1996, sixteen students from the Surveying Engineering program were inducted into Lambda Sigma at Purdue University. These students became the nucleus of the Ferris chapter. Each year, those in the top one-third of the junior class or the top one-third of the senior class are eligible to apply for membership. Three members of the advisory committee have been inducted as honorary members and faculty members have been inducted as associate members.

These changes and improvements were driven by a number of sources:

- Reaction to past constituent surveys.
- Deficiencies noted in evaluations.
- Strategic planning.
- Needs identified by program faculty.
- Identification of market forces.

VIII. Materials that will be available for review during the visit to demonstrate achievement of the Program Outcomes and Assessment.

- Course materials that illustrate evaluation of student performance
- Course outlines and descriptions
- Licensing examination results
- Alumni survey results
- Employer survey results
- Student survey results
- Faculty survey results
- Advisory Committee survey results
- Ferris State University transfer student and outside credit evaluation policies

IX. Policies for transfer student acceptance are detailed in Appendix II and the Ferris State University Catalogue. Transfer credit is subject to the following criteria:

- FSU articulation agreements with the former institution
- Regional accreditation of the former institution
- Achievement of an overall GPA of 2.0/4.0 from the former institution
- Individual course grades of less than 2.0 are not transferred to the Surveying Engineering program
- Students who transfer to Ferris from a Michigan community college with an associate degree and a 2.0 GPA are given junior status. These students are considered to have met general education requirements.
- Students who transfer from a Michigan community college with a MACRAO-stamped transcript who do not possess an associates degree are considered to have fulfilled the lower level general education requirements.
- Credit may be granted for military training courses, group study or correspondence work if the course(s) or other work is recommended for credit by the American Council of Education or verified through an appropriate Ferris competency assessment process.
- Credits from transferred course work are recorded on the Ferris State University

transcript but do not count toward the FSU cumulative GPA or academic honors computation.

X. Policies for transfer credit validation are detailed in Appendix II and the Ferris State University Catalogue. Major highlights are:

- Transcripts of transfer students are evaluated by the Dean's Office and the program coordinator.
- Transfer course equivalency evaluations are determined by the Construction and Facilities Department with comparable course work as indicated by the Ferris course designator.
- Course evaluations allow equivalency determination where courses are at least 75% the same content. Course numbering is not a deciding factor.
- In those cases where specific course equivalents are not transferred, prerequisite course requirements may be waived and the course equivalency granted when the transfer student completes the next course in a sequence with a grade of "C" or better, demonstrating prior preparation equivalent to preceding courses in the sequence. Failure to achieve a grade of "C" or better in the latter course indicates that the student needs to take the appropriate Ferris prerequisite course.
- Course sequences or clusters may be evaluated for FSU course equivalency in toto rather than course by course.

4. Professional Component

The Professional Component is an important part of the Surveying Engineering program. The program objectives have been formulated and published and they indicate the critical role that the professional component has on the education of the survey engineer here at Ferris State University.

As a minimum, students must have a year of college mathematics and basic sciences. The 19 semester hours of mathematics (includes SURE 372 and a part of SURE 373) and 18 hours of physics, chemistry and geology prepare the student to meet the challenges of the upper division courses within the program. The mathematics and science courses provide the basic tools necessary for students to understand the surveying engineering courses. In addition, the science courses are critical in providing the experimental experience that the students need in the engineering design portion of the curriculum.

A minimum of one and one-half years of engineering topics are also required. The 65 semester hours of engineering courses are designed to prepare the graduate for the work place of tomorrow. Just as engineering has a number of divisions, survey engineering has a number of specialties. With the onset of new technologies such as the global positioning systems and geographic information systems, it is essential that the graduates be prepared to enter a profession that will change considerably during their working years. The goal is to give the student the ability to see how technology has transformed the work place. The program consists of a mixture of practice and theory so that the graduates understand not only the advantages of this technology but also the limitations of these tools.

General education courses function to help students grow into productive citizens of the community where they will reside. For a community to survive, it needs the support of its citizenry. The commitment to help and serve is nurtured through the general education requirements all students must complete prior to graduation. The general education requirements at Ferris State University require graduates to be able to communicate effectively and to understand issues of race, gender and ethnicity. In addition, cultural enrichment, social awareness and global consciousness courses help to make that graduate a more well-rounded individual. This program has integrated general education principles into the curriculum. This is done with writing intensive coursework, requirements of papers and reports, oral presentations, and a host of other activities that the faculty have incorporated within their courses. In addition, some courses also bring in invited speakers from industry to supplement the formal lectures the students receive.

To ensure that graduates are capable of functioning within the broad engineering field, the specialization of surveying is augmented with other engineering courses. In particular, students must successfully complete coursework in materials, testing, statics and strengths of materials, soils engineering, hydrology and hydraulics engineering. These courses provide the breadth necessary to function as an engineering team member on design projects.

The ability to design and undertake experiments is critical for the surveying engineer since real-world problems are diverse and seldom follow the ideal setting found in textbooks. There are 18 courses within the program with a laboratory component. These problem-solving experiences are designed to augment the material presented within the lectures. In addition, it gives the students experience in formulating experiments, conducting data collection, and analysis of the results. It is also important for students to be exposed to "real-world" experiences as much as possible before they enter their professional lives. This approach to education has led to the success of the program as shown in the results of the Surveyor Fundamentals examination that most of the graduates take during their senior year. Last year, Ferris graduates had the highest percentage of success from all universities/colleges in the country (considering only those programs with more than two test takers).

The program is designed to show that it is incumbent upon the graduates to consider their degree as just the first step in a life-long commitment to education. Professional status is maintained through a program of continuing education. Students are encouraged by faculty to commit to continuing education. For example, the Michigan Society of Professional Surveyors (MSPS) allows students to attend seminars for only $25.00. It also allows students to attend the annual conference free. In both cases the students receive the same treatment as professional MSPS members. Most students take advantage of this. Students are encouraged to become involved in professional organizations. Again, many are student members of at least one professional organization. This activity sometimes diminishes once the student graduates but those who remain committed form a very active core. For example, 50% of the current officers on the MSPS Board of Directors are Ferris State University graduates.

The capstone course, SURE 435, requires students to draw upon their diverse background in a major design project. The creation of a subdivision forces the student to look at the economic, technical and aesthetic components of development. Economically, students see the dichotomous needs of maximizing profits for the developer with societal goals of sustainable development. Legal restrictions may limit the actual number of parcels that can be created but when tied into the fabric of the development can enhance the return for the developer. Technically students see the impact that development has on its surroundings.

Students learn best when they are given the tools that they will be utilizing in their career. For that reason the program maintains a well-equipped and modern facility. The computer has permeated the complete curriculum from solving complex surveying and engineering problems to simple word processing and spreadsheet utilization. The computer is the tool used for most of the problem solving within the curriculum. Modern surveying instruments are generally integrated with computers to facilitate data processing. CAD is so ingrained within the curriculum that in many classes its utilization in problem solving is as routine as the hand-held calculator.

Evidence that will be available to show achievement in this Criterion will include:

- Samples of student work
- Course descriptions and outlines
- Student surveys
- Employer surveys
- Alumni surveys

5. Faculty

The program faculty are dedicated and more than qualified to teach within the curriculum. To date there are five full-time, tenure-track faculty (the program coordinator is given no more than a 50% teaching load). Two Surveying Engineering courses (SURE 321 and SURE 421) are taught by Construction Technology and Management faculty. In addition, the program requires one additional adjunct faculty member to meet all the demands of the courses within the curriculum. While program demands are being met through the use of adjunct faculty, the authorization for a full-time tenure track position would enhance the quality of instruction and remove the need to hire on a semester to semester basis. A request for this position has been made as part of the Unit Action Plan process described in Section 7, "Institutional Support and Financial Resources".

All of the full-time faculty have at least a Master's degree in the surveying engineering area. In addition, four of these members, along with the adjunct, are licensed as Professional Surveyors. The faculty resumes demonstrate that the faculty are professionally involved at the state and national level. There is also an important thread through the faculty that maintaining professional competency is critical to the viability of the Surveying Engineering program.

Evidence that will be available to show achievement in this Criterion will include:

- Faculty resumes in Appendix I C.
- Data in Appendix I, Tables 3 and 4
- Faculty surveys
- Advisory Committee surveys

6. Facilities

Classrooms, laboratories, equipment and infrastructure must be adequate to accomplish program objectives.

Survey instruments, photogrammetry instruments and support equipment available to the faculty and students are both modern and representative of the surveying and mapping industry. The surveying and mapping instrument inventory at Ferris State University has been assembled over a forty-year history of surveying education. It has always been the objective of the faculty to provide a sufficient supply of high quality and well-maintained instruments to our students. University funding, industrial consignment and donations, government loans by the National Imagery and Mapping Agency and matching grants from the National Science Foundation have enabled our program to acquire many sophisticated instruments and software. As a result, the program has maintained modern and advanced surveying and mapping laboratories.

Consignments from instrument manufacturers include:

Five total stations and a digital level from TOPCON Corporation of America. According to the consignment agreement made in 1992, TOPCON will provide the university with new instruments every academic year. At the end of the academic year the instruments are returned back to TOPCON at no costs to the university.

Two Trimble SSTI geodetic Global Positioning Systems (GPS) receivers with software.

Two Magellan NAV 5000 PRO GPS receivers with submeter kit and software.

National Science Foundation Grants:

$72,000 Instrumentation and Laboratory Improvement (ILI) grant received for the purchase of analytical and softcopy photogrammetry equipment. The university provided an additional $72,000 as matching funds. This provided for the purchase of one Leica SD-2000 analytical stereoplotter, one Zeiss P-33 analytical stereoplotter, three softcopy Digital Video Photogrammetry (DVP) stations, and eight Kork Systems mapping software keys.

$25,000 Instrumentation and Laboratory Improvement (ILI) grant received for the purchase of "field-to-finish" surveying equipment. The university provided an additional $25,000 as matching funds. This provided for the purchase of three Leica total stations, three 80386 microcomputers, and one HP Draftmaster plotter.

Newer specific state-of-the art equipment available to accomplish program objectives is categorized below. The entire equipment inventory is too extensive to list here and is included in Table 6, Appendix I.

1. Total Stations, Levels, and Theodolites

5 - TOPCON Total Stations
5- LEICA Total Stations
2- TOPCON Digital levels each with two bar-coded rods
5- Leica Automatic Levels
5–Wild T3 Precision Theodolites

2. GPS Hardware and Software

4 PROXR Receivers
2 SST Trimble receivers capable of kinematic measurements.
2 SSI Trimble receivers capable of kinematic measurements.
2 Magellan NAV 5000 PRO receivers with submeter kit and software

3. Computers

1 80486/50 EISA Server with 1 GB Hard Drive
15 Pentium processor microcomputers
1 HP LaserJet Printer
1 24" x 36" Calcomp Digitizing Tablet

4. Photogrammetric Equipment

1 SD-2000 Leica analytical plotter with ATLAS mapping software
1 Zeiss P-33 analytical plotter with CADMAP software
3 DVP softcopy photogrammetry stations
1 Intergraph Imagestation

5. Major Software

Complete package of EAGLE POINT
3 Tripod Data System TDS
10 ARC VIEW
10 PC ARC/INFO (NT versions)
4 PATHFINDER OFFICE
1 50 stations 386 NOVEL Local Area Network (LAN)
1 DRAGON Image processing software for GIS
8 Kork Systems mapping software for analogue stereoplotters
Site license for several modules of Softdesk

As stated in previous sections, the laboratory equipment is sufficient and adequate for the number of students currently enrolled in the program. However, an increase in enrollment will require additional equipment through university funding as well as outside support.

The following laboratory and classroom space is available for instruction:

Computing Laboratory Swan 206 - 1000 sq. ft.

This laboratory houses 19 microcomputer stations, one laser printer, two plotters, and one Calcomp digitizer. These computers are all linked by a NOVEL Local Area Network. The network has graphics packages, high level programming language compilers, spreadsheets, word processor and the surveying and mapping specialty software. In addition, these computers are connected to the College of Technology file server. A link to the outside the university is facilitated by T1 line which provides Internet access. Additional microcomputer stations are housed in Swan 201, Mapping Laboratory, adjacent to Swan 206.

Mapping Laboratory Swan 201, 204 - 1980 sq. ft.

This laboratory houses 13 photogrammetric stereoplotters, and 6 microcomputers. Of the 13 plotters, three are analytical plotters, six are analog plotters interfaced with computers, three are DVP units (located in the adjacent computing laboratory), and one is an Intergraph Image Station.

Mapping Laboratory General Campus - 750 Acres

All outdoor surveying laboratory courses are taught and supervised by faculty themselves. The university owns approximately 750 acres of land that provides ample space to perform surveying functions.

Surveying Engineering Classroom Swan 211 - 930 Sq. ft

This area serves as a primary classroom/lab for the Surveying Engineering program. It is located close to the surveying instrument room, and is convenient for teaching courses which require actual equipment demonstration. It also houses a Mapograph in the back of the room, and some display cases. The classroom furnishings are adequate. This room was remodeled in 1988, is carpeted and has excellent new furniture. All field-surveying courses use this room. A large screen monitor and computer is available to facilitate computer instruction.

Surveying Instrument Room Swan 209 - 600 sq. ft.

This area houses all the surveying and surveying related equipment, and also has an equipment dispensing area with counter as well as office space for the dispensing personnel.

Drafting Laboratory Swan 203 - 1500 Sq. ft.

This room is primarily used by the Architectural Technology program. However, it is also used for various drafting courses within the Construction and Facilities Department. This room was also remodeled in 1988 and has excellent drafting tables. Topographical drafting and subdivision design courses use this room.

Construction Materials Lab CTC 107 - 5600 sq. ft.

This laboratory provides a well-equipped 1200 SF soils and material laboratory and a construction assembly and testing laboratory of 4400 SF. The space and equipment in this lab are used for teaching soils, materials, and construction practices courses. CONM 121 and SURE 421 use this facility. This facility is primarily used for other courses within the Construction and Facilities Department.

EQUIPMENT MAINTENANCE AND UPGRADE PLAN:

* COT means College of Technology
** S. & E. means Supplies and Expenses allocation fund

Five-Year Plan

	COST	FUNDING SOURCE
First Year: 1993/94		
Upgrade 8 80386 Microcomputers @ $800 each	$6,400	*COT Equipment Allocation
Remodeling of Surveying Instrument Room	$4,000	Development Fund
Replacement of existing laser printer	$1,500	COT Equipment Allocation
Equipment Maintenance Cost	$3,500	**Department S. & E. Fund
	$15,400	
Second Year: 1994/95		
Upgrade remaining 8 80386 Microcomputers at $800 ea.	$4,800	COT Equipment Allocation
Replacement of 8 dumpy levels	$5,600	COT Equipment Allocation
One Additional hard drive for the Server	$2,500	COT Equipment Allocation
Equipment Maintenance	$3,500	Dept. S. & E. Fund
	$16,400	
Third year: 1995/96		
Replacement of Existing Server, and software	$8,000	COT Equipment Allocation
4 microcomputers $2,000 ea.	$8,000	COT Equipment Allocation
Equipment maintenance	$4,000	Dept. S. & E. Funds
	$20,000	
Fourth Year: 1996/97		
Replacement of Vernier Type Instruments	$10,500	COT Equipment Allocation
4 microcomputers	$8,000	COT Equipment Allocation
Equipment Maintenance	$4,000	Dept. S. & E. Funds
	$22,500	

Fifth Year: 1997/98

Replacement of laser Printer	$1,500	COT Equipment Allocation
Replacement of HP Plotter	$5,000	COT Equipment Allocation
4 microcomputer upgrades	$3,200	COT Equipment Allocation
Replacement of 2 EDMIs	$6,000	COT Equipment Allocation
Equipment maintenance	$4,500	Dept. S. & E. Funds
	$20,200	

Fifth Year: 1998/99

5 Leica Total Stations	$20,000	S & E and Vocational Education Funds
TDS Software	$300	University equipment funding
EAGLE POINT Software	$1,500	University equipment funding
TOPCON Digital level	$3,500	University equipment funding
Upgrade photogrammetry equipment	$2,500	University equipment funding
Upgrade computer Lab. (hard drives, memory and zip drives)	$ 4,685	University equipment funding
	$32,485	

7. Institutional Support and Financial Resources

The yearly Supplies and Expense budget is allocated by the Construction and Facilities Department Head who allocates the funding received from the College of Technology among the four major program areas: Architectural Technology/Facilities Management, HVACR, Construction Technology and Management, and Surveying Engineering. This allocation depends on such factors as past funding, number of faculty, number of students, accreditation needs, etc.

Table 5, Appendix I presents supporting documentation.

As stated previously, the key words in the mission statement of Ferris State University are: national leader, career oriented, technological, and professional. The Surveying Engineering program reflects all these key words. All administrators from department head to university president and the members of the Board of Trustees are aware of the importance and relevance of the Surveying Engineering program to the university. The university has made significant investment in the program in terms of facilities, equipment, and personnel. The university wants the program to continue as a national leader in undergraduate surveying engineering education in the country.

The faculty in the program believe that the members of the Board of Trustees, the president, and the vice president for academic affairs all strongly support the Surveying Engineering program.

The university president has devised a method of planning and budgeting. It is called Unit Action Plan (UAP). Briefly, UAP's are developed by program faculty. Faculty determine which instruments need to be upgraded and what new equipment to buy and how the facilities need to be renovated. They also set the priorities as to which of the items in the UAP are of high importance. The UAP's are submitted to the department head. UAP's are consolidated and prioritized at department and college level before being forwarded to the vice president for academic affairs, who recommends funding and priorities to the university president.

For Fiscal Year 1999 to date, Unit Action Plans included the following:

FY 1999 Unit Action Plan	Outcome
Surveying Technology:	
UAP 1, Create an Outreach Program	Conducted a one-day and a two-day seminar at LIAA. Carried forward as FY 2000 UAP 6.
UAP 2, Student Outcomes Assessment	Compiled and analyzed data.
UAP 3, Vocational Education Funding	Received $17,500, funds applied to purchase of five TC1100 Theomats. Carried forward as FY 2000 UAP 3.
Surveying Engineering:	
UAP 1, New Faculty Position	No action. Carried forward as FY 2000 UAP 1.
UAP 2, Recruitment	Recruiting poster not funded. Carried forward as FY 2000 UAP 2.
UAP 3, Accreditation	Self-study funded, $500. SD 2000 plotter repair funded $2,000. Travel to ABET conference funded $1,660. Fall 1999 ABET visit funded $4,240. Carried forward as FY 2000 UAP 4.

Copies of the six FY 2000 UAP's follow. An additional $5,000 in FY 1999 funding has been received, allowing the program to fund two items on FY 2000 UAP 3 (upgrade photogrammetry laboratory computers and purchase one digital level).

GOAL 1. **New Faculty Position**
Seek funding approval to add a tenure track faculty position to Surveying Engineering (Academic, Quality)

MAJOR ACTIVITIES AND PROCESSES

- Prepare needs statement and justification for the position.
- Seek administrative approval for the position.
- Develop new faculty qualification statements.
- Advertise, interview and hire.

EXPECTED OUTCOMES

- Improve the quality of instruction academic standards.
- Minimal need to hire temporary faculty.
- More consistent delivery of instruction.
- Provision for better student advising.
- More flexible class scheduling for students.

INDICATORS/SOURCES

- Have hired a full time temporary faculty for the past seven semesters.

REPORTING PROCESS

- Report to department head, dean, and the Academic Affairs to seek funding approval.

RESOURCE REQUIREMENTS

	FTE	Salary	Adult Part-time	Student Wages	S&E	Equipment	Total
Internal reallocation							
One-time resource request							
Base funding request	1	50,000					50,000
Total							50,000

GOAL 2. **Recruitment**
Develop and carry out an aggressive marketing of the programs.
(Academic, Visibility, Enrollment)

MAJOR ACTIVITIES AND PROCESSES

- Develop a poster and other materials with the help of university advancement mail to all high schools, community colleges in Michigan.
- Visit the neighboring states during their annual surveying conventions and promote the new FSU Midwest Exchange Program.
- Partnering with community colleges and professional societies
- Visit more high school career days. Use our students as students of Ferris State University for recruiting more students.

EXPECTED OUTCOMES

- Increase enrollment.
- More students with better backgrounds resulting in higher retention.

INDICATORS/SOURCES

- High demand for graduates - not enough qualified employees to fill the needs of the profession. Last year, every graduate had three/four job offers.

- One time funding request of $3,500 for material development and student travel.

REPORTING PROCESS

- Report to faculty, advisory committee, and the surveying and mapping community.

RESOURCE REQUIREMENTS

	FTE	Salary	Adult Part-time	Student Wages	S&E	Equipment	Total
Internal reallocation							
One-time resource request					3,500		3,500
Base funding request							
Total					3,500		3,500

GOAL 3. **Equipment Purchase**
To purchase needed surveying and mapping equipment not obtainable through industry donations.
(Academic, Quality)

MAJOR ACTIVITIES AND PROCESSES

- Seek funding approval.
- Evaluate different alternative equipment suitable for instructional purposes.

EXPECTED OUTCOMES

- Maintain quality of instruction using current instrumentation in the laboratories.

INDICATORS/SOURCES

- Funding sources will be the Vocational Education Funding.
- Four regular theodolites and four levels $12,000
- Large screen 17" monitors for computer lab. $10,000
- Upgrade Computers in Photogrammetry Lab. $2,500
- One Lap Top Computer $3,000
- Three digital levels $12,000
- Upgrade faculty computers $10,000

REPORTING PROCESS

- Report results to Department Head, Dean and the program Advisory Committee.

RESOURCE REQUIREMENTS

	FTE	Salary	Adult Part-time	Student Wages	S&E	Equipment	Total
Internal Reallocation							
One-time Resource Request						49,500	49,500
Base funding Request							
Total						49,500	49,500

GOAL 4. **Accreditation**
Enhance professional development of faculty to fulfill ABET requirements.
(Academic, Quality, Visibility)

MAJOR ACTIVITIES AND PROCESSES

- Attend national conferences
- Participate in national and state level professional societies.
- ABET requires that faculty regularly attend such meetings.

EXPECTED OUTCOMES

- Faculty will network nationally and internationally
- Become aware of new technology developed by high-tech firms.
- Bring new equipment hardware and software

INDICATORS/SOURCES

- ABET requires that faculty attend national and state professional conferences. Request is for $5000 for faculty travel.

REPORTING PROCESS

- Report results to the faculty, department head, and advisory committee.
- Correction of deficiencies cited in ABET report.

RESOURCE REQUIREMENTS

	FTE	Salary	Adult Part-time	Student Wages	S&E	Equipment	Total
Internal reallocation							
One-time resource request							
Base funding request					5,000		5,000
Total					5,000		5,000

GOAL 5. **New Option in GIS**
Establish New Option in GIS
(Enrollment, Resources)

MAJOR ACTIVITIES AND PROCESSES

- Prepare needs statement and justification for the option.
- Seek academic and administrative approval for the GIS option
- Develop new courses.
- Use as many as existing FSU courses.
- Collaboration with Geography, Computer Science, and Computer Information System.

EXPECTED OUTCOMES

- Increase in student enrollment.
- Satisfy Industry need since GIS is being used in every level of government as well as industry.

INDICATORS/SOURCES

- Better use of existing equipment and software
- No need to buy new equipment or software
- Long history of excellence of surveying program at FSU

REPORTING PROCESS

- Report to department head, dean, and the Academic Affairs to seek funding approval.

RESOURCE REQUIREMENTS

No resources needed at this time.

GOAL 6.	**Create An Outreach Program**

Increase workshop/seminar offerings through LIAA/ISIS, and on campus.
Study the feasibility of offering a certificate program in Grand Rapids. Distance Learning
Expand the existing Certificate Program in GIS
(Visibility, Resources)

MAJOR ACTIVITIES AND PROCESSES

- Conduct annual training in Photogrammetry
- Promote distance learning in Geographic Information Systems (GIS) Conduct training and workshops through Institute for Spatial Information Science (ISIS) on GIS and Global Positioning Systems (GPS).
- Offer courses in Grand Rapids and explore the possibility of weekend classes

EXPECTED OUTCOMES

- Promotion of Ferris State University in general and Surveying Technology and Engineering in particular.
- Financial gains from training and workshops for the program.
- Increase enrollment potential in B.S. Surveying Engineering.
- Development of positive industry contacts.
- Certificate program in GIS offered via Internet has been profitable for the University.

INDICATORS/SOURCES

- Industry needs.
- Collaboration with community colleges, high schools, utility companies on GIS training.
- Collaboration with local governments and utility companies.

REPORTING PROCESS

- Report results to the faculty, department head, and advisory committee.
- Publish results to the surveying and mapping community within Michigan and nationally.

RESOURCE REQUIREMENTS

- The program has made an annual $7500 seed money commitment to LIAA. However, it is anticipated that this amount will be generated by faculty through training workshops and possible grants.

A base increase of $5,000 for faculty development has been requested in the UAP. In addition, there are other sources of funding available within the university. For example, there is Timme travel funding which is limited to $400 per faculty per year. There are also Timme grants available for faculty development. The Surveying Engineering faculty have received both of the above grants several times. The Center for Teaching, Learning and Faculty Development also provides grants and stipends for those faculty who are involved with faculty development activity sponsored by them. One Surveying Engineering faculty member received this funding this year.

The previously discussed institutional supply and expense budgeting process, Unit Action Plan process, physical facilities support and support from the industry have all combined to allow the Surveying Engineering program to acquire, maintain and operate adequate or better facilities and equipment.

The equipment repair technician discussed previously is for repair and maintenance of all photogrammetry and surveying equipment along with the software that is intrinsically related to the hardware such as TDS software, GPS software, photogrammetry software, and all other software which is hardware locked such as ARC/INFO, ARC/CAD, IDRISI, etc. The technician assigned to this position is very familiar with the survey engineering equipment and software.

The other institutional services such as general computing support and library support are adequate. A new library is under construction and will be completed in spring of 2001.

8. Program Criteria

Program criteria in the area of curricular topics are met in two ways, by course content and by course sequence. Course content is designed to meet the requirements of the State of Michigan Board of Licensing for Professional Surveyors, ABET, and Ferris State University and to produce the desired program outcomes. Course sequence is designed such that lower level courses provide the foundation needed to support upper level courses and that integration of disciplines occurs throughout the Ferris experience. Details can be found Section 3, "Program Outcomes and Assessment".

Details of program faculty qualification are addressed in Section 5, "Faculty". All tenure-track program faculty members hold graduate degrees in their specialties. Most faculty members are licensed as Professional Surveyors. All faculty members take active roles in local, state and national professional societies, maintain extensive contacts with the industry and, as part of their professional responsibilities, regularly advise students on both academic and professional matters. The faculty prides itself on its diversity, combining and integrating education with experience and theory with practice.

Appendix I - Additional Program Information

A. Tabular Data for Program

Table 1. Basic level Curriculum

Table 2. Course and Section Size Summary

Table 3. Faculty Workload Summary

Table 4. Faculty Analysis

Table 5. Support Expenditures

Table 6. Equipment Inventory

B. Course Syllabi

C. Faculty Curriculum Vitae

Table 1. Basic-Level Curriculum

Surveying Engineering

Year; Semester or Quarter	Course (Department, Number, Title)	Category (Credit Hours)			
		Math & Basic Sciences	Engineering Topics Check if Contains Design (✓)	General Education	Other
First Year First Semester	SURE 110:Fund. of Surveying		4 (✓)		
	MATH 130:Adv. Alg. & Trig.	4	( )		
	ENGL 150: English I		( )	3	
	SURE 115: Intro. Comp. Mapping		2 (✓)		
	Cultural Enrichment Elec		( )	3	
	HLTH 128: First Aid		( )		1
			( )		
First Year Second semester	SURE 116: Intro. Microstation		2 (✓)		
	MATH 220:Ana. Geo. & Calculus	5	( )		
	CONM 121:Mat. Pro. & Testing		3 (✓)		
	CHEM 121: General Chemistry	5	( )		
	ENGL 250: English II		( )	3	
			( )		
Second Year Third Semester	SURE 220: Eng. Surveying		4 (✓)		
	SURE 215: Sur. Computations		3 (✓)		
	MATH 230:Ana. Geo. & Calculus	5	( )		
	PHYS 241: Physics I	5	( )		
			( )		
Second Year Fourth Semester	SURE 230: Advanced Surveying		4 (✓)		
	SURE 272: Geomatics Computation		( )		3
	PHYS 242: Physics II	5	( )		
	CONM 221: Stat. & Stren. Of Matl.		3 (✓)		
	BLAW 221: Elem. Business Law		( )		3
Third Year Fifth Semester	SURE 365: Legal Aspects of Surv.		3 (✓)		
	SURE 372: Advanced Surv. Comp.	3	( )		
	SURE 329: Modern Cartography*		3 (✓)		
	SURE 339: Remote Sensing*		3 (✓)		
	SURE 131: Geology & Land Use	3	( )		
	COMM 121: Fund. Of Pub. Speaking			3	
	Social Awareness Elective			3	

*Choose one.

(continued on next page)

Table 1. Basic-Level Curriculum (continued)
Surveying Engineering

Year; Semester or Quarter	Course (Department, Number, Title)	Category (Credit Hours)			
		Math & Basic Science	Engineering Topics Check if Contains Design (✓)	General Education	Other
Third Year Sixth Semester	SURE 340: Photogrammetry		3 (✓)		
	SURE 325: Principles of GIS		2 (✓)	1	
	SURE 373 Adjustment Computations	2	1 (✓)		
	SURE 452: Geodesy 1		4 (✓)		
	SURE 331: Ethics & Prof. In E & T		( )	3	
			( )		
Fourth Year Seventh Semester	SURE 453: Geodesy II		4 (✓)		
	SURE 425: Technical Issues in GIS		3 (✓)		
	SURE 440: Analy. Photogrammetry		3 (✓)		
	SURE 421: Soils Engineering		4 (✓)		
	Cultural Enrichment Elective		( )	3	
			( )		
Fourth Year Eighth Semester	SURE 420: Prof. Practice of Survey.		3 (✓)		
	SURE 321: Hydraulics Engineering		4 (✓)		
	SURE 465: Legal Aspects of Surv. II		4 (✓)		
	SURE 435: The Urban Environment		3 (✓)		
	Social Awareness Elective		( )	3	
			( )		
			( )		
TOTALS-ABET BASIC-LEVEL REQUIREMENTS			( )		
OVERALL TOTAL FOR DEGREE		37	69 ( )	25	7
PERCENT OF TOTAL		27%	50%( )	18%	5%
Totals must satisfy one set	Minimum semester credit hours	32 hrs	48 hrs		
	Minimum percentage	25%	37.5 %		

Table 2. Course and Section Size Summary

Surveying Engineering

Course No.	Title	No. of Sections offered in Current Year	Avg. Section Enrollment	Type of Class			
				Lecture	Laboratory	Recitation	Other
SURE 110	FUND. OF SURVEYING	2	15	50	50		
MATH 130	ADV. ALG. & NUM. TRIG.	8	25	100	0		
SURE 115	INTRO. TO COMP. MAPPING	2	16	50	50		
SURE 116	MICROSTATION	2	16	50	50		
MATH 220	ANALY. GEOM. & CALCULUS	4	25	100	0		
CONM 121	MATERIALS PROP. & TEST	4	16	67	33		
CHEM 121	GENERAL CHEMISTRY	20	25	80	20		
SURE 220	ENGINEERING SURVEYING	2	18	50	50		
SURE 215	SURVEYING COMPUTATIONS	2	25	67	33		
SURE 230	ADVANCED SURVEYING	2	18	50	50		
PHYS 241	GENERAL PHYSICS I	2	25	80	20		
PHYS 242	GENERAL PHYSICS II	2	25	80	20		
MATH 230	ANALY. GEOM. & CALCULUS	4	25	100	0		
ENGL 150	ENGLISH I	10	25	100	0		
ENGL 250	ENGLISH II	10	25	100	0		
COMM 121	FUND. PUBLIC SPEAKING	15	20	100	0		

Course No.	Title	No. of Sections offered in Current Year	Avg. Section Enrollment	Type of Class			
				Lecture	Laboratory	Recitation	Other
SURE 272	GEOMATICS COMPUTATIONS	1	18	100	0		
CONM 221	STAT. & STRENGTH OF MAT.	3	25	100	0		
BLAW 221	ELEM. BUSINESS LAW	6	45	100	0		
SURE 365	LEGAL ASPECTS OF SURV. I	1	24	100	0		
SURE 372	ADV. SURVEYING COMP.	1	24	100	0		
SURE 329	MODERN CARTOGRAPHY	1	18	67	33		
SURE 339	REMOTE SENSING	1	18	67	33		
SURE 340	PHOTOGRAMMETRY I	1	18	67	33		
GEOL 131	GEOL. & LAND USE MANG.	2	24	67	33		
SURE 325	PRINCIPLES OF GIS	1	18	67	33		
SURE 373	ADJUSTMENT COMP.	1	25	100	0		
SURE 452	GEODESY I	1	18	75	25		
SURE 425	TECHNICAL ISSUES ON GIS	1	18	75	25		
SURE 321	HYDRAULICS ENGINEERING	1	25	75	25		
SURE 331	ETHICS & PROF IN EGRG/TECH	1	20	100	0		
HLTH 128	FIRST AID DESIGNATED FIELDS	1	25	100	0		

Course No.	Title	No. of Sections offered in Current Year	Avg. Section Enrollment	Type of Class			
				Lecture	Laboratory	Recitation	Other
SURE 440	ANALY. PHOTOGRAMMETRY	1	20	75	25		
SURE 421	SOILS ENGINEERING	1	20	75	25		
SURE 420	PROF. PRACTICE OF SUR.	1	20	100	0		
SURE 453	GEODESY II	1	18	75	25		
SURE 465	LEGAL ASPECTS OF SURE II	1	20	75	25		
SURE 435	THE URBAN ENVIRONMENT	1	20	67	33		

Table 3. Faculty Workload Summary

Surveying Engineering

Faculty Member (Name)	FT or pt	Classes Taught (Course No./Credit Hrs.) Term and Year	Total Activity Distribution		
			Teaching	Research	Other
Bueche	pt	Winter 1999:	100%		
		CONM 122/3			
		CONM 122/1 (lab only)			
		SURE 110/4			
		(Temporary replacement for Hashimi, who was			
		on sabbatical leave)			

Table 3. Faculty Workload Summary

Surveying Engineering

Faculty Member (Name)	FT or pt	Classes Taught (Course No./Credit Hrs.) Term and Year	Total Activity Distribution		
			Teaching	Research	Other
Burtch	FT	Fall 1998:	70%		30%
		SURE 339/3			
		SURE 339/1 (lab only)			
		SURE 425/3			
		SURE 425/1 (lab only)			
		Winter 1999:	70%		30%
		SURE 215/3			
		SURE 325/3			
		SURE 325/1 (lab only)			
		SURE 425/4			

Table 3. Faculty Workload Summary

Surveying Engineering

Faculty Member (Name)	FT or pt	Classes Taught (Course No./Credit Hrs.) Term and Year	Total Activity Distribution		
			Teaching	Research	Other
Hashimi	FT	Fall 1998:	70%		30%
		SURE 115/2			
		SURE 116/2			
		SURE 215/3			
		SURE 372/3			
		Winter 1999:			100%
		Sabbatical Leave			

Table 3. Faculty Workload Summary

Surveying Engineering

Faculty Member (Name)	FT or pt	Classes Taught (Course No./Credit Hrs.) Term and Year	Total Activity Distribution		
			Teaching	Research	Other
Myers	pt	Fall 1998:	100%		
		SURE 110/4			
		SURE 220/4			
		Winter 1999:	100%		
		SURE 220/4			
		SURE 435/3			
		SURE 435/1 (lab only)			

Table 3. Faculty Workload Summary

Surveying Engineering

Faculty Member (Name)	FT or pt	Classes Taught (Course No./Credit Hrs.) Term and Year	Total Activity Distribution		
			Teaching	Research	Other
Rick	FT	Fall 1998:	80%		20%
		SURE 230/4			
		SURE 440/3			
		SURE 440/1 (lab only)			
		Winter 1999:	80%		20%
		SURE 230/4			
		SURE 340/3			
		SURE 340/1 (lab only)			
		SURE 373/3			

Table 3. Faculty Workload Summary

Surveying Engineering

Faculty Member (Name)	FT or pt	Classes Taught (Course No./Credit Hrs.) Term and Year	Total Activity Distribution		
			Teaching	Research	Other
Shangraw	FT	Fall 1998:	80%		20%
		CONM 122/3			
		CONM 122/1 (lab only)			
		CONM 122/1 (lab only)			
		SURE 365/3			
		Winter 1999:	80%		20%
		SURE 115/2			
		SURE 272/3			
		SURE 420/3			
		SURE 465/4			

Table 3. Faculty Workload Summary

Surveying Engineering

Faculty Member (Name)	FT or pt	Classes Taught (Course No./Credit Hrs.) Term and Year	Total Activity Distribution		
			Teaching	Research	Other
Thapa	FT	Fall 1998:	40%	20%	40%
		SURE 453/4			
		Program Coordinator			
		Winter 1999:	40%	20%	40%
		SURE 116/2			
		SURE 331/1.5			
		Program Coordinator			

Table 3. Faculty Workload Summary

Surveying Engineering

Faculty Member (Name)	FT or pt	Classes Taught (Course No./Credit Hrs.) Term and Year	Total Activity Distribution		
			Teaching	Research	Other
		Construction Management faculty teaching			
		Surveying Engineering courses:			
Moore	FT	Fall 1998:			
		SURE 421/4			
Hanna	FT	Winter 1999:			
		SURE 321/4			

Table 4. Faculty Analysis
Surveying Engineering

Name	Age	Rank	FT or PT	Highest Degree	Institution from which Highest Degree Earned & Year	Years of Experience			Professional Registration (Indicate State)	Level of Activity (high, med, low, none) in:		
						Govt./Industry Practice	Total Faculty	This Institution		Professional Society	Research	Consulting/Summer Work in Industry
ROBERT BURTCH	52	PROF	FT	MS	OHIO STATE UNIVERSITY, 1983	8	20	20	MICHIGAN	HIGH	NONE	MED
SAYED HASHIMI	54	PROF	FT	MS	PURDUE UNIVERSITY, 1975	7	22	22	MICHIGAN	HIGH	NONE	MED
JENS RICK	58	PROF	FT	MS	UNIVERSITY OF MICHIGAN, 1971	7	27	27	MICHIGAN	MED	NONE	MED
CARL SHANGRAW	51	ASST PROF.	FT	MS	PURDUE UNIVERSITY, 1993	20	4	4	MICHIGAN	MED	LOW	MED
KHAGENDRA THAPA	48	PROF.	FT	PHD	OHIO STATE UNIVERSITY, 1987	2	19	12	UK LIST	HIGH	LOW	MED
MARVIN MYERS	48	ADJ	PT	BS	FERRIS STATE UNIVERSITY, 1979	26	5	5	MICHIGAN	LOW	NONE	HIGH

Table 5. Support Expenditures

Construction and Facilities Department

	1	2	3	4
Fiscal Year	(prior to previous year)	(previous year)	(current year)	(year of visit)
Expenditure Category	**FY 97**	**FY 98**	**FY 99**	**FY 00**
Operations (1) (not including staff)	$101,432	$87,816	$174,574	$140,000
Travel (2)	29,527	24,869	32,519	30,000
Equipment (3)				
(a) Institutional Funds	60,027	36,984	33,653	30,000
(b) Grants and Gifts (4)	238,983	636,254	247,879	NA
(c) Cash Gifts	16,916	20,839	25,909	NA
(d) Voc Ed Funds	75,904	46,848	81,100	NA
Graduate Teaching Assistants				
Part-time Assistance (5) (other than teaching)				

Surveying Engineering Program

	1	2	3	4
Fiscal Year	(prior to previous year)	(previous year)	(current year)	(year of visit)
Expenditure Category	**FY 97**	**FY 98**	**FY 99**	**FY 00**
Operations (1) (not including staff)	$14,740	$6,265	$21,185	$22,000
Travel (2)	6,815	2,774	3,493	5,000
Equipment (3)				
(a) Institutional Funds	16,813	16,129	13,280	15,000
(b) Grants and Gifts (4)	102,300	173,995	220,000	NA
(c) Cash Gifts	5,450	2,534	675	NA
(d) Voc Ed Funds	12,824	0	17,500	NA
Graduate Teaching Assistants				
Part-time Assistance (5) (other than teaching)				

NOTE: FY 99 Department Operations includes approximately $40,000 in one-time income and expenditures.

Table 6. Equipment Inventory

COMPUTER HARDWARE & SOFTWARE

12 Zenith 386's (IBM Compatible) with 40 mb hard drives
3 Epson FM-285 printers
1 Toshiba P-341 printer
1 Hp Draftsmaster plotter
4 Summasketch digitizing tablets
1 Kurta digitizing tablet
8 MS-mice
Software includes WILDsoft, CivilCADD, PC ARC/INFO, Turbo Pascal, MS-Fortran, Lotus 123, Idrisi, Macro Assembler, BASIC, DBASE III+, Trimble GPS software

-Electronic Distance Measuring Equipment and Accessories

1 Wild DI-1000
1 Wild Citation
1 AGA - Model 76 Laser DM
1 L.S.E. - Laser Ranger EDM
1 K&E - Infrared Auto Ranger EDM
1 Kern - DM100 Infrared EDM
2 AGA - Model 6, Incandescent Geodimeter
1 AGA - Model 6A, Incandescent Geodimeter
1 AGA - Model 4B, Incandescent Geodimeter
1 AGA - Model 4D, Incandescent Geodimeter
2 Tellurometer - Microwave EDM
16 Retro-prisms & Housing
7 Battery Chargers
8 Battery Power Packs
2 Altimeter Barometers
2 Lietz - Tribrach Adapters

-Theodolites/Accessories

3 Wild T-1600 total Stations w/ Rec. Modules & DI-1000
6 Wild - T2 Theodolite
1 Wild - T1 Theodolite w/ Traverse Kit
5 Wild - T16 Theodolite
1 Wild - T4 Precision Theodolite
1 Wild - T0 Forester Theodolite
5 Wild - T3 Precision Theodolites
2 Lietz - TM20C Theodolite w/ Tribrachs
1 Kern - DKM2 Theodolite
1 K&E - KE-1E Theodolite
1 Kern - DKM1 Theodolite
1 Dietzgen - Theodolite
5 Wild - Traverse Kits
5 Nikon NT2S Theodolites
3 Roeloeff - T2 /T16 Solar Prisms
13 Wild - T2 Travel Holders
15 Wild - T2 Lights
5 Wild - Battery Packs
3 Electronic Stop Watches
2 Realistic - Time Cubes
2 Bacarach - Sling Psychrometers
1 Astronomical Amplifier
1 Hamilton - Sidereal Chronometer Watch
1 Chronograph
1 MK II Astrocompass
1 Suncompass
1 Wild - Optical Kit Assembly
1 Trimble 4000SX Global Positioning System Receiver

- Transits/Accessories

9 - 20" Gurley
1 - 20" David White
5 - 30" K&E
1 - 30" Burger
2 - 1" David White
2 - Schoensteadt - Magnetic Locator
1 - Knight - Magnetic Locator
1 - Aqua - Dip Needle

- Leveling

2 - Wild NA2 Automatic Levels
1 - Wild N3 Precise Tilting Level with two precision invar rods
2 - Wild N10 Tilting Levels
4 - Zeiss N2 Compensator Levels
1 - Kern GK1-A Compensator Level
11 - 18" Dumpy Engineering Levels
2 - 18" Wye Engineering Levels
2 - Wild Invar GPL3 Level Rods

- **Topographic Equipment**
  - 1 - Mapograph
  - 1 - Wild RDS Tacheometer
  - 2 - Wild GVLV "E Face" Topographic Rods
  - 4 - Explorer Alidades
  - 6 - Plane Tables
  - 1 - Sextant

- **Ancillary Equipment for Above Instruments**
  - Numerous 100-foot steel Tapes
  - Numerous 100-foot fabric Tapes
  - 1 – Precision Invar-steel tape - 100'
  - 1 - Standardized carbon steel tape - 100'
  - 2 - Surveying Compasses
  - 4 - Silva Ranger Compasses
  - Numerous Line Rods
  - Numerous Level Rods
  - Numerous Tripods
  - 8 Motorola VHF/FM 2 and 5 watt hand held radios all sharing a common frequency.

- **Maintenance & Repair Equipment**
  - 1 - Atlas - Metal Turning Lathe
  - 1 - Atlas - Drill Press
  - 1 - Bench Grinder
  - 1 - Oscilloscope
  - 3 - VOM Meters
  - Hand Tools & Other Repair Equipment

B. Course Syllabi

1. **COURSE:** BLAW 221 - Elementary Business Law.

2. **DESCRIPTION:** A survey course in business law; covers contracts and sales, business organizations, negotiable instruments, and real and personal property.

3. **PREREQUISITES:** None.

4. **TEXTBOOK:** *College Law for Business*, John D. Ashcroft & Janet E. Ashcroft.

5. **OBJECTIVES:** To acquaint the student with the basic concept of business law and provide him/her with a general idea of the nature of the legal principles and problems encountered in the business world (ABET Criteria 3d, 3f, & 3h).

6. **TOPICS:** Legal system and legal environment of business, contracts, sales, property, commercial paper, agency and employment, business organization.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight Lecture Hours
a.	The legal system and the legal environment of business. Introduction to law. Courts and court procedures.	3
b.	Contracts. Nature and classes. Offer and acceptance. Defective agreements. Capacity to contracts.	6
c.	Consideration. Illegal agreements. The written contract. Third parties and contracts. Termination of contracts.	5
d.	Sales. Sales of personal property. Formalities of a sale. Transfer of title and risk in sales contracts. Warranties of the seller. Consumer protection.	7
e.	Property. Nature of property. Transfer of real property. Real estate mortgages. Landlord and tenant. Wills and inheritances.	8
f.	Commercial paper. Nature of commercial paper. Essentials of negotiability. Promissory notes and drafts deposit. Liabilities of the parties to commercial paper. Negotiation and discharge. Holders in due course. Defenses.	7
g.	Agency and employment. Nature and creation of an agency. Operation and termination of an agency. Employer and employee.	4
h.	Business organization. Introduction to a business organization. Creation and operation of a partnership. Dissolution of a partnership. Nature of a corporation. Ownership of a corporation. Management and dissolution of a corporation. Business torts and crimes.	5
	Total	45

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Other: 3 credits.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Provide an educational experience that prepares our students for the challenges of the surveying profession that they will encounter during their professional life.

10. PREPARED BY: W. Halm **DATE:** March 1999

1. **COURSE:** CHEM 121 – General Chemistry 1.

2. **DESCRIPTION:** Fundamental principles, laws and theories of general chemistry, including stoichiometry, gas laws, thermochemistry, atomic structure, chemical bonding, periodicity, liquids and solids, solution chemistry, and theories of acids and bases. Concurrent workshop/laboratory sessions will include exercises illustrating the principles discussed in lecture. Co-requisite: MATH 115. Prerequisite: CHEM 103 or a year of high school chemistry.

3. **PREREQUISITES:** Co-requisite: MATH 115 (algebra). Prerequisite: CHEM 103 or a year of high school chemistry.

4. **TEXTBOOK:** *General Chemistry*, Darrell. D. Ebbing (5th edition). Published by Houghton Mifflin Company, Boston, MA, 1996. (Note: a new textbook—not yet determined—will be adopted for Fall Semester 1999).

5. **OBJECTIVES:**
   a. Learn basic concepts of chemistry applicable to a wide variety of fields (ABET Criteria 3a, 3h).
   b. Apply the methods of science, both in laboratory and lecture settings involving the production and interpretation of scientific date (ABET Criterion 3b).
   c. Solve problems involving chemical contexts (ABET Criteria 3b, 3e).
   d. Explain observable properties of matter in terms of the underlying structure of matter (ABET Criteria 3a, 3b).

6. **TOPICS:** See list of topics in next item.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	**Time Weight**	
		Lecture Hours	**Lab Hours**
a.	Basic concepts of chemistry.	4	6
b.	Atoms, elements, molecules and compounds.	8	3
c.	Chemical reactions and stoichiometry: an introduction.	8	9
d.	Thermochemistry.	4	3
e.	Electronic structure and the chemical bond.	11	3
f.	States of matter: gases, liquids and solids.	10	6
g.	Solutions and colloids.	5	6
h.	Metathesis and neutralization reactions.	4	6
i.	Introduction to acids and bases.	2	3
j.	Testing	4	
	Total	60	45

8. **CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:**
Basic Science: 5 credits.

9. **RELATIONSHIP TO PROGRAM OBJECTIVES:**
Provides broad educational experience including communications skills, mathematics, basic science preparing students for life-long learning.

Incorporate interdisciplinary concepts and problem solving exercises in the program.

10. **PREPARED BY:** D. Frank **DATE:** May 1999

1. **COURSE:** COMM 121 – Fundamentals of Public Speaking

2. **DESCRIPTION:** Training and experience in preparation and delivery of short speeches with emphasis on the clear, concise, local communication of ideas. Emphasis will be placed on informative and persuasive speaking.

3. **PREREQUISITES:** None

4. **TEXTBOOK:** *The Art of Public Speaking,* Lucas, Stephen E. 6th Edition. New York: Random House, 1998.

5. **OBJECTIVES:**
   a. The focus of this course will be to understand the role of oral communication in the functioning of a democratic society (ABET Criterion 3g).
   b. There will be an opportunity provided for students to learn and practice the fundamental principles of speaking and listening. Emphasis will be placed on informative and persuasive speaking (ABET Criterion 3g).

6. **TOPICS:** Characteristics of a speech, components of a speech, use of visual aids, speech topics and audience, research skills, selection and organization of topics for persuading the audience.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight Lecture Hours
a.	Demonstrate the ability to present speeches which are easily audible, smooth, clear, concise and interesting.	5
b.	Demonstrate the use of a variety of techniques for introduction and conclusion.	4
c.	Demonstrate effective use of visual aids.	4
d.	Demonstrate the ability to select topics and adopt them to specific audiences.	4
e.	Demonstrate the ability to use research skills for obtaining the highest quality support for speeches.	5
f.	Demonstrate an understanding of the group discussion process and the way it fits in our society.	4
g.	Demonstrate the ability to prepare and organize messages to most effectively persuade an audience.	4
	Total	30

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
General Education: 3 credits

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
To provide broad educational experience including communications skills, mathematics, basic science preparing students for life-long learning.

Provide opportunities for our students to exhibit creativity, leadership and team building abilities, cultural appreciation, global understanding, and social issues.

10. PREPARED BY: G. Horn **DATE:** March 1999

1. **COURSE:** CONM 121 - Materials Properties and Testing.

2. **DESCRIPTION:** Application and properties of construction materials. The sampling, testing and application of the physical properties of aggregates and portland cement concrete; bituminous materials, metals, and wood.

3. **PREREQUISITES:** MATH 116 concurrent.

4. **TEXTBOOK:** *Basic Construction Materials*, 5th ed., Marotta and Herubin, Prentice Hall, ISBN 0-13-570169-4.

5. **OBJECTIVES:**
   a. Provide the opportunity to analyze and interpret data (ABET Criterion 3b).
   b. Develop the ability to communicate effectively (ABET Criterion 3g).
   c. Provide a broad education (ABET Criterion 3h).

6. **TOPICS:** Introduction; laboratory use, standard testing procedures; origins, properties, uses and specification of aggregates; aggregate sampling and sieve analysis; aggregate weight-volume and moisture relationships; aggregate quality testing; history, types and uses of portland cement; properties, uses, mixing, placing and curing of portland cement concrete; design and testing of portland cement concrete mixes; properties, uses and specification of asphalt materials; properties, uses and specification of masonry and mortar; properties, uses and specification of steel and other metals; properties, uses and specification of wood and wood products.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight: Lecture Hours	Time Weight: Lab Hours
a.	Introduction.	1	
b.	Laboratory use, standard testing procedures.		3
c.	Origins, properties, uses and specifications for aggregates.	6	
d.	Aggregate sampling and sieve analysis.		3
e.	Aggregate weight-volume and moisture relationships.	1	3
f.	Aggregate quality testing.	1	3
g.	History, types and uses of portland cement.	2	
h.	Properties, uses, mixing, placing and curing of portland cement concrete.	4	3
i.	Design and testing of portland cement concrete mixes.		18
j.	Properties, uses and specification of asphalt materials.	3	
k.	Properties, uses and specification of masonry and mortar.	3	6
l.	Properties, uses and specification of steel and other metals.	3	3
m.	Properties, uses and specification of wood and wood products.	3	3

n.	Examinations.	3	
	Total	30	45

8. **CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:**
Engineering Sciences: 3 credits.

9. **RELATIONSHIP TO PROGRAM OBJECTIVES:**
Provides educational experience to prepare students for the challenges of the surveying profession.

10. **PREPARED BY:** J. Moore **DATE:** May 1999

1. **COURSE:** CONM 221 - Statics and Strength of Materials.

2. **DESCRIPTION:** Statics and strength of materials as related to the design and construction of structural components, including stress-strain, tension and compression, elasticity, shear, bending and deflection of beams, centroids, moments of inertia, thermal expansion and truss analysis.

3. **PREREQUISITES:** MATH 116 - Intermediate Algebra & Numerical Trigonometry and PHYS 211 - Introductory Physics I.

4. **TEXTBOOK:** *Determinate Structures: Statics, Strength, Analysis, Design*, with Technical Manual), French.

5. **OBJECTIVES:**
   a. Understand the principles of forces systems at rest (ABET Criterion 3a).
   b. Determination of design loads on beams (ABET Criterion 3e).
   c. Beam design for shear, bending and deflection (ABET Criterion 3e).
   d. Understanding principles of stress and strain (ABET Criterion 3a).
   e. Determining deformations from loads and thermal changes (ABET Criterion 3e).
   f. Understanding principles of column analysis (ABET Criterion 3e).
   g. Determination of loads in truss members (ABET Criterion 3e).

6. **TOPICS:** Basic equilibrium, support reactions, shear bending and deflection in beams, centroids and moments of inertia, stress and strain, modulus of elasticity, thermal stress and expansion, column analysis and truss analysis.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	**Time Weight** **Lecture Hours**
a.	Introduction, grading.	1
b.	Force systems.	9
c.	Beam loadings.	3
d.	Shear and moment in beams.	5
e.	Centroids.	3
f.	Moments of inertia.	4
g.	Shear and bending stress, deflections.	4
h.	Stress/strain, modulus of elasticity, thermal expansion.	5
i.	Column analysis.	3
j.	Truss analysis.	4
k.	Examinations.	4
	Total	45

8. **CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:**
   Three credits engineering science.

9. **RELATIONSHIP TO PROGRAM OBJECTIVES:**
   Provides educational experience for students to understand basic design, analysis and problem solving components of structural analysis.

10. **PREPARED BY:** R. Eastley **DATE:** May 1999

1. **COURSE:** ENGL 150 - English I.

2. **DESCRIPTION:** Students will organize and develop papers for diverse audiences and purposes, including how to discover and focus on a topic, develop ideas, gather support, and draft and revise papers effectively. Fundamental language skills will be covered and library research and argumentation will be introduced.

3. **PREREQUISITES:** ACT over 13 or ENGL 074.

4. **TEXTBOOK:** *Keys to Successful Writing*, M. Anderson, Longman, 1998.

5. **OBJECTIVES:** By the end of the course the student will complete a minimum of six papers, or 4000 words. Of the papers, some will contain expressive prose, some will require expository prose, some will necessitate argumentation, and some will require library research with appropriate documentation (ABET Criteria 3g, 3h & 3i).

6. **TOPICS:** Prewriting and planning, effective organization, mastering the conventions of written English, and use of library research materials.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight Lecture Hours
a.	Prewriting and planning strategies.	4
b.	Effective organization strategies.	7
c.	Paragraphing skills.	5
d.	Mastering the conventions of written English.	12
e.	Analytic and reasoning strategies.	7
f.	Self evaluation and revision skills.	5
g.	Introduction and use of library research materials.	5
	Total	45

8. **CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:**
General Education: 3 credits.

9. **RELATIONSHIP TO PROGRAM OBJECTIVES:**
To provide broad educational experience including communication skills, mathematics, basic science preparing students for life-long learning.

10. **PREPARED BY:** R. Cullen **DATE:** March 1999

1. **COURSE:** ENGL 250 - English II.

2. **DESCRIPTION:** The second of a two-course sequence, this course focuses on research. Students will learn how to use the library resources to produce a longer documented paper, to evaluate conflicting claims and evidence, to write an extended argument. The course will stress problem solving and reasoning skills but will also teach the grammatical structure, diction, and style appropriate to professional writing situations.

3. **PREREQUISITES:** ENGL 150 or equivalent.

4. **TEXTBOOK:** *Writer's Reference*, D. Hacker, St. Martins Press, 1995.

5. **OBJECTIVES:** By the end of the course the students will have written no fewer than 5,000 words encompassing the following: summaries, critical essays, journals, abstracts, annotated bibliographies, and a formal research paper (ABET Criteria 3g, 3h, and 3i).

6. **TOPICS:** Analysis of varieties of arguments, gathering evidence, library research, report presentation, and presentation techniques.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight Lecture Hours
a.	Analyze varieties of argument.	12
b.	Find a workable topic.	5
c.	Gather evidence.	10
d.	Work with evidence located in the library.	9
e.	Report research findings to a professional audience.	4
f.	Presentation techniques.	5
	Total	45

8. **CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:**
General Education: 3 credits.

9. **RELATIONSHIP TO PROGRAM OBJECTIVES:**
To provide broad educational experience including communication skills, mathematics, basic science preparing students for life-long learning.

10. **PREPARED BY:** R. Cullen **DATE:** March 1999

1. **COURSE:** GEOL 131 – Geology and Land-Use Management

2. **DESCRIPTION:** Examines the geologic factors important to making wise land-use decisions. Hazards of development in areas prone to earthquakes, volcanoes, flooding, mass-wasting, and shoreline erosion are considered, together with hazard reduction measures. The impact of development on resources such as soil and groundwater is also considered.

3. **PREREQUISITES:** Enrollment in the Surveying Engineering program or the Hazardous Waste option of the Industrial & Environmental Health Management program.

4. **TEXTBOOK:** *Environmental Geology*, Carla W. Montgomery. Published by W. C. Brown.

5. **OBJECTIVES:**
   a. To make students aware of the geologic processes that shape the earth's surface, especially those processes that present hazards to both economic development and human life (ABET Criterion 3h).
   b. To make students aware of society's dependence on geologic resources (ABET Criteria 3h, 3j).
   c. To make students aware of the effects of economic development on those resources (ABET Criteria 3h, 3j).
   d. To show students that Earth is an active, dynamic planet undergoing continuous change (ABET Criterion 3h).
   e. To improve students' abilities to work with others in small groups (ABET Criterion 3d).

6. **TOPICS:** See list of topics in next item.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	**Time Weight** Lecture Hours	Lab Hours
a.	Composition and physical properties of geological materials.	4	6
b.	Plate tectonics, earthquakes and volcanoes.	7.5	4
c.	Hydrological cycle, streams and flooding.	3.5	2
d.	Shoreline and coastal processes.	2	2
e.	Mass movement.	3	2
f.	Water and soil as a resource.	6	4
g.	Topographical maps.		4
h.	Field exercise.		2
i.	Geological time and remote sensing.		4
j.	Testing	4	
	Total	30	30

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Basic Science: 3 credits.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Provides broad educational experience including communications skills, mathematics, basic science preparing students for life-long learning.

Incorporate interdisciplinary concepts and problem solving exercises in the program.

Provide students an educational experience that prepares students for the challenges of the surveying professions that they will encounter during their professional life.

10. PREPARED BY: D. Frank **DATE:** May 26, 1999

1. **COURSE:** MATH 130 - Advanced Algebra and Analytical Trigonometry.

2. **DESCRIPTION:** Quadratic equations, inequalities, straight lines, functions and inverse functions, exponential and logarithmic functions, trigonometry from an analytical point of view, sequences, mathematical induction, permutation and combinations and the binomial theorem.

3. **PREREQUISITES:** High school trigonometry and one and one-half units of high school algebra or MATH 115 and MATH 120, or permission from the instructor.

4. **TEXTBOOK:** *A Primer for Calculus*, 6th ed., Holder, Wadsworth, 1993.

5. **OBJECTIVES:**
   a. Equations and inequalities of first and second degree (ABET Criterion 3a).
   b. Functions and graphs (ABET Criteria 3a & 3b).
   c. Linear and quadratic functions (ABET Criteria 3a & 3b).
   d. Polynomial functions of higher order (ABET Criteria 3a & 3b).
   e. Exponential and logarithmic functions (ABET Criteria 3a & 3b).
   f. Trigonometric functions (ABET Criterion 3a).
   g. Trigonometric identities and equations (ABET Criterion 3a).
   h. Applications of trigonometric functions (ABET Criteria 3a & 3b).
   i. Systems of equations and inequalities (ABET Criteria 3a & 3b).
   j. Sequences and series (ABET Criterion 3a).

6. **TOPICS:** Basic Algebraic Concepts, equations and inequalities of first and second degrees, functions and graphs, linear and quadratic functions, polynomial functions of higher degree, exponential and logarithmic functions, the trigonometric functions, trigonometric identities and equations, further applications of trigonometric functions, systems of equations and inequalities and sequences and series.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	**Time Weight** **Lecture Hours**
a.	Basic algebraic concepts. Order, absolute value. Would be good review of exponents and radicals (optional). Binomial theorem only.	5
b.	Equations and inequalities of first and second degrees. Quadratic equations, complex numbers. Applications (optional). Linear, absolute value, quadratic and other inequalities.	5
c.	Functions and graphs. Functions, composite functions, inverses.	5
d.	Linear and quadratic functions. Linear functions, distance formula, quadratic functions graphing equations, and the straight line.	5

e.	Polynomial functions of higher degree. Remainder theorem, factor theorem, synthetic division, fundamental theorem of algebra. Rational roots and rational functions (optional).	5
f.	Exponential and logarithmic functions. Exponential and logarithmic functions with applications of both.	5
g.	The trigonometric functions. Trigonometric functions, radian measure, trig functions of real numbers, inverse trig functions and trigonometric graphs.	5
h.	Trigonometric identities and equations. Basic identities, sum and difference formulas, double-angle and half-angle formulas, trigonometric equations (omit reduction formulas pg. 367 and sum and product formulas pg. 372).	5
i.	Further applications of trigonometric functions. Polar coordinates, trigonometric forms of complex numbers.	5
j.	Systems of equations and inequalities. Nonlinear systems.	4
k.	Sequences and series. Sequences, arithmetic and geometric sequences, series mathematical induction and proof of the binomial theorem.	6
l.	Testing.	5
	Total	60

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Mathematics: 4 credits.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Incorporates interdisciplinary concepts and problem solving exercises in the program.

Provides broad educational experience including communication skills, mathematics, basic science preparing students for life-long learning.

10. PREPARED BY: J. Hansen **DATE:** May 1999

1. **COURSE:** MATH 220 - Calculus and Analytic Geometry I.

2. **DESCRIPTION:** Topics include: the limit, continuity, the derivative, differentiation of algebraic and transcendental functions with applications, implicit differentiation, and introduction to integration with applications.

3. **PREREQUISITES:** MATH 130 with a grade of C- or better or its equivalent.

4. **TEXTBOOK:** *Calculus*, 5th ed., Larson, Hostetler, and Edwards, Heath Publishing Company.

5. **OBJECTIVES:**
   a. Algebraic and trigonometric functions (ABET Criteria 3a & 3b).
   b. How to use DERIVE (ABET Criteria 3a & 3b).
   c. Limits and their properties (ABET Criteria 3a & 3b).
   d. Differentiation (ABET Criteria 3a & 3b).
   e. Applications of differentiation (ABET Criteria 3a & 3b).
   f. Differentials (ABET Criteria 3a & 3b).
   g. Integration (ABET Criteria 3a & 3b).
   h. Trapezoidal rule (ABET Criteria 3a & 3b).
   i. Logarithmic and exponential functions (ABET Criteria 3a & 3b).

6. **TOPICS:** Algebraic and trigonometric functions, limits and their properties, differentiation, applications of differentiation, integration, and logarithmic and exponential functions.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight Lecture Hours
a.	Algebraic and trigonometric functions (introduce DERIVE - lab).	5
b.	Limits and their properties (omit formal definition of the limit).	6
c.	Differentiation.	14
d.	Applications of differentiation. Differentials. (Omit 3.8 and 3.10.)	14
e.	Integration. Trapezoidal rule only.	12
f.	Logarithmic and exponential functions. (Omit 5.7, 5.8, and 5.9.)	12
g.	Review, quizzes and exams.	10
h.	Final exam.	2
	Total	75

8. **CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:**
Mathematics: 4 credits.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Incorporates interdisciplinary concepts and problem solving exercises in the program.

Provide broad educational experience including communication skills, mathematics, basic science preparing students for life-long learning.

10. PREPARED BY: J. Hansen **DATE:** May 1999

1. **COURSE:** MATH 230 - Calculus and Analytic Geometry.

2. **DESCRIPTION:** Applications of integration, inverse trigonometric functions techniques of integration, indeterminate forms, numerical methods and approximation, infinite series, conics and polar coordinates, vector-valued functions and curvilinear motion.

3. **PREREQUISITES:** MATH 220 with a grade of C- or better or its equivalent.

4. **TEXTBOOK:** *Calculus*, 5th ed., Larson, Hostetler, and Edwards, Heath.

5. **OBJECTIVES:**
   a. Inverse trigonometry functions (ABET Criteria 3a and 3b).
   b. Applications of integration (ABET Criteria 3a and 3b).
   c. Integration methods, L'Hopitals rule, improper integrals (ABET Criteria 3a and 3b).
   d. Sequences and series, polynomial approximation (ABET Criteria 3a and 3b).
   e. Basic conic sections (ABET Criteria 3a and 3b).
   f. Parametric equations and polar coordinates (ABET Criteria 3a and 3b).

6. **TOPICS:**

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight Lecture Hours
a.	Inverse trig. functions.	7
b.	Applications of integration.	11
c.	Integration methods, L'Hopitals rule, improper integrals.	12
d.	Sequences and series, polynomial approximation.	12
e.	Basic conic sections.	12
f.	Parametric equations and polar coordinates.	11
g.	Review, quizzes, and exams.	8
h.	Final exam.	2
	Total	75

8. **CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:**
Mathematics: 4 credits.

9. **RELATIONSHIP TO PROGRAM OBJECTIVES:**
Incorporate interdisciplinary concepts and problem solving exercises in the program.

Provides broad experience including communication skills, mathematics, basic science preparing students for life-long learning.

10. **PREPARED BY:** J. Hansen **DATE:** May 1999

1. **COURSE:** PHYS 241 - General Physics I.

2. **DESCRIPTION:** Principles and practical applications of motion, force, energy, fluid, heat and sound. Intended for science and engineering majors. Calculus is utilized.

3. **PREREQUISITES:** MATH 220 (C- or better).

4. **TEXTBOOK:** *Physics for Scientists and Engineers*, by Fishbane, Thornton and Grasiorowicz, published by Prentice Hall.

5. **OBJECTIVES:**
   a. Provide students (particularly majors in science, mathematics or engineering) with a rigorous introduction to the concepts of general physics (ABET Criteria 3a and 3h).
   b. Solve problems involving physics contexts, including the use of differential and integral calculus as tools to solve these problems (ABET Criteria 3a and 3e).

6. **TOPICS:** See list of topics in next item.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	**Time Weight**	
		Lecture Hours	**Lab Hours**
a.	Measurement systems, dimensional analysis, and vectors.	3	3
b.	One- and two-dimension kinematics.	7	6
c.	Force and Newton's laws of motion with applications.	5	3
d.	Work, energy, conservation of mechanical energy and conservation of energy.	5	3
e.	Linear momentum and impulse, conservation of linear momentum, one- and two-dimensional collisions.	5	6
f.	Rotational kinematics and dynamics.	4	3
g.	Angular momentum and torque, moment of inertia, conservation of angular momentum.	4	3
h.	Rigid body in equilibrium.	4	3
i.	Oscillatory motion, Hooke's law, simple harmonic motion.	4	3
j.	Buoyancy and fluid mechanics.	4	3
k.	Mechanical wave and its properties, sound wave and its applications, standing wave.	5	3
l.	Temperature scales and ideal gases, concepts of heat and entropy, law of thermodynamics.	6	6
m.	Testing.	4	
	Total	60	45

FYI

Ferris State University
Construction & Facilities Department

DATE: September 21, 1999

TO: Donald Mullens, Bill Kerwin, Ladi Terry, Ray Dickinson, David Frank, John Thorp, Donald Flickinger, George Wales, Mindy Britton, Tom Oldfield, Doug Haneline, Elaine Kamptner

FROM: Donna Schmidt ds

RE: Surveying Engineering Program Reaccreditation Visitation Schedule

C: Chuck Matrosic, Khagendra Thapa

I have attached the ABET Reaccreditation Visiting Team Schedule for October 23-26, 1999, for the Surveying Engineering Program. I have spoken on the phone with most of you or your secretaries to set up the meetings that the ABET team requires for the visit. Please reconfirm your department's meeting time on your calendar. Thank you.

FERRIS STATE UNIVERSITY
Construction and Facilities Department
Surveying Engineering Program

ABET Re-Accreditation Visiting Team Schedule

Saturday, October 23, 1999: Team arrives, check in at Holiday Inn

Sunday, October 24, 1999:

11:00 – 12:00	Lunch	Team Matrosic Thapa
12:00 - 1:00	Tour campus, program facilities	Team Matrosic Thapa
1:00 - 4:15	Review program materials, student work SWN 312	Team
4:15 - 4:30	Enroute to Holiday Inn	Team Matrosic Thapa
4:30 - 5:30	Meet with Advisory Committee	Team
5:30 – 7:00	Dinner	Team Faculty Advisory Committee
7:00 -	Team Meeting	Team

Monday, October 25, 1999:

7:30 – 8:00	Enroute to Johnson Hall	Team Matrosic Thapa
8:00 – 8:30	Meet with Department Head JHN 200 Conference Room	Team Matrosic

8:30 – 9:00	Meet with Dean JHN 200 Conference Room	Team Waldheim Matrosic Thapa
9:00 – 9:30	Meet with Department Head JH 200 Conference Room	Murphy Matrosic
	Meet with R. Burtch JH 409	Ingram
	Meet with J. Rick JH 305	Walker
9:30 – 10:00	Meet with Program Coordinator JH 200 Conference Room	Murphy Thapa
	Meet with R. Burtch JH 409	Walker
	Meet with J. Rick JH 305	Ingram
10:00 – 10:30	Meet with Enrollment Services PRK 110	Murphy Mullens/Kerwin
	Meet with S. Hashimi JH 414	Ingram
	Meet with M. Myers JH 407	Walker
10:30 – 11:00	Meet with Career Services RC 206	Murphy Terry
	Meet with S. Hashimi JH 414	Walker
	Meet with M. Myers JH 407	Ingram

11:00 – 11:30	Meet with Library Liaison LIB 203	Murphy Dickinson
	Meet with C. Shangraw JH 407	Ingram
	Meet with K. Thapa JH 411	Walker
11:30 – 11:45	Enroute to lunch	
11:45 – 12:45	Lunch	
12:45 – 1:00	Enroute to Bishop Hall	Murphy Matrosic Thapa
1:00 – 1:30	Meet with VPAA BIS 403	Team Chapman Waldheim Matrosic Thapa
1:30 – 1:45	Enroute to Johnson Hall	
1:45 – 2:15	Open	Murphy
	Meet with C. Shangraw JH 407	Walker
	Meet with K. Thapa JH 411	Ingram
2:15 – 2:30	Enroute	
2:30 - 3:15	Open	Murphy
	Meet with Head, Physical Sciences Department ASC 3021	Ingram Frank
	Meet with Head, Social Sciences Department ASC 2108	Walker Thorp
3:15 – 3:30	Enroute	

3:30 – 4:15	Open	Murphy
	Meet with Head, Humanities Department JH 117	Ingram Flickinger
	Meet with Head, Mathematics Department ASC 2021	Walker Wales
4:15 – 4:30	Enroute	
4:30 – 5:30	Meet with students SWN 313	Team Students
5:30 – 5:45	Enroute to Holiday Inn	Team Matrosic Thapa
5:45 -	Dinner Team meeting	Team

Tuesday, October 26, 1999:

7:45 – 8:00	Enroute to Johnson Hall (Check out of hotel)	Team Matrosic Thapa
8:00 – 8:30	Open	Murphy
	Meet with D. Hanna JH 302	Walker
	Meet with J. Moore JH 304	Ingram
8:30 – 9:00	Open	Murphy
	Meet with D. Hanna JH 302	Ingram
	Meet with J. Moore JH 304	Walker
9:00 – 11:30	Open	Team

11:30 – 12:00	Debriefing JHN 200 Conference Room	Team Waldheim Matrosic Thapa
12:00 – 1:15	Lunch	Team
1:15 – 1:30	Enroute to Bishop Hall	Team
1:30 – 2:00	Exit briefing BIS 421G	Team Sederburg Chapman Waldheim Matrosic Thapa Faculty
2:00 -	Enroute to airport	Team Thapa

FERRIS STATE UNIVERSITY

June 25, 1999

Daniel B. Hodge, PhD, PE
Accreditation Director
Accreditation Board for Engineering and Technology
111 Market Place, Suite 1050
Baltimore, MD 21202-4012

Dear Dr. Hodge:

Enclosed are the self-study and supplemental materials prepared for the upcoming Fall, 1999 comprehensive general review of our BS, Surveying Engineering program.

As Department Head, I will be handling all the logistics of the accreditation visit, and ask that all contacts be made with me, or in my absence our Department Secretary, Ms. Donna Schmidt. I can be reached at (231) 591-2749, or email matrosic@ferris.edu. Ms. Schmidt is at (231) 591-2893 or email schmidtd@ferris.edu. Our website address is www.ferris.edu.

We look forward to scheduling and conducting the visit. Please contact me as soon as feasible to begin the visit planning.

Sincerely,

Charles A. Matrosic, PE
Department Head

cc: President Sederburg
VPAA Chapman
Associate VPAA Oldfield
[redacted]
Dr. K. Thapa, Program Coordinator

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CONSTRUCTION AND FACILITIES DEPARTMENT
COLLEGE OF TECHNOLOGY
1009 Campus Drive, JHN 200, Big Rapids, MI 49307-2280
Phone 616 592-2893 Fax 616 592-2946

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Basic Science: 5 credits.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Provides broad educational experience including communications skills, mathematics, basic science preparing students for life-long learning.

Incorporate interdisciplinary concepts and problem solving exercises in the program.

10. PREPARED BY: D. Frank **DATE:** May 1999

1. **COURSE:** SURE 110 - Fundamentals of Surveying.

2. **DESCRIPTION:** Orientation and introduction in proper field surveying theory and techniques. Subject areas include: taping, take corrections, leveling, angle measurements, traversing, traverse adjustments, proper use and care of dumpy and automatic levels as well as engineers and scale-reading transits, detail by stadia, contouring, and surveying drafting.

3. **PREREQUISITES:** Knowledge of fundamental trigonometry and algebra.

4. **TEXTBOOK:** *Surveying, Principles of Applications*, 4th ed., by B.Kavanagh and S.Bird, published by Prentice Hall.

5. **OBJECTIVES:**
   a. Demonstrate the ability to work within a team environment (ABET Criterion 3d).
   b. Demonstrate an ability to solve surveying problems using mathematics (ABET Criterion 3a).
   c. Learn how to design a traverse, take observations, perform computations, and analyze and interpret the data (ABET Criteria 3b, 3c, and 3e).
   d. Recognize the importance of surveying in other disciplines and consequences of dishonesty during observation, computation, and reporting of survey data (ABET Criteria 3f and 3k).
   e. Plot the map and write a report (ABET Criterion 3g).

6. **TOPICS:** Distance measurement, leveling, angular measurements, detail survey, survey drafting.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight Lecture Hours	Time Weight Lab Hours
a.	Introduction, orientation and safety.		
b.	Types of surveys, types of measurement and fundamental principles of surveying.	3	
c.	Taping and tape corrections.	3	12
d.	Levels and leveling definitions.	2	
e.	Leveling procedures.	3	12
f.	Transits and angle measurements.	5	18
g.	Traversing and traverse adjustment, including area computations.	4	12
h.	Tacheometry, including detail survey by stadia method.	3	12
i.	Topographic mapping.	4	
j.	Report writing and plotting of map.		24
k.	Three tests.	3	
	Total	30	90

8. **CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:**
Engineering Sciences: 4 credits.

9. **RELATIONSHIP TO PROGRAM OBJECTIVES:**
Provides educational experience to prepare students for the challenges of the surveying profession.

Provides opportunities for students to exhibit creativity, leadership, and team building abilities.

10. **PREPARED BY:** K. Thapa **DATE:** February 1999.

1. **COURSE:** SURE 115 - Introduction to Computer Mapping.

2. **DESCRIPTION:** The course is concerned with fundamentals of computers and their use in surveying engineering. Computer Aided Design (CAD) as applied to surveying engineering and computer aided mapping. Mapping as a graphical means of communication, the essential requirements of a map will be discussed. The emphasis of this course is mainly on hands-on experience in a number of software used such as AutoCAD, WILDsoft, WILDsoft 2000, and Softdesk.

3. **PREREQUISITES:** None.

4. **TEXTBOOK:** *Discovering AutoCAD*, by Mark Dix, and Paul Riley - Release 14.

5. **OBJECTIVES:**
   a. Understand basic CAD mapping concepts (ABET Criteria 3b, 3c, and 3e).
   b. Understand graphic object construction and editing (ABET Criteria 3a, 3b and 3e).
   c. Apply the CAD concepts to surveying and mapping (ABET Criteria 3b, 3c, and 3g).

6. **TOPICS:** CAD menu structure, object construction, object editing, drawing setup, paper space, model space, scaling.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight: Lecture Hours	Time Weight: Lab Hours
a.	Introduction: Laboratory use guidelines, and course requirements. Computers and peripheral devices. Windows functionality and command structure. Files and file naming conventions.	1	3
b.	Lines: Menu structure. Command sets. Beginning a drawing. Editing a drawing. Commands used: LINE, REDO, UNDO, NEW, SAVE, SAVEAS, OPEN, UCSICON.	1	3
c.	Circles and Drawing Aids: Use of dialogue box. Using an axis. Changing units. Drawing circles. Use of ERASE, and DIST commands.	1	3
d.	Layers, colors and linetypes: Creating new layers. Assigning colors to layers. Assigning line types. Changing the current layer. Editing corners using FILLET. Editing corners using CHAMFER. ZOOM and PAN commands.	1	3
e.	Template drawings: Setting LIMITS. AutoCAD's setup utility. Creating a	1	3

	prototype drawing. Configuring AutoCAD to use your own prototype drawing. Use of MOVE, COPY and ARRAY commands.		
f.	Arcs and polar arrays: Creating polar arrays. Drawing ARCs. Using ROTATE command. Creating MIRROR images of objects on the screen.	1	3
g.	Object Snap: Selecting points with OSNAP - single point override, and running mode. Changing the size of the aperture. BREAKing previously drawn objects. Using the TRIM, EXTEND, and STRETCH commands.	1	3
h.	Text: Entering TEXT in standard style. Entering multiline text. Writing text directly to the screen with DTEXT command. Changing styles. Changing previously drawn text with CHANGE. CHANGEing other entities. Scaling previously drawn entities. SCALEing by reference.	1	3
i.	Dimensions: Drawing linear dimensions. Multiple linear dimensions - baseline and continue. Angular dimensions. Dimensioning arcs and circles. Dimensioning with leaders. Dimension variables. Using HATCH command.	1	3
j.	Polylines: Drawing points, polygons, donuts, traces. Creating parallel copies with OFFSET.	1	3
k.	Groups and blocks: Creating blocks. INSERTing previously defined blocks. Defining attributes with ATTDEF. Editing attributes with ATTEDIT. Extracting information from attributes with ATTEXT.	1	3
l.	Project using a surveying application: CAD system.	3	12
m.	Midterm examination. Final exam.	1	
	Total	15	45

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Engineering Sciences: 2 credits.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Provides educational experience to prepare students for challenges of the surveying profession.

Provides opportunities for students to exhibit creativity.

10. PREPARED BY: S. Hashimi **DATE:** April 1999

1. **COURSE:** SURE 116 - Introduction to Microstation.

2. **DESCRIPTION:** This course covers the fundamentals of Microstation. It deals with basic graphical elements, design file concepts, views, and their attributes, working with levels, element creation, precision input, changing element attributes, element modification and manipulation, texts, cells, distance and area measurement, patterning and dimensioning. The emphasis of this course is hands on experience with Microstation.

3. **PREREQUISITES:** None.

4. **TEXTBOOK:** *The Microstation User's Guide*, or *The Microstation Reference User's Guide*.

5. **OBJECTIVES:**
   a. Learn about Microstation as a tool for survey drawing (ABET Criterion 3k).
   b. Recognize the importance of graphics as a tool for graphical communication (ABET Criterion 3g).

6. **TOPICS:** Graphic elements manipulation, texts, cells, precision input, patterning and dimensioning using Microstation.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight Lecture Hours	Time Weight Lab Hours
a.	Introduction. Class conduct. Brief introduction to computers such as CPU, input output devices, hardware, and software. Introduction to file handling.	1	
b.	Auxiliary views, perspective and orthographic projections.	2	
c.	Concepts of coordinates, grids, lines, and orientation.	1	3
d.	Designing with Microstation, input devices. Creating files, screen layout.		3
e.	Working with layers, views, level features.	1	3
f.	Element creation, tool settings, lines, polygons, circles, arc, ellipse, curves, undo and redo.	1	6
g.	Precision input, global origin, drawing vs. view, key-in commands, changing element attributes. Element manipulation, copy, move, scale, rotate, and mirror.	2	6
h.	Working with multiple elements, fences, modifying elements, delete part of an element, extend, trim, insert vertex, fillet, and chamfer.	2	6
i.	Snaps, measurement of distance and area. Problem of text placement, different fonts, letter sizes, text attributes.	2	6

j.	The use of dimensioning of engineering drawings. The role of patterning and use of different colors.	1	6
k.	Cells, cells library and their use in mapping and drafting.	1	6
l.	Test	1	
	Total	15	45

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Engineering Design: 1 credit.
Other: 1 credit.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Provides educational experience to prepare students for the challenges of the surveying profession.

10. PREPARED BY: K. Thapa **DATE:** February 1999

1. **COURSE:** SURE 215 - Surveying Computation.

2. **DESCRIPTION:** This is a detailed study of surveying problems and computations related to the Cartesian coordinate system, introduction to spherical coordinate systems as applied to spherical astronomy. Reduction of Polaris and solar observations for azimuth, and the use of spreadsheet in surveying problem solving will be covered.

3. **PREREQUISITES:** SURE 110, Fundamentals of Surveying.

4. **TEXTBOOK:** *Surveying*, by Moffitt and Bossler, 10^{th} ed.

5. **OBJECTIVES:**
   a. Understand traverse computation and simple adjustments - Compass Rule and Transit Rule (ABET Criteria 3b, 3c and 3e).
   b. Understand two dimensional coordinate geometry calculations (ABET Criteria 3b, 3c, 3e, 3g, and 3k).
   c. Understand basic concepts of spherical trigonometry and be able to identify the position of a celestial object on the celestial sphere using three coordinate systems - horizon system, equatorial system, and the hour-angle system (ABET Criteria 3a, 3b, and 3c).
   d. Be able to reduce solar and astronomic observations for azimuth (ABET Criteria 3a, 3c, and 3g).

6. **TOPICS:** Traverse computation, two dimensional coordinate geometry, and spherical astronomy.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight Lecture Hours	Time Weight Lab Hours
a.	Introduction.	2	2
b.	Traverse computations (review): Slope distance reduction to horizontal. Angular error of closure. Latitudes and departures. Linear error and its direction. Relative error of closure. Traverse adjustment by compass and transit rules. Final adjusted traverse. Coordinates of traverse points. Area by coordinates and DMD.	3	4
c.	Coordinate geometry: Writing equation of a line in general form. Writing equation of a circle in general form. Solving linear equations simultaneously. Solving quadratic equation. Line/line intersection. Line/circle intersection. Circle/circle intersection. Missing data calculation. Area partitioning. Three point resection problems.	16	18

d.	Spherical astronomy: Celestial sphere, great circle, zenith, nadir meridian, prime vertical, horizon, equator, latitude, longitude, declination, right ascension azimuth, hour angle, hour circle, vertical circle culmination, elongation, first point of Aries. Solution of right spherical triangles. Application of sine cosine laws to the PZS spherical triangle. Computation of field astronomic and solar observations for azimuth of the line.	9	4
e.	Midterm examination. Final exam.		2
	Total	30	30

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Engineering Sciences: 3 credits.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Provides educational experience to prepare students for challenges of the surveying profession.

Provides opportunities for students to exhibit creativity and problem solving.

10. PREPARED BY: S. Hashimi **DATE:** April 1999

1. **COURSE:** SURE 220 - Engineering Surveying.

2. **DESCRIPTION:** A continuation of SURE 110 in which the student received practical engineering surveying training which includes horizontal, vertical and easement curve calculations, and layout, slope staking, earthworks, instrument adjustment, and aspects of hydrographic tunnel and mine surveying.

3. **PREREQUISITES:** SURE 110 Fundamentals of Surveying.

4. **TEXTBOOK:** *Surveying, Principles and Applications*, 4th ed., B.F. Kavanagh & S.J. Bird, Prentice Hall, Englewood Cliffs, New Jersey 1996.

   Route Surveying, 5th ed., C.F. Meyers & D.W. Gibson, Happer Collins, New York, New York (any addition, former textbook no longer in publication).

   Surveying, 10th ed., F.H. Moffitt & J.D. Bossler, Addison-Wesley Longman.

5. **OBJECTIVES:**
   a. Acquire an understanding of procedures for horizontal and vertical measurements for route surveying and engineering projects (ABET Criteria 3a, 3e).
   b. Appreciate the requirements of good field notes (ABET Criterion 3g).
   c. Work effectively and interdependently as a crew (ABET Criterion 3f).
   d. Know how to use modern equipment and techniques for field procedures (ABET Criterion 3e).
   e. Introduce students to mapping methods and computer assisted drafting (ABET Criterion 3e).
   f. Develop geometry for calculations of surveying and engineering projects (ABET Criterion 3b) .

6. **TOPICS:** Theodolites, simple horizontal curves, compound curves, spiral curves, grade lines, vertical curves, slope staking, earth quantities, E.D.M. theory, hydrographic surveying, tunnel and mining surveying, and instrument adjustment.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	**Time Weight**	
		Lecture Hours	**Lab Hours**
a.	Introduction, orientation and safety.	1	
b.	Theodolite operations.	2	6
c.	Review of basic traverse calculations and adjustments.	2	6
d.	Simple horizontal curves.	3	12
e.	Compound curves.	3	12
f.	Spiral curves.	2	6
g.	Grade lines and vertical curves.	2	9
h.	Slope staking.	2	6
i.	Earth quantities.	2	9
j.	E.D.M. theory.	2	6

k.	Hydrographic surveying.	2	6
l.	Tunnel and mine surveying.	2	6
m.	Instrument adjustment.	2	6
n.	Three exams.	3	
	Total	30	90

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Engineering Science: 3 credits.
Engineering Design: 1 credit.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Provides hands on education and experience to prepare our students for the challenges of the surveying profession that they will encounter during their professional life.

Provide opportunities for our students to exhibit creativity, leadership and team-building abilities, and social issues.

Employ state-of-the-art technologies in the surveying engineering curriculum.

10. PREPARED BY: M. Myers **DATE:** May 1999

1. **COURSE:** SURE 230 - Advanced Surveying.

2. **DESCRIPTION:** This course introduces advanced optical, mechanical and electronic concepts necessary to refine survey observations to achieve first and second order precision assuming a flat earth model. It is intended that students acquire a realistic and critical appraisal of current production angle and distance measuring instruments. Such appraisal will be based upon actual laboratory experience using first order instruments.

3. **PREREQUISITES:** SURE 110 Fundamentals of Surveying.

4. **TEXTBOOK:** *SURVEYING, Theory and Practice*, 7th education by James M. Anderson and Edward Mikhail, published by McGraw-Hill.

5. **OBJECTIVES:** The student will apply knowledge of mathematics, science and engineering appropriate to the discipline (ABET Criterion 3a). The student will develop the ability to perform measurements, analyze and interpret data (ABET Criterion 3b). The student will learn to function on multidisciplinary teams (ABET Criterion 3d).

6. **TOPICS:** This course introduces advanced methods in surveying measurements. Emphasis is placed upon the physical principals employed in first and second order optical and electronic instruments. Students execute a second order traverse and provide direction by astronomical observations.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight Lecture Hours	Time Weight Lab Hours
a.	Introduction course objectives, goals and grading policy. Overview of advanced surveying procedures.	1	
b.	Introduction to electromagnetic spectrum, reflection refraction and transmission with scattering of light. Thin and thick lens theory and basic lens equations.	2	
c.	Introduction to basic direct current circuits, resisters capacitors, induction coils, and transformers. Modulation of carrier wave by induction/capacitor circuitry.	2	
d.	Phase resolution of modulated carrier, schematic description of EDM construction, reflector geometry, and mathematical techniques for determining distance using multiple frequencies.	4	
e.	Execution and calculations of horizontal distance from slope distance, atmospheric and sea level correction, scale factor, calibration base line observations and system constant.	4	20

f.	Design and use of precision direction theodolites, elimination of eccentricity errors, precision refraction of circle images by optical micrometer, angle sets and statistical appraisal of data.	3	20
g.	Celestial sphere and solid trigonometry. Derivation of basic formulas for determination of direction, latitude and longitude.	5	20
h.	Astronomic azimuth by Polaris observation at any time is performed with the precision theodolite.		
i.	Correction of horizontal angle error due to deflection of the vertical and grid azimuth in state plane coordinates is calculated.	2	20
j.	Theory of state plane coordinate systems, computation of position, direction and distance from survey observations.	4	10
k.	Review and examination of academic material.	3	
	Total	30	90

A laboratory project illustrating and utilizing the theory and concept regarding electronic distance measurement and astronomic direction will be undertaken. Typically a three to five kilometer traverse between monuments of the remonumentation program in Mecosta County will be performed. All techniques and refinements covered in the lecture regarding planning, design, scheduling as well as astronomical azimuth, electronic distance observations and targeting will be utilized. Class members will consider the appropriate instrument resource to be used, design and location of traverse stations, scheduling of measurements and human and physical resources, meeting of deadlines and assignment of responsibilities.

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Engineering Science: 3 credits.
Engineering Design: 1 credit.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Provides an educational experience that prepares our students for the challenges of the surveying profession that they will encounter during their professional life.

Incorporate interdisciplinary concepts and problem solving exercises in the program.

10. PREPARED BY: J. Rick **DATE:** February 1999

1. **COURSE:** SURE 272 - Geomatics Computation.

2. **DESCRIPTION:** Exploring fundamental concepts of surveying and mapping using a high level object oriented programming language. This includes: conversion of angular units from radians to degrees, minutes, and seconds, and vise versa; transformation of coordinates from polar to rectangular and rectangular to polar; traverse computation, adjustment and graphical plotting; reading and writing binary and text files; and using one and two dimensional arrays including pointer variables.

3. **PREREQUISITES:** SURE 215 and MATH 130.

4. **TEXTBOOK:** *Essential FORTRAN 90 & 95*, L.P. Meissner.

5. **OBJECTIVES:**
   a. Understand high level programming language (FORTRAN) syntax (ABET Criteria 3a, 3b, 3c and 3g).
   b. Understand program control (loops and nested loops) (ABET Criteria 3a, 3b, 3c, and 3g).
   c. Understand inputs (keyboard, file) and output (screen and file) concepts (ABET Criteria 3a, 3b, 3c and 3g).
   d. Understand one and two-dimensional arrays (ABET Criteria 3a, 3b, 3c, and 3g).
   e. Understand program debugging procedure (ABET Criteria 3a, 3b, 3c and 3g).

6. **TOPICS:** FORTRAN language syntax, use of the FORTRAN compiler editor and debugger, loops, arrays, files.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight Lecture Hours
a.	Introduction: Course objectives, attendance and grading policy. Why FORTRAN? Lahey FORTRAN Compiler.	1
b.	Introduction to ELF Compiler 2: Use ED Editor in creating, saving and edition a file. Compiling and linking a FORTRAN source.	2
c.	Numerical computing: Data types. Names and declarations. Constants. Number Representation. Expressions, assignment and procedures. Assignment statements and their execution. Arithmetic expressions and assignment. Numerical intrinsic functions. Subprograms. Initialized variables.	6

d.	Control: Program patterns for selection. Two-way selection with the if construct. Multi-way selection. Simplified selection. Logical data type. Program patterns for repetition. Count-controlled loops. Simple loops. Nesting of loops and branches. Looping in file processing. Recursion.	8
e.	Programs and subprograms: Creating procedures and modules. Program organization. Modules. Subprograms. Recursion. Writing procedures with arguments. Arrays as dummy arguments. Dummy arguments of character type. Implementation of arguments.	10
f.	Data objects: Arrays. Array shape. Whole arrays and array sections. Procedures and array processing. Array applications with loops. Strings, structures, and pointers. String (character data type). Structures and derived types. Pointers.	10
g.	Input and output: Input and output statements. Files.	5
h.	Examinations.	3
	Total	45

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Other: 3 credits.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Provides educational experience to prepare students for the challenges of the surveying profession.

Provides opportunities for students to exhibit creativity and problem solving.

10. PREPARED BY: S. Hashimi **DATE:** April 1999

1. **COURSE:** SURE 321 – Hydraulic Engineering

2. **DESCRIPTION:** Combined presentation of hydrology and hydraulics. Course shall include the natural occurrence of water on the earth and the study of fluid mechanics, kinematics of fluid flow, energy and momentum relating to the movement of water. Open channel flow and pressure conduits leading to gravity drainage design and pressure water supply systems.

3. **PREREQUISITES:** PHYS 242, General Physics II; MATH 230, Analytical Geometry and Calculus 2.

4. **TEXTBOOK:** *Applied Fluid Mechanics,* R. L. Mott, 4th edition, 1990, Merrill/Macmillan.

5. **OBJECTIVES:**
   a. Understand the concept of basic hydraulics (ABET Criterion 3a).
   b. Estimate hydraulic quantities and the design impact (ABET Criteria 3a, 3b, 3c).
   c. Understand the concepts of hydrology and the impact on the planning and design process (ABET Criteria 3a, 3c, 3e).
   d. Understand the fundamental importance of hydraulics in civil engineering work (ABET Criteria 3h, 3k).
   e. Provide technical sufficiency for preparation for the EIT examination (ABET Criterion 3f).
   f. Prepare engineering calculations with clarity, accuracy, and thoroughness (ABET Criterion 3k).

6. **TOPICS:** Basic properties of fluids, pressure flow hydraulics, open channel flow hydraulics, flow measurement, hydrology, culverts and pumping hydraulics.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight	
		Lecture Hours	Lab Hours
a.	Introduction and orientation.	1	0
b.	Basic properties of fluids.	1	0
c.	Overview of hydrology and hydraulics.	0	2
d.	Viscosity of fluids.	1	0
e.	Pressure.	2	2
f.	Buoyancy.	1	2
g.	Fluid flow and Bernoulli Theorem.	5	2
h.	Pressure conduits and flow classification.	6	2
i.	Piping systems and headlosses.	6	6
j.	Open channel flow and flow measurement.	4	2
k.	Pumping systems.	4	1
l.	Hydrology.	4	1
m.	Runoff, precipitation, infiltration.	3	2
n.	Groundwater.	3	2

o.	Frequency analysis.	1	0
p.	Drainage systems and culverts.	3	0
q.	Examinations.	0	6
	Total	45	30

*Lab is nonlecture time and does not have a physical laboratory or any experimental equipment.

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Engineering science: 4 credits.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Incorporate interdisciplinary concepts and problem solving exercises in the program.

10. PREPARED BY: D. Hanna **DATE:** April 1999

1. **COURSE:** SURE 325 - Principles of Geographic Information Systems.

2. **DESCRIPTION:** This course will explore the fundamental principles of Geographic Information Systems (GIS). The student will learn GIS terminology, capabilities, and applications. Data collection methodologies, data base concepts and system configuration, including hardware and software, will be presented. Benefits and cost will be evaluated. Students will work with both raster and vector GIS software packages.

3. **PREREQUISITES:** Basic computer skills.

4. **TEXTBOOK:** *Geographic Information Systems: A Guide to the Technology*, J. Antenucci, et al., Van Nostrand Reinhold.

   Understanding GIS: The ARC/INFO Method, Environmental Systems Research Institute (for lab section 1).

   ArcView GIS Exercise Book, 2nd ed., P. Hohl and B. Mayo, Onward Press (for lab section 2).

5. **OBJECTIVES:**
   a. Understand the role of GIS in the surveying engineering profession and the surveyor's role in the implementation and maintenance of a GIS (ABET Criterion 3a).
   b. Ability to work with GIS software to solve spatial problems (ABET Criteria 3b & 3e).
   c. Prepare written reports and papers and to orally present the findings in a group environment (ABET Criterion 3g).
   d. Know the effects that a GIS has on society and the economic and legal ramifications that a GIS presents (ABET Criterion 3j).

6. **TOPICS:** Benefits and cost, legal issues, data base concepts, data collection methologies, system implementation, and hardware and software issues.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight Lecture Hours	Time Weight Lab Hours
a.	Introduction, basic nomenclature found in GIS.	2	
b.	Benefits and costs: be able to identify different types of benefits; know how costs can be determined.	3	
c.	Legal issues: know the value of information; be able to discuss data access issues; understand information dissemination alternatives by government.	4	
d.	Data base concepts: know the relationship of graphic and non-graphic data; understand the concept of topology; be able to describe data quality issues.	2	
e.	Data collection methodologies: understand the role and importance of the control framework; be able to	2	

	identify methods of data collection; understand limitations of available technologies; know the cost/accuracy relationship.		
f.	System implementation: know the importance of a design philosophy; be aware of implementation procedures; understand the importance of gaining and maintaining support.	4	
g.	GIS hardware: be familiar with hardware components of GIS technology; be able to identify trends in systems.	2	
h.	GIS software: be aware of processing capabilities of different types of software; know utilities like rubber sheeting, etc.	2	
i.	System configuration: be aware of computer network; know centralized versus distributed systems and data exchange.	4	
j.	Applications.	2	
k.	Work with raster GIS software: students will understand file structures, raster overlays, vector to raster conversion and find a proper development site given a set of criteria.		18
l.	Work with vector GIS software: one lab will work with Arc/Info and learn about entering data into the software, editing procedures, data base management and geographic analysis. The other lab will work with ArcView and learn about the manipulation and editing capabilities of a view software package. The goal is to have students prepared to put together a GIS in the next course that can exploit the functionality of one package and the display of another.		24
m.	Three exams.	3	
n.	Term paper speech.		3
	Total	30	45

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Engineering Science: 1 credit.
Engineering Design: 1 credit.
Humanities/Social: 1 credit.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Provides an educational experience that prepares our students for the challenges of the surveying profession that they will encounter during their professional life.

Provides opportunities for our students to exhibit creativity, leadership and team building abilities, cultural appreciation, global understanding, and social issues.

Incorporate the state-of-the-art technologies in the surveying engineering curriculum.

Incorporate interdisciplinary concepts and problem solving exercises in the program.

10. PREPARED BY: R. Burtch **DATE:** May 1999

1. **COURSE:** SURE 329 - Modern Cartography.

2. **DESCRIPTION:** Explores concepts of cartography as a graphical means of communication. The role of mapping in modern society, classes of maps, general and thematic maps, charts, are discussed. History of cartography, map simplification, classification, symbolization, and generalization are discussed. Other topics include map design, color and pattern, typography and lettering, and computer mapping.

3. **PREREQUISITES:** Basic computer literacy.

4. **TEXTBOOK:** *Analytical and Computer Cartography*, 2nd ed., K. Clarke, Prentice Hall.

5. **OBJECTIVES:**
   a. Knowledge of the mathematics and manipulations of spatial data (ABET Criterion 3a).
   b. Be able to design maps and convey spatial data to the reader (ABET Criteria 3e and 3k).
   c. Prepare written reports and papers and to orally present the findings in a group environment (ABET Criterion 3g).

6. **TOPICS:** Classification, data structures, cartographic transformations.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight Lecture Hours	Lab Hours
a.	Introduction, history of cartography.	2	
b.	Basic principles of classification.	2	6
c.	Geocoding and cartography.	2	
d.	Data storage and representation.	2	3
e.	Access to spatial data.	3	6
f.	Spatial data structures for computer cartography.	2	3
g.	Map data structures.	2	3
h.	Attribute data structures.	2	3
i.	Cartographic transformations.	2	3
j.	Map transformation.	2	3
k.	Data structure transformation.	2	3
l.	Designing the map.	4	3
m.	Three exams.	3	
n.	Internet sources for cartography.	0	3
n.	Term paper speech.		6
	Total	30	45

8. **CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:**
Engineering Science: 3 credits.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:

Provide an educational experience that prepares our students for the challenges of the surveying profession that they will encounter during their professional life.

Provide opportunities for students to exhibit creativity, leadership and tem-building abilities, cultural appreciation, global understanding, and social issues.

To provide broad educational experience including communications skills, mathematics, basic science thereby enabling them for life-long learning.

10. PREPARED BY: R. Burtch **DATE:** April 1999

1. **COURSE:** SURE/HUMN 331 - Ethics and Professionalism in Engineering and Technology.

2. **DESCRIPTION:** This course discusses the codes of ethics, which have been adopted by many engineering societies. In addition, it will explain the meaning and attributes of professionalism along with the ethical, moral, and social responsibilities of technologists and engineers. Moreover, standards, law, safety, risks, obligations of loyalty to employer, professional client relationship, global awareness, bribery, contracts, and intellectual property are discussed.

3. **PREREQUISITES:** ENGL 150 - English I.

4. **TEXTBOOK:** *Ethical Issues in Engineering*, D. Johnson, Prentice Hall, NJ 1991.

5. **OBJECTIVES:**
   a. To introduce the concepts of ethics and professionalism as applied to engineering technology (ABET Criterion 3f).
   b. To understand the impact of surveying and engineering projects on society (ABET Criteria 3h & 3i).

6. **TOPICS:** Codes of ethics, attributes of a profession, ethical, moral, and social responsibilities of engineers and technologists, global awareness, bribery, intellectual property.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight Lecture Hours
a.	Introduction: Moral thinking. What is morality? Realism vs. Constructivism. Relativisim, moral education for engineers and technologists.	6
b.	Moral Theories: Utilitarianism, kantianism, virtue ethics, divine command, and social contract theories.	6
c.	Environmental ethics. Cost benefit analysis, animal rights, biocentric individualism, ecocentric holism, deep ecology.	7
d.	Ethics and safety obligations. Concern for safety, safety and risk, risk-benefit analysis. Consequences of not following safety precautions. Case studies from different engineering disciplines. Interaction of law with professional engineers, professional liability.	6
e.	The definition of a profession. Attributes of a profession, engineers' creed, code of ethics for engineers professional licensure.	6

f.	Engineers' and technologists' responsibilities to the society public health, public safety, trade secrets, patents, intellectual property, computer ethics, global awareness.	5
g.	Obligations of loyalty to employers. Moral status of loyalty, whistle blowing, employee rights, professional rights, confidentiality, moral justification for whistle blowing. The role of law in protecting scientific and technical dissent.	4
h.	Obligations to clients and fair play in engineering. Conflict of interest, bribery, gift giving and morality, international bribery, ethics and corrupt practices.	2
i.	Three tests.	3
	Total	45

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Cultural Enrichment (Humanities): 3 credits.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Incorporates interdisciplinary concepts and problem solving exercises.

Provides educational experience to prepare students for the challenges of the surveying profession.

10. PREPARED BY: K. Thapa **DATE:** February 1999

1. **COURSE:** SURE 339 - Remote Sensing.

2. **DESCRIPTION:** This course will explore fundamental concepts of remote sensing as they relate to engineering and environmental problems. Other topics covered include energy interactions, reflectance, scanning systems, satellite systems, digital image processing, and image classification. Students will work with image processing software.

3. **PREREQUISITES:** PHYS 211 or PHYS 241.

4. **TEXTBOOK:** *Introduction to Remote Sensing*, James Campbell, Guilford Press.

5. **OBJECTIVES:**
   a. Know the basic principles of remote sensing and how it is utilized in mapping today (ABET Criteria 3a and 3e).
   b. Be able to evaluate the design necessary for an effective remote sensing data collection strategy (ABET Criteria 3b and 3c).
   c. Prepare written reports and papers and to orally present the findings in a group environment (ABET Criterion 3g).
   d. Know the role and applicability of remotely sensed data in society such as the economic role, political role and engineering role (ABET Criteria 3h and 3k).

6. **TOPICS:** Electromagnetic radiation, image interpretation, observing satellite systems, radar, and classification.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight Lecture Hours	Time Weight Lab Hours
a.	Introduction, remote sensing principles.	2	
b.	Electromagnetic radiation: electromagnetic spectrum, Planck's Law, scattering, rectification, absorption, atmospheric windows, reflection, transmission, spectral signatures.	4	3
c.	Image interpretation: interpretation tasks, elements of interpretation, use of collateral information.	2	
d.	Land observation satellite systems: LANDSAT, SPOT, commercial ventures.	4	3
e.	Active microwave remote sensing: SLAR, radar geometry, look direction, look angle, synthetic aperture radar, interpretation of brightness values, radar systems.	3	6
f.	Image resolution: target variables, measurement of resolution, mixed pixels, spatial and radiometric resolution.	2	6
g.	Digital analysis: machine classification, image-processing system, tape formats, look-up tables.	4	3

h.	Preprocessing digital imaging: radiometric, destriping image enhancement, resampling.	2	6
i.	Image classification: unsupervised and supervised classification, distance measure, training data.	2	6
j.	Accuracy assessment: error characteristics, error matrix.	2	3
k.	Three exams.	3	
l.	Internet resources for remote sensing.	0	3
m.	Term paper speech.		6
	Total	30	45

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Engineering Science: 3 credits.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Provide an educational experience that prepares our students for the challenges of the surveying profession that they will encounter during their professional life.

Incorporate the state-of-the-art technologies in the surveying engineering curriculum.

To provide broad educational experience including communications skills, mathematics, basic science thereby enabling them for life-long learning.

10. PREPARED BY: R. Burtch **DATE:** May 1999

1. **COURSE:** 340 - Photogrammetry.

2. **DESCRIPTION:** An introductory course in photogrammetry covering, in part, the history of photogrammetry, aerial cameras and camera calibration, geometry of the aerial photograph, steroscopy and stereoscopes, parallax and the theory and techniques of orientation. Students will perform basic mapping tasks on the stereoplotter.

3. **PREREQUISITES:** SURE 110 - Fundamentals of Surveying.

4. **TEXTBOOK:** *Elements of Photogrammetry*, Paul Wolf, published by McGraw-Hill.

5. **OBJECTIVES:**
   a. The student will apply knowledge of mathematics, science and engineering appropriate to the discipline (ABET Criterion 3a).
   b. The student will develop the ability to perform measurements, analyze and interpret data (ABET Criterion 3b).
   c. The student will develop the ability to identify, formulate and solve engineering problems (ABET Criterion 3e).
   d. The student will acquire an ability to use techniques, skills and modern engineering tools necessary for engineering practice (ABET Criterion 3k).

6. **TOPICS:** Image forming process and geometry of the aerial mapping camera is introduced. Analogue and analytical restitution instruments are used to measure features and construct topographic maps. Design of flight lines, planning and bidding of mapping projects is introduced.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight: Lecture Hours	Time Weight: Lab Hours
a.	Introduction of course objectives, goals and grading process.	1	
b.	Introduction to the electromagnetic spectrum, solid optics, photographic film and the image making process.	2	
c.	Construction of the aerial mapping camera, its accessories and management aboard the aircraft, fiducial axis recording, lens aberrations, distortion and camera calibration is taught.	2	3
d.	Basic measurement on the vertical photograph such as scale, flying height and displacement due to relief is taught. The transformation between ground and photo coordinates is developed.	3	4
e.	Tilted photograph scale change, tilt displacement, relief displacement and transformation between ground and photo coordinates is developed.	3	3

f.	The stereo photo pair, stereoscopy and parallax are taught. The transformation between ground and model coordinates is developed.	2	5
g.	Analogue restitution of the photographic event is studied. Imaging techniques such as stereo image alternation with shutters and liquid crystal lenses, polarized images, anaglyphs and binocular viewing is covered.	2	5
h.	Construction and operation of the analogue stereoplotter is introduced. Interior, relative and absolute orientation is introduced.	3	5
i.	Radial lens distortion correction, installation of principal distance and fiducial axis alignment is taught.	1	4
j.	Independent relative orientation using the six Gruber Positions. Dependent relative orientation is explained using the universal analogue plotting instrument.	2	5
k.	Absolute orientation is introduced using random ground control, manual rotation and scale methods.	2	4
l.	Absolute orientation is introduced using coordinated ground control and analytical rotation and scale methods.	1	5
m.	Mapping specifications, design and data collection procedures are taught. National map accuracy standards and commercial specifications are covered.	1	
n.	Flight planning, project design and bid calculation are introduced.	2	2
o.	Review and examination of academic material.	3	
	Total	30	45

Use of current commercially available software for calculations such as KORK photogrammetric software, CadMAP, ATLAS, MATHCAD, AUTOCAD for computational applications and for graphic display are employed.

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Engineering Science: 3 credits.
Engineering Design: 1 credit.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Provides an educational experience that prepares our students for the challenges of the surveying profession that they will encounter during their professional life.

Incorporate interdisciplinary concepts and problem solving exercises in the program.

10. PREPARED BY: J. Rick **DATE:** January 1999

1. **COURSE:** SURE 365 - Legal Aspects of Surveying I.

2. **DESCRIPTION:** An introductory study to the subdivision of public lands, theory of original survey, resurvey, subdivision survey and the methods of describing real property along with the more important statute laws affecting the surveyor. (Writing Intensive.)

3. **PREREQUISITES:** SURE 110 - Fundamentals of Surveying, ENGL 250 - English II.

4. **TEXTBOOK:** *Brown's Boundary Control and Legal Principals, 4th ed.*, C.M. Brown et. al, John Wiley and Sons, Inc., New York, NY 1995.

   Prentice Hall Handbook for Writers, 12th ed., Kramer, et. al., Prentice Hall, Inc., Englewood Cliffs, New Jersey, 1995.

5. **OBJECTIVES:**
   a. Acquire an understanding and an appreciation of the United States Rectangular Survey System (ABET Criteria 3a & 3h).
   b. Understand the quasi-judicial capacity of the surveyor (ABET Criteria 3d & 3f).
   c. Learn the fundamentals of writing and interpreting legal property descriptions (ABET Criteria 3g, 3j & 3h).
   d. Become familiar with the essence of effective written communication (ABET Criterion 3g).

6. **TOPICS:** Effective Writing, Theory of Law, Estates in Land and Transfers of Real Property, the Sectionalized Land System, Systems of Describing Real Property, Land Conveyance as a Function of Time, Michigan Surveying Statutes.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	**Time Weight** **Lecture Hours**
a.	Introduction. Course goals, policies and grading procedures. Proper presentation of assigned work.	1
b.	Effective writing. The role of writing in academic/professional settings; strategies for determining the appropriate document type and style. Effective writing for different audiences. Organization of papers for various purposes.	3
c.	Law. The functions of law. The constitution. Types of law.	3
d.	Estates in land and transfers of real property. Forms of land title. Land title terms. Distinguishing between elements of land title and land location. Documents of written property transactions. Common form and requirements for transfer of title. Transfer of property rights through written and unwritten means.	6

e.	The sectionalized land system. Historical development. Original instructions for the survey of Michigan. Private claims.	12
f.	Systems of describing real property. Basic forms. Combined and multiple forms. Interpretation of basic descriptive terms.	10
g.	Land conveyance as a function of time. Sequential conveyancing. Simultaneous conveyancing.	6
h.	The Land Division Act. Requirements of platting. Flow charts for preliminary and final plat approvals. Vacating and amending plats. Assessors plats. Penalties for violation.	2
i.	Exams.	2
	Total	45

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Engineering Science: 1 credit.
Engineering Design: 3 credits.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Provides educational experience to prepare students of the challenges of the surveying profession they will encounter during their professional lives.

Incorporates interdisciplinary concepts and problem solving exercises.

10. PREPARED BY: C. Shangraw **DATE:** February 1999

1. **COURSE:** SURE 372 – Advanced Surveying Computation

2. **DESCRIPTION:** This course deals with advanced computational techniques as applied to solving surveying engineering problems. The use of vectors, set theory, partial differentiation, differential equations, statistical inference and hypothesis testing and matrix algebra in the surveying engineering discipline is included. Different types of errors viz.: observational and computational and their effect on surveying calculations are examined.

3. **PREREQUISITES:** SURE 230, SURE 272 or CPSC 205, MATH 230.

4. **TEXTBOOK:** *Advanced Surveying Calculations: Lecture Notes*, 1992, Dr. Khagendra Thapa.

5. **OBJECTIVES:**
   a. Understand the concepts of set theory (ABET Criteria 3a, 3b, 3c).
   b. Understand manipulation and operation of vectors and matrices (ABET Criteria 3a, 3b, 3c, 3d).
   c. Understand statistical concepts such as: measure of central tendency, measures of variability, hypothesis testing of the mean and variance (ABET Criteria 3a, 3b, 3c, 3d).
   d. Understand concepts of elementary differential equations (ABET Criteria 3a, 3b, 3c, 3d).
   e. Understand the application of partial differentiation to the propagation of random errors in surveying (ABET Criteria 3a, 3b, 3c, 3d).
   f. Understand the relationship between weight matrix and variance covariance matrix (ABET Criteria 3a, 3b, 3c, 3d).

6. **TOPICS:** Set theory, operations of vectors and matrices, theory of probability, measures of central tendency dispersion, elementary differential equations, propagation of random errors.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	**Time Weight** **Lecture Hours**
a.	Introduction, set theory: sets, elements, set operations & ven diagrams: union, intersection, difference (relative complement), absolute complement, finite and countable sets, classes of sets.	3
b.	Vectors: vector definitions, basic vector algebra: vector sum, vector differences, vector dot products, vector cross products.	4

c.	Theory of matrices: types of matrices: triangular, scalar, diagonal, identity, matrix operations: addition, subtraction, multiplication, inversion.	6
d.	Matrix applications: solving a system of linear equations, error analysis: partial differentiation, covariance matrix.	7
e.	Ordinary differential equations: analysis, solution.	9
f.	Basic statistical concepts: methods of describing data: graphical (bar charts, histograms, pie charts, etc.), numerical, measure of central tendency (mean, median, mode), measure of variability (standard deviation, variance, range), normal and binomial distributions.	7
g.	Statistical estimation: confidence interval for the mean, confidence interval for the standard deviation.	6
h.	Hypotheses testing and significance: level of significance, normal distribution test, one tail and two- tailed tests (Chi Squared and F Tests).	
i.	Three unit examinations plus a final.	3
	Total	45

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Mathematics: 3 credits.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Provides educational experience to prepare students for the challenges of the surveying profession.

Provides opportunities for students to exhibit creativity and problem solving.

10. PREPARED BY: S. Hashimi **DATE:** April 1999

1. **COURSE:** SURE 373 - Adjustment Computations.

2. **DESCRIPTION:** A study of the concept of measurements together with the theory and propagation of random errors is covered. The theory and application of least squares, using matrix algebra, is utilized to adjust horizontal and vertical control (traversing, triangulation, trilateration and leveling). The design of survey control networks is also included.

3. **PREREQUISITES:** SURE 372 - Advance Surveying Computations.

4. **TEXTBOOK:** *Analysis and Adjustment of Survey Measurements*, Edward M. Mikhail and Gordon Gracie, published by Van Nostrand Reinhold Company.

5. **OBJECTIVES:**
   a. Develop an ability to apply knowledge of mathematics, science and engineering appropriate to the discipline (ABET Criterion 3a).
   b. Develop an ability to design and conduct experiments, analyze and interpret data (ABET Criterion 3b).
   c. Develop an ability to design a system, component, or process to meet desire needs (ABET Criterion 3c).
   d. Develop an ability to identify, formulate and solve engineering problems (ABET Criterion 3e).

6. **TOPICS:** Error propagation in computations and linearization of nonlinear equations is first covered. Investigating modern least squares with matrix algebra follows an introduction to classical least squares. Condition equations for adjustment by indirect observations, observations only and finally the combined generalized condition using multiple observations and parameters is taught. Adjustments using weighted observations and nonlinear condition equations is covered.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight Lecture Hours
a.	Introduction of course objectives, syllabus and grading policy. Introduction to the concept of errors in measurement and the classification of these errors.	1
b.	Elaboration on the classification of errors with emphasis on random error and its character.	1
c.	Analysis of the propagation of error through computations. Linearization of equations for the purpose of error propagation.	4
d.	Introduction to classical least squares such as condition equations using single observation and parameters (the method of indirect observations) and condition equations using only observations (the method of observations only).	4

e.	Least squares using matrix algebra to write conditions for adjustment by the method of indirect observations and the method of observations only are taught.	4
f.	Least squares adjustment of nonlinear condition equations using both the method of indirect observations and the method of observations only are taught.	4
g.	Analysis of the propagation of variance and covariance, derivation of laws and stepwise propagation methods.	3
h.	Propagation of variance and covariance in least squares adjustment by both methods of indirect observation and observation only.	4
i.	The general least square adjustment using the combined model of adjustment of indirect observations and observations together is introduced.	3
j.	General least squares propagation of variance and covariance, application to linear and nonlinear problems is presented.	3
k.	Statistical analysis of adjustment results is presented. Estimation of the mean and the confidence interval of the mean, estimation of the variance and the confidence interval of the variance are presented.	4
l.	Application of adjustment in plan coordinates. Distance, azimuth and angle condition equations and their linearization.	4
m.	Two and three dimensional coordinate transformation using both pseudo and rigorous condition equations.	3
	Review and examination of academic material.	3
	Total	45

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Engineering Science: 1 credits, Mathematics: 2 credits.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Provides an educational experience that prepares our students for the challenges of the surveying profession that they will encounter during their professional life.

Incorporate interdisciplinary concepts and problem solving exercises in the program.

10. PREPARED BY: J. Rick **DATE:** February 1999

1. **COURSE:** SURE 420 – Professional Practice of Surveying

2. **DESCRIPTION:** A study of business practices as they apply to the organization offering professional engineering/surveying.

3. **PREREQUISITES:** SURE 230, Advanced Surveying, ENGL 250, English 2.

4. **TEXTBOOK:** *The Wall Street Journal*, Dow Jones and Company, New York, NY; *Prentice Hall Handbook for Writers, 12th Ed.*, Kramer, et. al., Prentice Hall, Inc., Englewood Cliffs, New Jersey, 1995.

5. **OBJECTIVES:**
   a. Understand the leadership role of the surveyor in society (ABET Criteria 3d, 3f, 3i & 3h).
   b. Learn the fundamentals of operating a successful business (ABET Criteria 3d, 3f, 3g, 3h & 3j).
   c. Integrate the practices of surveying engineering with the concepts of ethical conduct and sustainable development (ABET Criteria 3f & 3i).

6. **TOPICS:** Effective Writing, Leadership, Strategic Planning and Goal Setting, Business Essentials, Engineering Economics, Contracting, Project Management, Quality Assurance, Professionalism.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight Lecture Hours
a.	Introduction: course goals, policies, grading procedure, proper presentation of assigned work.	1
b.	Effective writing: role of writing in professional/academic settings, strategies for determining appropriate document type and style, effective writing for different audiences, organization of papers for various purposes.	3
c.	Leadership: the vision, communicating the vision, seeing the vision through, attributes of a leader.	4
d.	Strategic planning and goal setting: strategic, operational and tactical levels of planning; management by objectives.	4
e.	Business essentials: organizational structure, time value of money, financial analysis, personnel issues.	9
f.	Contracting: contractual considerations, estimating a job for profit, negotiating the right fee, partnering, collection of accounts.	7
g.	Project management: the critical path method, introduction to "Microsoft Project".	6
h.	Total quality management: focus, structure, potential obstacles, ISO 9000.	4

i.	Professionalism: the environment and sustainable development, canons of ethics, "7 Habits of Highly Effective People".	5
j.	Exams	2
	Total	45

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Engineering Science: 1 credit; Engineering Design: 2 credits.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Provides educational experience to prepare students for the challenges of the surveying profession.

Incorporates interdisciplinary concepts and problem solving exercises in the program.

Provides opportunities for students to exhibit creativity, leadership and team building abilities.

10. PREPARED BY: C. Shangraw **DATE:** February 1999

1. **COURSE:** SURE 421 – Soils Engineering

2. **DESCRIPTION:** Introductory course in soils engineering. Topics include engineering characteristics, classifications, weight-volume relationships, permeability, flow nets, dams, lateral earth pressures, shear stresses, loads on buried conduits, slope stability, and foundations.

3. **PREREQUISITES:** CONM 121, MATH 220

4. **TEXTBOOK:** *Essentials of Soil Mechanics and Foundation: Basic Geotechnics*, 5th Ed., David F. McCarthy, Prentice Hall.

5. **OBJECTIVES:**
   a. Provide an opportunity to apply knowledge of math, engineering, and science. (ABET Criterion 3a).
   b. Provide an opportunity to analyze data (ABET Criterion 3b).
   c. Provide an opportunity to identify, formulate, and solve engineering problems (ABET Criterion 3e).
   d. Develop the ability to communicate effectively (ABET Criterion 3g).

6. **TOPICS:** Introduction, soil and rock, the material of Planet Earth, soil composition, soil classification systems, movement of water through soil, subsurface stresses in the soil mass, settlement and consolidation, shear strength theory, site investigations, construction of structured earth fill, foundations—introductory concepts, foundations—design considerations and methods, stability of unsupported slopes and slope movement, lateral pressures and retaining structures, underground structures.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight	
		Lecture Hours	Lab Hours
a.	Introduction	1	3
b.	The material of Planet Earth.	2	0
c.	Soil composition.	4	9
d.	Soil classification systems.	9	6
e.	Movement of water through soil.	2	0
f.	Subsurface stresses in the soil mass.	4	0
g.	Settlement and consolidation.	3	0
h.	Shear strength theory.	2	3
i.	Site investigations.	2	6
j.	Structured earth fill and excavation.	3	12
k.	Foundations.	5	6
l.	Stability of unsupported slopes.	1	0
m.	Retaining structures.	1	0
n.	Underground structures.	1	0
o.	Examinations.	5	0
	Total	45	45

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Engineering Sciences: 2 credits, Engineering Design: 2 credits.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Provides educational experience to prepare students for the challenges of the surveying profession.

10. PREPARED BY: J. Moore **DATE:** May 1999

1. **COURSE:** SURE 425 - Technical Issues in Geographic Information Systems.

2. **DESCRIPTION:** This course deals with advanced concepts of geographic information systems. Topics such as data structures, data compaction, digital elevation models, data input methodologies, analysis and spatial modeling, data quality, and spatial interpretation will be covered. Laboratory assignments will be project oriented using existing raster or vector GIS software.

3. **PREREQUISITES:** SURE 325 - Principles of GIS.

4. **TEXTBOOK:** *Principles of Geographic Information Systems,* P. Burrough & R. McDonnell, Oxford University Press

   Understanding GIS: The ARC/INFO Method, published by Environmental System Research Institute.

5. **OBJECTIVES:**
   a) Understand the technical issues in GIS, particularly as they relate to geographic structure (ABET Criteria 3a & 3e).
   b) Work on the design of a controlled GIS Project (ABET Criteria 3b & 3c).
   c) Understand the role that GIS has in society such as technical design issues required for particular client GIS needs (ABET Criteria 3h & 3k).

6. **TOPICS:** Data models, geographic data, Thiessen polygons/Voronoi diagrams, spacial analysis, errors, and quality control.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight Lecture Hours	Lab Hours
a.	Introduction: Course objectives, lab expectations.	1	0
b.	Data models: Geographic primitives, data types.	1	0
c.	Geographical Data: Binary and hexadecimal coding, file access methologies, database structure, chain codes, quadtrees, data organization/structure.	5	0
d.	Data input, verification, storage, and output.	2	0
e.	Creating continuous surfaces: Data sampling strategies, local and global interpolation strategies, Thiessen polygons, linear interpolation methods, digital elevation models.	5	0
f.	Analysis of discrete entities: Spatial analysis operations, buffering.	2	0
g.	Spatial analysis using continuous fields: Map algebra, filtering, slope & aspect, drainage, viewshed.	3	0
h.	Errors and quality control: Sources of errors, improper assumptions.	4	0

i.	Error propagation: Statistical approach, optimizing sampling schemes.	4	0
j.	Lab projects.	0	45
k.	Three examinations.	3	0
	Total	30	45

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Engineering Science: 1 credit.
Engineering Design: 2 credits.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Provide an educational experience that prepares our students for the challenges of the surveying profession that they will encounter during their professional life.

To provide broad educational experience including communications skills, mathematics, and basic science thereby enabling them for life-long learning.

10. PREPARED BY: R. Burtch **DATE:** May 1999

1. **COURSE:** SURE 435 - The Urban Environment.

2. **DESCRIPTION:** The urban environment, covering in part; land use controls, land study and development, design, utility supply, site ecology and social and psychological analysis of development. Laboratory skills will emphasize subdivision design, and cost analysis of development.

3. **PREREQUISITES:** Senior standing.

4. **TEXTBOOK:** *Land Development for Civil Engineers*, T.R. Dion, John Wiley & Sons, Inc., New York, New York 1993.

   Subdivision Control Act of 1967, 4th ed., Department of Consumer & Industry Services, Corp. & Securities Bureau Property Development Division, 5th ed., State of Michigan (Used as a model law) 1983.

5. **OBJECTIVES:**
   a. Acquire an understanding of procedures designing streets, utilities, and subdivisions (ABET Criteria 3a, 3b, 3c, 3e, & 3k).
   b. Appreciate the history of urban development and how social, political, demographics, transportation and economics result in change (ABET Criteria 3d & 3f).
   c. Requires the students to draw upon their diverse backgrounds in a major design project (ABET Criteria 3i & 3k).
   d. Know how legal restrictions, site conditions, aesthetic, environmental conditions and economic goals of sustainable developments are met (ABET Criteria 3h, 3i & 3j).

6. **TOPICS:** History of the city, transportation systems, engineered services, zoning and regulation, subdivision design, government and budgetary restraints, social and cultural issues.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight	
		Lecture Hours	**Lab Hours**
a.	Introduction.	1	
b.	History of the City.	2	
c.	Transportation systems.	3	
d.	Engineered services.	4	4
e.	Zoning and regulations.	4	
f.	Subdivision design.	6	22
g.	Government and budgetary restraints.	3	2
h.	Social and cultural issues.	4	2
i.	Three exams.	3	
	Total	30	30

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Engineering Design: 1 credit.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Provides educational experience to prepare our students for the challenges of the surveying profession that they will encounter during their professional life.

Provides opportunities for our students to exhibit creativity, cultural appreciation, global understanding, and social issues.

Employs state-of-the-art technologies in the surveying engineering curriculum.

10. PREPARED BY: M. Myers **DATE:** May 1999

1. **COURSE:** SURE 440 – Analytical Photogrammetry.

2. **DESCRIPTION:** A continuation of SURE 340. This course will acquaint the student to control extension using analytical and semi-analytical methods. Emphasis is placed on cadastral applications. Other topics include orthophotography, terrestrial and close-range photogrammetry, digital photogrammetry, flight planning and contracting for mapping in an engineering environment.

3. **PREREQUISITES:** SURE 340, Photogrammetry; SURE 373, Adjustment Computations.

4. **TEXTBOOK:** *Elements of Photogrammetry*, P. Wolf, McGraw-Hill.

5. **OBJECTIVES:**
   a. Be able to identify the geometric aspects of the collinearity and coplanarity concepts to solving photogrammetric problems (Criteria 3a, 3e).
   b. Know the role of integrated surveying systems and their design considerations like airborne GPS (Criteria 3b, 3c).
   c. Understand the role that photogrammetry has in today's society such as the importance of digital photogrammetry (Criteria 3j, 3k).

6. **TOPICS:** Analytical photogrammetry, semi-analytical photogrammetry, digital photogrammetry.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight Lecture Hours	Time Weight Lab Hours
a.	Introduction, principles of computer mapping and concepts of the analytical and digital plotter.	1	6
b.	Analytical photogrammetry: theory of comparator measurements, difference between comparator and photo coordinates, transformations, correcting photographic measurements, physical interpretation of the collinearity concept, single photo resection and intersection, use of photogrammetry in control and cadastral surveying, and standards and specifications for photogrammetrically-derived control, use of point transfer devices.	7	12
c.	Semi-analytical photogrammetry: stereotriangulation theory with universal and analytical plotters, independent model triangulation, determination of perspective centers.	3	3
d.	Airborne GPS: utilization of GPS in photogrammetry, mathematical models, economics of airborne-GPS.	2	0
e.	Orthophotography: classification of orthophoto systems, concepts of fixed line and rotating line	2	0

	element rectification, stereo orthophotos, digital orthophotos.		
f.	Project planning: basic elements of overlap and sidelap, effect of scale variation, crab and drift, computation of flight plan, contracting for photogrammetric services.	2	3
g.	Digital photogrammetry: basic principles, image correlation principles, theory of digital rectification.	6	0
h.	Computer-assisted mapping with stereoplotters.	2	21
i.	Terrestrial and close range photogrammetry: characteristics of terrestrial cameras, computation of horizontal and vertical angles from terrestrial photos, special control surveys, use of terrestrial photogrammetry for engineering purposes.	2	0
j.	Three exams	3	0
	Total	30	45

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Engineering Science: 2 credits, Engineering Design: 1 credit.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Provide an educational experience that prepares our students for the challenges of the surveying profession that they will encounter during their professional life.

Incorporate the state-of-the-art technologies in the surveying engineering curriculum.

10. PREPARED BY: R. Burtch **DATE:** May 1999

1. **COURSE:** SURE 452 - Geodesy I.

2. **DESCRIPTION:** This course deals with ellipsoidal geometry, direct and inverse geodetic problems, geodetic datums, coordinate systems, deflections of vertical, celestial sphere, astronomical triangle and its solution, different time systems, determination of astronomical azimuth and Laplace's equation. An introduction to cartography as a means of graphical communication and its objectives and scope are discussed. The problem of projecting the earth's surface to a plane and different developable surfaces are introduced. The basic properties and characteristics of most common map projections are included.

3. **PREREQUISITES:** SURE 230 and SURE 372.

4. **TEXTBOOK:** *State Plane Coordinate System of 1983*, J.E. Stem NOAA Manual NOS NGS 5.

   Coordinate Systems and Map Projections, D.H. Maling, 2nd ed., Pergamon Press, 1992.

5. **OBJECTIVES:**
   a. To understand basic ellipsoidal geometry, and direct and inverse problem (ABET Criterion 3a).
   b. To introduce the concepts of astronomy as applied to surveying engineering (ABET Criterion 3a).
   c. To understand the concepts of datum, and coordinate systems (ABET Criterion 3a).
   d. Be able to reduce observations to the computational surface (ABET Criteria 3a, 3e, and 3k).
   e. Be able to understand the theory of map projections and application of map projection to state plane coordinates (ABET Criterion 3a & 3k).

6. **TOPICS:** Ellipsoidal geometry, datum, coordinate system, map projections.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight	
		Lecture Hours	Lab Hours
a.	Introductory cartography.	2	
b.	Geometry of sphere and ellipsoid.	4	
c.	Coordinate systems (plane, sphere, ellipsoid).	2	3
d.	Basic astronomy.	2	
e.	Astronomical coordinates, azimuth.	2	
f.	Motions of the earth, stars, and sun.	2	
g.	Time systems.	2	
h.	Corrections to observations.	2	
i.	Determination of azimuth.	3	6
j.	Computation on the ellipsoid.	3	9

k.	Direct and inverse geodetic problems.	2	6
l.	Gaussian fundamental quantities.	1	
m.	Theory of distortions in map projection.	4	
n.	Fundamental methods of map projection.	4	6
o.	Conformal projections (state plane coordinates).	7	15
p.	Three tests.	3	
	Total	45	45

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Engineering Science: 3 credits.
Engineering Design: 1 credit.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Provides educational experience to prepare students for the challenges of the surveying profession.

Provides opportunities for students to exhibit creativity, leadership, and team building abilities.

10. PREPARED BY: K. Thapa **DATE:** February 1999

1. **COURSE:** SURE 453 – Geodesy II

2. **DESCRIPTION:** This course is a continuation of SURE 452 Geodesy I and it involves Lambert, Transverse Mercator, and Universal Transverse Mercator Projections and their use in state plane coordinates computations. Introduction to physical geodesy, gravity observation and reduction, Stoke's integral, Bruns formula are discussed. Basic concepts of positioning by observing satellites, Doppler positioning concepts, Global Positioning System (GPS) including both theoretical and practical aspects, VLBI, lunar and satellite laser ranging are included.

3. **PREREQUISITES:** SURE 373, SURE 452.

4. **TEXTBOOK:** *Global Positioning Systems Theory and Practice*, Hoffman-Wellenhof, Springer Verlag, New York.

5. **OBJECTIVES:**
   a. To familiarize students with the concepts of geodesy and its relationship with other disciplines (ABET Criterion 3d).
   b. Computations of state plane coordinates (ABET Criterion 3b).
   c. Gravity and its potential, gravity anomalies (ABET Criteria 3a, 3b).
   d. Satellite positioning, GPS, and use of GPS equipment to establish geodetic networks (ABET Criteria 3a, 3b, 3c, 3e, 3k).
   e. Introduction to laser ranging and VLBI (ABET Criteria 3a, 3e).

6. **TOPICS:** State plane coordinates, physical Geodesy, positioning by satellite, GPS, VLBI.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	**Time Weight**	
		Lecture Hours	**Lab Hours**
a.	History of Geodesy, Eratosthenes, Ptolemy, Shape and size of the earth.	1	
b.	Importance of Geodesy and its relationship to other disciplines.	1	
c.	Geodetic survey planning standards and accuracy.	2	
d.	Geodetic networks and functions of NGS.	1	6
e.	Conformal projections and state plane coordinates.	4	9
f.	Coordinate systems and transformations.	1	
g.	Gravity and its potential.	3	
h.	Gravity reductions.	3	
i.	Solution of Laplace equation.	1	
j.	Stoke's and Vening-Meinesz Equations	1	
k.	Disturbance potential and Bruns formula.	1	
l.	Satellite orbits Keplerian elements	1	
m.	Satellite Doppler.	1	
n.	Global Positioning System (GPS).	2	

o.	Antennas and receivers.	2	
p.	Biases and errors.	2	
q.	GPS survey design and its practical aspects.	5	6
r.	Observation equations.	2	
s.	GPS observations and positioning.	3	24
t.	Inertial positioning system.	2	
u.	VLBI and laser ranging.	3	
v.	Three tests.	3	
	Total	45	45

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Engineering Science: 3 credits, Engineering Design: 1 credit.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Provides educational experience to prepare students for the challenges of the surveying profession.

Provides opportunities for students to exhibit creativity, leadership, and team building abilities.

Employ state-of-the-art technologies in the Surveying Engineering curriculum.

10. PREPARED BY: K. Thapa **DATE:** February 1999

1. **COURSE:** SURE 465 – Legal Aspects of Surveying II.

2. **DESCRIPTION:** A study of the total body of law as it applies to the practice of Land Surveying. Both statute law and common law are covered. A number of court cases are studied for the purpose of defining the land surveyor's role in the judicial process and the use of legal precedent in answering the related questions of law and fact. Practical description writing and interpretation is an essential portion. Writing intensive.

3. **PREREQUISITES:** SURE 365, Legal Aspects of Surveying I; BLAW 221, Business Law; ENGL 250, English 2. It is expected that the student have proficiency in the following areas: English composition, basic land boundary theory, history of surveying, fundamental traverse, coordinate and area calculations.

4. **TEXTBOOK:** *Clark on Surveying and Boundaries, 6th Ed.*, Robillard, W.G. and Bouman, L.J., The Mitchie Company, Charlottesville, VA, 1992; *Prentice Hall Handbook for Writers, 12th Ed.*, Kramer, et. al., Prentice Hall, Inc., Englewood Cliffs, NJ, 1995.

5. **OBJECTIVES:**
   a. Acquire a working knowledge of the major statutory laws affecting the practice of surveying (ABET Criteria 3d, 3e & 3h).
   b. Know how to research court cases and public documents (ABET Criteria 3d, 3f, 3i & 3h).
   c. Continue to gain competence in the preparation and interpretation of legal descriptions (ABET Criteria 3f, 3h & 3j).
   d. Understand the role of evidence in the conduct of boundary surveys (ABET Criteria 3d, 3i & 3h).
   e. Explore the fundamental concepts of riparian rights and easements (ABET Criteria 3d, 3f & 3h).
   f. Further develop effective writing skills (ABET Criterion 3g).

6. **TOPICS:** Effective writing, duties and liabilities of the surveyor, statutory regulations for surveyors, property descriptions, retracement of sectionalized lands, excess and deficiency, possessor rights, evidence, riparian ownership and water boundaries, easements.

7. **CLASS/LABORATORY SCHEDULE:**

	Units of Instruction	Time Weight Lecture Hours	Time Weight Lab Hours
a.	Introduction: course goals, policies and grading procedures, proper presentation of assigned work.	1	

b.	Effective writing: role of writing in professional/academic settings, strategies for determining appropriate document type and style, effective writing for different audiences, organization of papers for various purposes.	3	
c.	Duties and liabilities of the surveyor: the legal role of the surveyor, the American judicial system, a forum for dispute resolution, professional liability, negligence, torts.	6	
d.	Property descriptions, writing and interpreting.	8	
e.	Retracement of sectionalized lands: general rules founded upon congressional legislation, restoration of lost or obliterated corners.	6	
f.	Platted subdivision retracement, general principles, evidence, apportionment.	4	
g.	Excess and deficiency: public land surveys, sequential parcels, simultaneous conveyances.	4	
h.	Possessor rights: adverse or hostile, eminent domain.	3	
i.	Evidence: the law of evidence, definition and effect, classification of evidence, understanding the laws of boundaries and evidence.	3	
j.	Riparian ownership and water boundaries: ownership of subaqueous lands, riparian rights and navigation law, changes to the shore line.	5	
k.	Using a law library.		2
l.	Researching documents of record.		4
m.	Fractional section subdivision/government lots.		4
n.	Michigan survey statutes.		12
o.	Easements and rights of way		8
p.	Exams	2	
	Total	45	30

8. CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
Engineering Science: 1 credit; Engineering Design: 3 credits.

9. RELATIONSHIP TO PROGRAM OBJECTIVES:
Provides educational experience to prepare students for the challenges of the surveying profession they will encounter during their professional life.

Incorporates interdisciplinary concepts and problem solving exercises.

10. PREPARED BY: C. Shangraw **DATE:** February 1999

C. Faculty Resumes

1. **Name:** Robert Burtch, P.S.
   Academic Rank: Professor

2. **Degrees:** M.S. Geodetic Science, Ohio State University, December 1983.

3. **Years of Service at Ferris State University:** 20
   Original appointment: Instructor, 1979
   Promotion: Assistant Professor, 1981
   Associated Professor, 1989
   Professor, 1992

4. **Related Experience:** 8 years of surveying experience prior to teaching

5. **Consulting:** None

6. **Registration:** Professional Surveyor, Michigan, Certified Photogrammetrist, ASPRS

7. **Principal Publications in Last Five Years:**

Burtch, R. "An Introduction to Horizontal and Vertical Curves", Paper presented at the MSPS 55th Annual Meeting, Lansing, MI, February 20, 1996.

_____. "A Note on Different Methods for Computing the Eccentric Anomaly", SURE Technical Memorandum 1, Ferris State University, March 1996, 14p.

_____. "Creating Map Products - Map Design and Layout", Paper presented at the 5th Annual IMAGIN Forum, New Directions for Spatial Information Sciences, Lansing, MI, April 11-12, 1996.

_____. "Leica SD 2000 Operating Procedures: A Laboratory Manual", SURE Technical Memorandum 2, Ferris State University, July 1996, 47p.

_____. "Conventional Aerial Photography vs. Digital Orthophotography", Paper presented at the 1st Annual Michigan County GIS Conference, September 19, 1996.

_____. "The Professional Surveyor and Geographic Information Systems", Paper presented at the MSPS 56th Annual Meeting, Traverse City, MI, February 18-21, 1997.

_____. "Introduction to Survey Adjustments", Presentation made at the Michigan Department of Transportation Seminar on Datums, State Plane Coordinates & Least Squares Adjustments, Big Rapids, March 18-20, 1997 and November 4-6, 1997.

_____. "Acquiescence: Basic Principles", Paper presented at the 1997 ACSM-ASPRS Annual Convention, Seattle, WA, April 7-10, 1997.

_____. "Astronomical Observations Workshop Notes", Presentation for workshop on Astronomic Observations, MSPS Para-Professional Council, Big Rapids, May 17, 1997.

_____. "Using the Global Positioning System (GPS)", Workshop Notes, Traverse City, July 11, 1997; September 19, 1997.

_____. "Leveling Adjustment", Notes presented at the Seminar on Datums, State Plane Coordinates & Least Squares Adjustment, Big Rapids, November 4-6, 1997.

_____. "Surveying Education at Ferris State University", <u>Surveying and Land Information Systems</u>, Vol. 57, No. 4, December 1997.

Kovas, J. and R. Burtch. "Datums, State Plane Coordinates and Transformations", Seminar Notes, Lansing, MI, December 4, 1997.

Burtch, R. "Introduction to ARCVIEW GIS", Seminar notes, Traverse City, September 1998.

Burtch, R. and J. Kovas. "GPS Leveling and Surveying Standards", Seminar Notes, Clare, MI, November 5, 1998.

Burtch, R., "A Look at the Education of Surveyors at Ferris State University", Paper presented at the MSPS 58th Annual Meeting, Grand Rapids, MI, February 16-19, 1999.

8. Scientific and Professional Society Membership:
ACSM, ASPRS, ASCE, CIG, ION, MSPS, Photogrammetric Society, URISA

9. Honors and Awards:
Merit Award, ASPRS, 1998

10. Institutional and Professional Service in Last Five Years:

FSU:

Student Life Committee, 1997-present
College of Technology Dean Search Committee, 1997-1998
Promotion Committee 1997-1999

Professional:

Secretary/Treasurer of Eastern Great Lakes Region ASPRS, 19986-present.
MSPS Scholarship Committee, 1989-present
ASCE Publications Committee, 1988-present, currently Editor, Journal of Surveying Engineering,
ASPRS Certified Photogrammetrist Committee, 1992 - present.
ACSM Scholarship Committee, 1996-present
MSPS Board Member, 1997 - present, currently Treasurer
MSPS Foundation Trustee, 1993 - present, currently Vice-President
Task Force on the NCEES Model Law for Surveying, 1997-present.
1999 HSPS Annual Meeting Committee, Co-Chair, 1997-1999.
MSPS Ethics Committee, 1998.

11. Professional Development Activities in Last Five Years:

ACSM-ASPRS Annual Meetings, 1995, 1997
GIS/LIS Annual Conferences and Expositions, GIS/LIS '96, GIS/LIS'97
MSPS Annual Meetings, 1995, 1996, 1997, 1998, 1999
Trimble Users Group Meeting, August 1995.
ARCCAD Training, March 1996.
Softcopy Photogrammetry Applications: Using the Tools Conference, July 1997.
Integrated Geospatial Data Acquisition Systems Tutorial, July 1998.
Image Understanding with Halcon Tutorial, July 1998.
Object Recognition and Scene Classification from Multispectral and Mulitsensor Pixels, ISPRS Commission III Symposium, July 1998.
Duane C. Brown International Summer School in Geomatics, July 1998.
ALTA/ACSM Land Title Surveys Seminar, October 1998.
The Land Division Act, February 1999.
Core Issues in Managing and Protecting Your Business, February 1999.
IMAGIN Form, May 1999.

1. **Name:** David J. Hanna, P.E.
   Academic Rank: Associate Professor

2. **Degrees:**
   B.S. Marine Engineering, United States Merchant Marine Academy, 1972
   M.S. Environmental Engineering, Rensselaer Polytechnic Institute, 1974

3. **Years of Service at Ferris State University:** 8
   Original appointment: Assistant Professor, 1991
   Promotion: Associate Professor, 1995

4. **Related Experience:**
   State University of New York, Adjunct Instructor, 1976-1983, Engineering Sciences
   Rensselaer Polytechnic Institute, Adjunct Instructor, 1988-1991, Environmental Engineer
   Southern Vermont College, Adjunct Instructor, 1991, Water Quality
   McClure Engineering Co., Branch Office Manager, 1990-1991, Civil and Environmental Engineer
   J.K.Fraser & Associates, Project Manager, 1985-1990, Civil & Environmental Engineer
   Ralph M. Parsons Co., Project Manager, 1983-1985, Process Engineering
   Stearns & Wheler, Managing Engineer, 1979-1983, Environmental Eng.
   Calocerinos & Spina, Head Mechanical Eng., 1975-1979, Civil and Environmental Engineer
   DuBois & King, Intern Engineer, 1974-1975, Water Resources Eng.

5. **Consulting:**
   Active in western Michigan from 1992 to 1998 with several consulting engineering firms. Services performed have included investigations, project reports, preliminary and final design on water and wastewater treatment and pumping projects for municipal and industrial clients.

6. **Registration:** Michigan, Ohio - Currently registered as a Professional Engineer

7. **Principal Publications in Last Five Years:** None

8. **Scientific and Professional Society Membership:**
   Associated Schools of Construction, Co-Chair, Undergraduate Education Committee 1998-Present
   American Society for Engineering Education, Executive Committee, North Central Section 1994-Present
   Hydraulic Institute, Standards Reviewer, 1999-Present

9. **Honors and Awards:**
   Outstanding Educator, Associated Schools of Construction, 1999
   University Excellence Award, Ferris State University, 1998
   Outstanding Educator, Associated Schools of Construction, Great Lakes Region, 1997
   Outstanding Teacher, American Society for Engineering Education, North Central Section, 1997
   Recognition of Service in University Program Review, Ferris State University, 1997
   Dow Outstanding New Faculty Award, American Society for Engineering Education, North Central Section, 1996
   National Teaching Award, Associated Schools of Construction, 1995 (1st year of this award)
   Award for Excellence, Technical Publications Category, American Association of Publishers (Chapter Author) 1990
   Special Recognition Award, New York State Society of Professional Engineers, Capital Chapter, 1989

Award of Merit in Concrete Design & Construction, American Concrete Institute, Central NY Chapter, 1985

10. Institutional and Professional Service in Last Five Years:

University:

- Chair, VP for Academic Affairs Search Committee, 1997-1998
- Member, Academic Senate, 1995-Present
- Member, University. Academic Program Review Council, 1995-1999
- Member, Task Force on Developing a New Pedagogy, 1997-1998
- Member, Writing Intensive Course Committee, 1996-Present
- Member, Substance Abuse Committee, 1993-1994
- Member, Organizing Committee 2nd Ferris Faculty Institute, 1996-1997
- Member, University Admissions Standards Committee, 1999-Present

College of Technology:

- Faculty Representative Summer Orientation and Registration, 1995, 1997-1999
- Member, Curriculum Committee, 1994-1995
- Co-Chair, Host Committee for ASEE Regional Conference at Ferris State University, 1995-1996

Construction & Facilities Department :

- Faculty Mentor, 1993-Present (three separate assignments)
- Chair, Faculty Member Tenure Committee, 1997-Present
- Member, Curriculum Committee, 1994-1996
- Faculty Coach, Student Project Management Competition Team, 1993-Present
- Instructor, Institute for Construction Education and Training, 1994-Present
- Faculty, FSU course at Grand Rapids Applied Technology Center, 1991-Present
- Instructor, EIT Review Seminar for Surveying Engineering students, 1998

State of Michigan:

- Member, Task Force on Construction Management, Office of Management and Budget, 1993-1997

11. Professional Development Activities in Last Five Years:

- Associated Schools of Construction National Conference, 1995-1999
- Associated Schools of Construction Regional Conference, 1992-1998
- American Society for Engineering Education National Conference, 1993, 1996
- American Society for Engineering Education Regional Conference, 1994-1997
- Fifth National Conference on Creativity in American Universities, 1994
- Electrical Systems Design for Non-Electrical Engineers, University of Wisconsin-Madison, 1998
- Federal Highway Administration Regional Training and Certification Conference, Ferris State University 1998
- Ferris Faculty Summer Institute, 1997
- Field Evaluation of Pump Operating Systems, 1997
- Design, Installation and Troubleshooting Mechanical Seal Systems, 1997
- Ferris Faculty Summer Institute, 1996
- Tips of the Teaching Trade, Ferris State University, 1996
- Michigan Quality in Construction Initiative, Michigan State University, 1994

1. Name: Sayed R. Hashimi, P.S.
Academic Rank: Professor

2. Degrees:

Associate of Engineering, Surveying Engineering Technology, Oregon Institute of Technology, 1968.
B.T. Civil Technology (Surveying Option), Oregon Institute of Technology, 1972.
M.S. Geodesy, Purdue University, 1975.
B.S. Computer Information Systems, Ferris State University, 1984.

3. Years of Service at Ferris State University: 24

Original appointment: Technical Instructor, 1975
Promotion: Assistant Professor, 1978
Associate Professor, 1984
Professor, 1990

4. Related Experience:

March 1995 to June 25, 1995, Associate/Consultant - McNeely & Lincoln, Assoc. Inc., Novi, MI.
September 1994-February 1995, President - METCO Land S.E.A. Corp., Clawson, MI.
May 1978-September 1978, Consulting - Gilbert/Commonwealth Assoc., Inc., Jackson, MI
June 1976-August 1977, Field Project Coordinator - Gilbert/Commonwealth Assoc. Inc., Jackson, MI.
September 1972-August 1974, Survey Party Chief - Clarence Blair Associates, New Haven CT
September 1969-September 1970, and March 1971 to September 1971, Assistant Survey Party Chief - Clarence Blair Associates, New Haven CT.
September 1968-August 1969, Survey Party Chief - Cadastral Survey, Kabul, Afghanistan

5. Consulting:

Written several commercial surveying application software packages. This includes a rigorous least squares adjustment program for microcomputers, Polaris and solar observations reduction for azimuth without the use of ephemeris, and several geodetic surveying application routines.
Completed numerous adjustment and State Plane Coordinate application projects for the private sector.
Testified as an expert witness

6. Registration: Professional Surveyor, Michigan 1979, #26456

7. Principal Publications in Last Five Years

"Teaching Surveying Applications With Mathcad", North American Surveying Teachers Conference, June, 1997, Las Cruces, NM

8. Scientific and Professional Society Membership:

American Congress on Surveying and Mapping
National Society of Professional Surveyors
Michigan Society of Professional Surveyors
Canadian Institute of Geomatics

9. Honors and Awards:

Certificate of Appreciation by the National Council of Examiners for Engineering and Surveying (NCEES) as a consultant on the Committee on Examinations

Recipient of the NSF $50,000 Instrumentation and Laboratory Improvement (ILI) grant, May 1989

Appointed by Michigan Governor John Engler to serve on the Board of Licensing for Professional Surveyors, September 1991

Recipient of a two-year tuition and fee paid scholarship by the U.S. Agency for International Development to attend Oregon Institute of Technology, formerly known as Oregon Technical Institute, September 1966 to September 1968.

Graduated second (in a class of 105) from Cadastral Survey High School, March 1966

Graduated first (in a class of 45 students) in junior high school, November, 1963

10. Institutional and Professional Service in Last Five Years:

FSU Faculty Research Committee

Construction and Facilities Department Computer Committee

National Council of Examiners for Engineering and Surveying (NCEES) Consultants Committee on Examination for Land Surveyors.

National Society of Professional Surveyors (NSPS) Education Committee.

Board Member (secretary) - Michigan State Board of Licensing for Professional Surveyors.

Advisory Committee - Macomb Community College Land Surveying Technology Program.

11. Professional Development Activities in Last Five Years:

NCEES item writing workshop, 1/22/99 - 1/23/99, Clemson, SC

NCEES item writing workshop, 1/9/98 - 1/10/98, Clemson, SC

ACSM Convention, 3/2/98-3/6/98, Baltimore, MD

NCEES item writing workshop, 6/13/97 - 6/14/97, Clemson, SC

NCEES item writing workshop, 1/14/97 - 1/15/97, Clemson, SC

MSPS Preparation of Licensure Examination, 1/9/97, Mt. Pleasant, MI

CAiCE Software Workshop, 1/27/97 - 2/31/97, Tampa, FL

MSPS Convention, Traverse City, MI, 2/19/97 - 2/20/97

Liscad Workshop, 3/4/97 - 3/5/97, Atlanta, GA

Presented a one-day workshop for Michigan Department of Transportation on March 20, 1997.

ACSM Convention 4/7/97 to 7/9/97, Seattle, WA

CAiCE Users Group Workshop, 5/7/97, Lansing, MI

North American Surveying Teachers Conference, 6/9/97-6/11/97, Presented Paper, Las Cruces, NM

ACSM/ASPRS Convention, 4/21/96-4/25/96, Baltimore, MD

NCEES item writing workshop, 6/14/96-6/15/96, Clemson, SC

MSPS Convention, 2/21/96-2/23/96, Lansing, MI

ACSM/ASPRS Convention, 2/27/95-3/02/95, Charlotte, NC

FSU - HRD Summer Workshops:

- "Taking a Look at Yourself & Others", 7/18,95
- "!!!It Can't Be Done, Maybe It can Be Done!!!", 7/20/95
- "Strategies for Dealing With Conflict", 7/25/95
- "Criticism: How To Give It & How To Take It", 7/27/95
- "Change & Stress: How To Cope!", 8/1/95
- "Dealing With Difficult People", 8/3/95

NCEES item writing workshop, 6/8/95-6/9/95, Clemson, SC

1. **Name:** John L. Moore, P.E., R.L.S.
   Academic Rank: Assistant Professor

2. **Degrees:**
   B.S. Civil Engineering; Purdue University, 1958
   M.S. Civil Engineering; Purdue University, 1961

3. **Years of Service at Ferris State University: 9**
   Original appointment: Assistant Professor, 1990

4. **Related Experience:**
   May 1990 to August 1990; Design Engineer. Responsible for the engineering design of highway projects for the Vanderburgh County Engineering Department, Room 325A, Administration Building, Civic Center Complex, Evansville, IN 47708.

   July 1985 to May 1990; Assistant Professor of Civil Engineering Technology. Responsible for courses in construction materials, construction methods, land surveying, soil mechanics and transportation in the Civil Engineering Technology Program, University of Southern Indiana, 8600 University Blvd., Evansville, IN 47712.

   August 1983 to June 1985; Assistant Professor of Civil Engineering Technology. Evansville Campus, Indiana State University, 8600 University Blvd., Evansville, IN 47712. The position was same, the Evansville Campus was granted independence on July 1, 1985.

   January 1980 to August 1983; Utility Engineer. Responsible for coordinating utility relocation with proposed highway construction projects for the Division of Design, Indiana Department of Highways, 100 N. Senate Ave., Indianapolis, IN 46204.

   September 1976 to January 1980; Traffic Statistics Supervisor. Responsible for traffic volume counting programs for the Division of Planning, Indiana State Highway Commission, 100 N. Senate Ave., Indianapolis, IN 46204.

   October 1975 to September 1976; Needs Analysis Engineer. Coordinate the development of the functional classification system with the realignment of the federal aid system in the State of Indiana for the Division of Planning, Indiana State Highway Commission.

   February 1972 to October 1975; Engineer of Buildings and Grounds. Responsible for coordinating major building repairs and the construction of capitol improvement programs for the Division of Maintenance, Indiana State Highway Commission.

   February 1970 to February 1972; Permit Engineer. Responsible for issuing driveway permits and coordinating access development for the Division of Maintenance, Indiana State Highway Commission.

   July 1963 to February 1970; Project Engineer. Supervise highway and bridge construction projects in the Greenfield District, Indiana State Highway Commission, Box 667, Greenfield, IN 46140.

   June 1962 to July 1963; Office Engineer. Responsible for engineering and surveying projects for P. E. Middleton Co., Inc., Engineers, 6375 South 800E, Zionsville, IN 46077. P.E. Middleton

Co., Inc., Engineers was a family owned company engaged primarily in subdivision design and land surveying. I also served on the board of directors for many years and as president of the company from about 1977 until the business was closed in 1983.

September 1959 to June 1962; Instructor. Taught surveying, engineering graphics and related subjects in the School of Civil Engineering, Purdue University, West Lafayette, IN 46907.

5. **Consulting:**
Provide minimal consulting activities. Consulting activities are limited to construction materials, primarily limited to asphalt materials and paving operations. No patents applied for.

6. **Registration:**
Registered Professional Land Surveyor, Indiana No. 9566
Registered Professional Engineer, Indiana No. 10803
Registered Professional Engineer, Oregon No. 14395
Registered Professional Engineer, Michigan No. 38365

7. **Principal Publications in Last Five Years:** None.

8. **Scientific and Professional Society Membership**:
ASCE
ASEE

9. **Honors and Awards:**
Honorary Member Sigma Lambda Chi, the Honor Society for Construction Education.
Honorary Member Lambda Sigma, the Honor Society for Surveying Engineering.

10. **Institutional and Professional Service in Last Five Years:**
Director of the Institute for Construction Education and Training at Ferris State University.
Member of the Library/Archival Committee.
Member and Past Chairman of the Tenure Committee for the Construction and Facilities Department at Ferris State University.
Advisor to the Student Club, The Associated Construction Students.
Member of the Laboratory Committee for the Construction Technology and Management Program.
Library Liaison for the Construction Technology and Management Program

11. **Professional Development Activities in Last Five Years**:
Attend FHWA Regional Workshops for Technician Training on a continuing basis.
Attended FHWA SuperPave Conferences and Workshops and receive up-dated communications as published.
Attend MAPA Annual Conferences on a continuing basis.

1. **Name:** Marvin E. Myers, P.S.
   Academic Rank: Adjunct Faculty

2. **Degrees:**
   A.A.S. Civil Engineer Technology, Ferris State University, 1979
   B.S. Surveying, Ferris State University, 1979
   B.S. Surveying Engineering, Ferris State University, 1993

3. **Years of Service at Ferris State University:** 5

4. **Related Experience:**
   North Central Survey Company, Party Chief, 1972-1975
   Williams and Works, Survey Team for Truman Dam, 1975-1976
   North Central Survey Company, Surveyor, 1977-1980
   Norstar Survey Company, Surveyor, 1980-1983
   Nordlund & Dunlap Associates, Professional Surveyor, 1983-1986
   North Central Survey Company, Survey Manager, 1986
   Myers Land Survey Company, Inc., President, 1986-present

5. **Consulting:** None

6. **Registration:** Professional Surveyor, MI

7. **Principal Publications in Last Five Years:** None

8. **Scientific and Professional Society Membership:**
   American Congress on Surveying and Mapping
   Michigan Society of Professional Surveyors (Northern Chapter)
   National Society of Professional Engineers
   Michigan Museum of Surveying—Charter Member
   Houghton Lake Rotary Club—Charter Member 1986
   Tri-Lakes Home Builders Association
   Houghton Lake Merchants Association
   Houghton Lake Historical Society
   Houghton Lake Area Chamber of Commerce
   Grayling Chamber of Commerce

9. **Honors and Awards:**
   Tri-Lakes Home Builders Associate of the Year 1996
   Habitat for Humanity Volunteer of the Year

10. **Institutional and Professional Service in Last Five Years:** None

11. **Professional Development Activities in Last Five Years:**
    Career Day Presenter for High School Students
    Speaker for Tri-Lakes Home Builders Association
    Crawford County GIS Steering Committee
    Roscommon County GIS Steering Committee
    Habitat for Humanity

1. **Name:** Jens Otto Rick, P.S.
   Academic Rank: Professor

2. **Degrees:**
   B.S.E. Civil Engineering, University of Michigan 1971
   M.S.E. Civil Engineering (Geodetic), University of Michigan 1972

3. **Years of Service at Ferris State University:** 27
   Original appointment: Assistant Professor, 1972
   Promotion: Associate Professor, 1978
   Professor, 1989

4. **Related Experience:**
   Seminar lecturer, Michigan Department of Transportation Seminar on Datums, Plane. Coordinates and Least Squares, Big Rapids, MI (March 18-20 and November 4-6, 1997.
   Photogrammetrist, GEOPLAN, Copenhagen, Denmark (August 1985- June 1986). Participated in digital mapping operations over the Faroe Islands, trunk line and distribution pipe lines for natural gas from the Danish gas fields in the North Sea to the Danish peninsula.
   Seminar lecturer, Pennsylvania State Society of Registered Land Surveyors (November 1979). Lectured on the elements of photogrammetry for land surveyors.
   Graduate teaching assistant, Purdue University, West Lafayette (September 1976- June 1977). Instructed in the graduate photogrammetry laboratory.
   Technical assistant, Abrams Aerial Survey Corporation, Lansing MI (July and August 1974). Assisted in strip and block adjustment for topographic mapping control, located pass points on photographs, assisted in photographic processing and ground control surveying.

5. **Consulting:**
   Photogrammetric consultant for Air-Land Surveys (August 1987). Calibrated stereoplotting instrument Galileo Stereosimplex IIIc.
   Photogrammetric consultant for University of Wisconsin (July 1987). Calibrated stereoplotting instrument Zeiss Stereoplanigraph C-8.
   Photogrammetric consultant for Western Michigan University (August 1983). Installed and calibrated stereoplotting instrument Galileo Stereocartograph IV.
   Consultant, Defense Mapping Agency, Aerospace Center (February 1982). Assisted in the design of vision testing and vision training for DMA employees. Consulting was in cooperation with College of Optometry, FSU.
   Academic consultant, Mankato State University, Minnesota (November 1980). Assisted academic staff in planning a baccalaureate degree program in land surveying to meet Minnesota State requirements for licensure.
   Academic consultant, McGraw-Hill Book Company (April 1979, January 1983, 1984). Performed several surveying textbook reviews.

6. **Registration:** Professional Surveyor, State of Michigan No. 21579

7. **Principal Publications in Last Five Years:**
   "The Michigan State Plane Coordinate System", prepared for the Michigan Department of Transportation Seminar on Datums, Plane. Coordinates and Least Squares, Big Rapids, MI (March 18-20 and November 4-6, 1997.

8. **Scientific and Professional Society Membership:**
   American Congress on Surveying and Mapping
   American Society of Photogrammetry and Remote Sensing
   The Photogrammetric Society, London, England
   Lambda Sigma member, honorary land surveying fraternity

9. **Honors and Awards:**
   Presidential Citation for Meritorious Service, American Society for Photogrammetry and Remote Sensing, March 1986.

10. **Institutional and Professional Service in Last Five Years:**
    Chairman, Executive Tenure Committee, Construction and Facilities Department, Academic year 1995-1996.
    Departmental Representative, Candidate Tenure Committee, Construction and Facilities Department, 1998 to present.
    Founder and Faculty Advisor, The Burt and Mullett Student Chapter of ACSM, 1975 to present.

11. **Professional Development Activities in Last Five Years:**
    Michigan Society of Professional Surveyors Annual Convention attendance 1999, 1997, 1995
    Introduction to Intergraph's ImageStation, January 1997.
    Global Positioning System seminar sponsored by Leica and National Geodetic Survey, April 1998.
    Survey Instrumentation Precision seminar sponsored by Leica Surveying, Inc., December 1998.

1. **Name**: Carl F. Shangraw, P.S.
   Rank: Assistant Professor

2. **Degrees:**
   B.A. Sociology, Aquinas College, 1971
   M.S. Surveying, Purdue University, 1993

3. **Years of Service at Ferris State University:** 4
   Original appointment: Assistant Professor, 1995

4. **Related Experience:**
   Michigan Department of Transportation, Lansing MI (May 1993 – August 1995)
     Statewide GPS Survey Crew Chief
   Purdue University, West Lafayette IN (August 1991 – May 1993)
     Graduate Teaching Assistant/Instructor
   Moore and Bruggink, Inc., Grand Rapids MI (January 1989 – April 1991)
     Director, Surveying Department
   Carl F. Shangraw, Land Surveyor, Belmont MI (May 1986 – January 1989)
     Owner/Operator
   Michigan Army National Guard, Wyoming MI (April 1984 – May 1986)
     Training Officer
   Moore and Bruggink, Inc., Grand Rapids MI (October 1976 – April 1984)
     Surveyor
   Glaza and Associates, Grand Rapids MI (May 1973 – October 1976)
     Instrument Operator, Crew Chief

5. **Consulting:**
   Michigan Department of Transportation – Design of Proposed Survey Manual
   U.S. Army Corps of Engineers – Flood Studies on Lake Ontario and GPS Strategies and Methodology

6. **Registration:**
   Professional Surveyor, State of Michigan, 1978 to Present
   Land Surveyor, State of Wisconsin, 1983 to Present

7. **Principal Publications in Last Five Years**:
   James M. Anderson, Edward M. Mikhail; Surveying, Theory and Practice 7th Ed.; WCB McGraw-Hill; New York, New York, 1998. Assisted principal authors with the revision of Chapter 18, "Land Surveys".
   Carl F. Shangraw, P.S.; "Diet Cola and the Michigan State Plane Coordinate System"; The Base Line News, Vol. V, No.1; Ferris State University, Big Rapids, MI; February, 1996.
   Carl F. Shangraw, P.S.; "Ferris Students Inducted into Lambda Sigma"; The Michigan Professional Surveyor; MSPS; May-June, 1996

8. **Scientific and Professional Society Membership:**
   Michigan Society of Professional Surveyors (MSPS)
   American Congress on Surveying and Mapping (ACSM)
   Society of American Military Engineers (SAME)

9. **Honors and Awards:**
   Magoon Award, Purdue University, 1991-1992, Excellence in Teaching
   Magoon Award, Purdue University, 1992-1993, Excellence in Teaching

10. **Institutional and Professional Service in Last Five Years:**
    Member, University Writing Assessment Committee, Sept. 1997 to Present
    Member, University Professional Development Committee, Sept. 1998 to Present
    Member, University ad hoc committee for the development of a ROPES course, a small bore rifle range and an orienteering course, Nov. 1997 to Present
    Member, Program Evaluation Committee for Construction Management, College of Technology, April 1998 to Nov. 1998
    Scholarship Coordinator, Surveying Engineering Program, March 1996 to Present
    Founder and Faculty Advisor, FSU Chapter of Lambda Sigma, the National Surveying Honors Society, March 1996 to Present

11. **Professional Development Activities in Last Five Years:**
    ACSM/ASPRS Convention, Spring 1997, Seattle WA: Moderated half-day session and presented paper on GPS Standards and Specifications
    MSPS Annual Conferences, 1997, 1998, 1999
    SAME, 1996-1998, Attended meetings of Detroit MI and Buffalo NY Posts
    Michigan Land Title Association, Fall 1998: Presentation on The Metric System
    Michigan Department of Transportation, 1997-1998: Organized and assisted in the presentation of a series of two-three day long seminars on survey related topics for MDOT employees and consultants.
    Completed beginning, intermediate, advanced CAiCE training, Tampa FL, Jan 1997
    Completed 16 credit hours French, Ferris State University, 1997-1999
    Completed U.S. Army Command and General Staff College, Sept. 1998

1. **Name:** Khagendra Thapa
   Academic Rank: Professor

2. **Degrees:**
   Ph.D. Geodetic Science and Surveying, Ohio State University, September 1987
   M.S. Geodetic Science Ohio State University, December 1985.
   M.S. Engineering (M.SC.E.) Surveying Engineering, University of New Brunswick, Canada, May 1980.
   B.S. (Honors Degree) CNAA, Land Surveying Sciences, University of East London, London, England, 1978
   M.S. Statistics (incomplete), Tribhuvan University, Kath., Nepal, July 1975.
   B.S. Physics, Statistics, & Math. Tri-Chandra College, Kath., Nepal, July 1973

3. **Years of Service at Ferris State University:** 12
   Original appointment: Associate Professor, 1987
   Promotion: Professor, 1991

4. **Related Experience:**
   Supervisor - Mapping Laboratory, Department of Geodetic Science and Surveying, The Ohio State University, June-Sept, 19987
   Research and Teaching Associate, Department of Geodetic Science and Surveying, The Ohio State University, Autumn, 1984 - Spring 1987.
   Teaching Associate, Department of Mathematics, The Ohio State University, Autumn, 1982 - Spring 1984.
   Lecturer, Institute of Engineering, Tribhuvan University, Kath, Nepal, 8/1980 – 8/ 1982.
   Lecturer, First Regional Training Course for Hydrology Technicians Sponsored by HM Government of Nepal, UNESCO, and World, Meteorological Organization, 11/1981 –8/1982.
   Worked part time for TAEC Consult P. Ltd. as a consultant. Oct. 1980 - Aug. 1982.
   Geodetic Survey of Canada, Dept. of Energy Mines and Resources, Ottawa Canada. 5/7, 1980
   Research and Teaching Assistant, Department of Surveying Engineering
   University of New Brunswick, September 1978 - May 1980.
   Taught in High School Part time, 1971-75

5. **Consulting:**
   External evaluator for Surveying Engineering Program, Cal. State Univ., Fresno, CA. April, 1996
   Worked for Center for Mapping of the Ohio State University (OSU) for the US Geological Survey Project as a consultant, July-August, 1990.
   Worked for Digital Mapping Project, Department of Geodetic Science and Surveying, The Ohio State University, 7/8, 1988.

6. **Registration**: Surveyor in Training with the Royal Institution of Chartered Surveyors (RICS). London, England.

7. **Principal Publications in Last Five Years:**
   Thapa, K. and J. Matonich (1997), "Ethics and Professionalism in Surveying," 1997 ACSM/ASPRS Annual Convention and Exposition Technical Papers, Seattle, WA.
   Thapa, K. and R. C. Burtch (1995) "Surveying Engineering Education at Ferris State University," 1995 ACSM/ASPRS Annual Convention and Exposition technical Papers, Charlotte, NC.

8. Scientific and Professional Society Membership:
American Congress on Surveying and Mapping, American Society of Photogrammetry & Remote Sensing, Michigan Society of Professional Surveyors, American Society for Engineering education, Institute of Navigation, Royal Institute of Chartered Surveyors, London, England.

9. Honors and Awards:
FSU, Provost's Award for Excellence, 1997
Distinguished Faculty Award, Michigan Association of Governing Boards
Certificate of Recognition by the Board of Trustees of Ferris State University, Jan., 1995 & March, 1996 for outstanding service to the University.
Construction Department "Spark Plug Award", 1989.
Certificate of Commendation given by the National Society of Professional Surveyors in 1990 and 1991.

10. Institutional and Professional Service in Last Five Years:
Served in the academic senate for over 8 years and actively involved in various other committees. Raised close to one and half million dollars worth equipment, hardware, software, and cash for the Surveying Engineering Program. Obtained research grants totaling over $300,000 including grants from National Science Foundation. Established Certificate in GIS taught via Internet. I am one of the Evaluators for Accreditation Board for Engineering and Technology (ABET). Served as a Reviewer for National Science Foundation. Also serves as a reviewer for journals. Presented several papers in ACSM/ASPRS annual conferences. Served as a moderator for many sessions over the years.

11. Professional Development Activities in Last Five Years:
Teaching Thinking Skills Workshop at Ferris State University arranged by Professional Development Committee, November 6/7, 1996.
Completed Microstation software Training from Intergraph Corporation, Detroit, MI, 1995.
Arranged First Michigan ARC/INFO Users Group Meeting in February 1994.
WebCT Training, Ferris State University, May 1999.

Appendix II - Institutional Profile

I. Background Information Relative to the Institution

A. General Information

1. Name and Address of the Institution
2. Chief Executive Officer
3. Person Submitting Questionnaire

B. Type of Control

C. Regional or Institutional Accreditation

D. Faculty and Students

E. Mission

F. Institutional Support Units

II. Background Information Relative to the Engineering Unit

A. Engineering Educational Unit

B. Program Offered and Degrees Granted

C. Information Regarding Administrators

D. Supporting Academic Departments

E. Engineering Finances

F. Engineering Personnel and Policies

G. Engineering Enrollment and Degree Data

H. Definition of Credit Union

I. Admission and Graduation Requirements, Basic Programs

J. Nonacademic Support Units

Table II-1. Faculty and Student Count for Institution

Table II-2. Supporting Academic Departments

Table II-3. Personnel and Students

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Table II-5. Engineering Enrollment and Degree Data

Table II-6. History of Admissions Standards for Freshmen

Table II-7. History of Transfer Engineering Students

Appendix II - Institutional Profile

I. Background Information Relative to the Institution

A. General Information

1. Name and Address of the Institution:

   Ferris State University

   915 Campus Drive, Swan 312

   Big Rapids, Michigan 49307

2. Chief Executive Officer:

   Dr. William A. Sederburg, President

3. Person Submitting questionnaire:

   Dr. Khagendra Thapa, Program Coordinator and Professor, Surveying Engineering program

B. Type of Control

Ferris State University has a well-deserved reputation for providing high quality and distinctive educational programs. These programs are implemented by the Colleges of: Allied Health Sciences, Arts and Sciences, Business, Education, Optometry, Pharmacy, and Technology, and the University College.

Ferris is a key contributor to Michigan's economic base. The university works to meet the technology and work force demands of business and industry, the health care professions, and society in general through applied research and practical education. Ferris teaches technical skills and applications focused on solving real problems, and produces graduates that are more hands-on than conceptual, more practical than theoretical, and more active than contemplative.

The university is governed by an eight member Board of Trustees appointed by the Governor of the State of Michigan and confirmed by the State Senate. The Board's authority includes the government, control, and management of all aspects of the operation and development of the university. The Board receives all state appropriations for the university and allocates these funds to the different branches of the university. The president of the university reports to the Board of Trustees.

C. Regional or Institutional Accreditation

Ferris State University is accredited by the North Central Association of Colleges and Schools.

Initial accreditation in 1959, most recent accreditation in 1996.

D. Faculty and Students

Table II-1 provides a summary of the faculty, staff and student counts for the Fall Semester 1998.

E. Mission

Ferris State University's Century Old Mission

Ferris' career-oriented mission dates back to its origin in 1884, when Woodridge Ferris, later a two-term Michigan governor and U.S. senator, established a private industrial school in Big Rapids. Although Mr. Ferris had the retraining of out-of-work lumberjacks in mind when he started the institution 115 years ago, the concept of providing students with marketable skills for a changing society is just as relevant today.

The Statement of Mission

Ferris State University will be a national leader in providing opportunities for innovative teaching and learning in career-oriented, technological and professional education.

Board of Trustees' Strategic Goals

The updated University strategic plan, based upon the *Defining the Future: Comprehensive Planning Document*, was presented to the Board of Trustees at its August 1998 retreat. The plan was an outgrowth of the prior campus planning activities culminating in a series of strategic planning issues identified at a summer planning summit of the University Planning Committee, campus leaders, and Board of Trustees members. The Board voted to support that plan and supported strategic goals to guide fiscal 2000 planning activities. The Strategic Goals and Objectives section of the *Defining the Future* document has been updated to reflect the Board's goals.

Board of Trustee's goals are:

- Academic Enhancement

  Improve the quality of our **academic** product.

- Strategic Enrollment Growth

  Grow **enrollment** strategically.

- Expanded University Visibility

  Expand the **visibility** of the University and the President.

- Quality Improvement

Continue **quality** improvement activities.

- Enhanced University Resources

  Develop more **resources** for the University; continue budget and capital project management.

F. Institutional Support Units

The New Ferris Library:

The new Ferris State University Library for Information, Technology, and Education (FLITE) will replace the current library facilities with an advanced library capable of serving FSU and its many communities with state-of-the-art facilities and services. FLITE will be the physical manifestation of compelling educational concepts currently under development at FSU, and will be the centerpiece of the FSU campus. In long-standing recognition of the centrality of information to education and development, FLITE will be centrally located on the FSU campus. The physical structure and outward appearance of FLITE will clearly announce the innovative environment fostered by FSU and its commitment to learning.

The Center for Student Services (CSS) is a centralized facility for student services, such as Admissions, Registration, Business Office, Residential Life, and Financial Aid, plus central administrative functions, such as the President, Academic Affairs, Administration and Finance, Student Affairs, and University Advancement divisions. The CSS will be located in the existing Timme Library building after FLITE is completed. FLITE and CSS will enable the university to be a leader in the use of library technology and to provide better services to our students and the people of the State of Michigan.

The Goal of FLITE:

The FSU Library for Information, Technology, and Education will assure an environment for intellectual inquiry by providing user-focused services to obtain and evaluate scholarly and professional information and knowledge—in many formats and from multiple sources—necessary for the FSU community to create new knowledge, to apply knowledge to our community's needs, to increase understanding, and to develop wisdom.

The goals of FLITE address the many needs, services, and constituencies that FSU serves. In particular, FLITE will:

- Maintain and enhance a co-operative, user-centered culture.
- Acquire information and knowledge resources to serve FSU's educational mission.
- Develop user-focused products, services, processes, and systems.
- Bring global resources to FSU, and disseminate FSU's knowledge across the state, nation, and world.
- Develop instructional initiatives and programs that support FSU's mission, from basic skills to cutting-edge applications.

- Provide the means and facilities for the management and distribution of scholarly and professional information.

New Facility:

FLITE will combine the services and advantages of a traditional library with the many opportunities and resources available through the use of electronic and digital media. The new facility will combine a digital information library with an Educational Technologies Center. FLITE will allow faculty to develop user-centered curricula and will facilitate the use of converging technologies to assist a wide range of users in creating and disseminating new knowledge from current information and experience.

The development of FLITE will:

- Effectively serve FSU's student, academic, faculty, and community needs.
- Bring FSU's library and information facilities up to national standards and meet accreditation needs.
- Provide parity with the other state university libraries.

FLITE will enable FSU to retain its position in Michigan's system of 21st century higher education. FLITE will allow the university to support its sophisticated educational programs with necessary library facilities and services, to assist the state's economy through technical information transfer, and to operate as an information hub for the northwest portion of Lower Michigan.

Physically, FLITE will take a commanding central position on the FSU campus. To meet the needs of a centralized, university teaching library to the year 2020, the current library will need to be replaced with a new building of 185,000 gsf (gross square feet) or 125,800 asf (net assignable square feet). The facility will surpass the current 57,000 gsf building by an additional 128,800 gsf to meet the facility needs projected.

The integration of information, learning, and teaching is the foundation for the organization of the building. Learning, teaching, and professional development will be enhanced for both students and faculty through services offered by the new library. Central to its success will be the continued collaboration among the Library, Instructional Services, Information Services and Telecommunications, Instructional Technologies, the Center for Teaching, Learning, and Faculty Development, and the Center for Distributed Learning units.

The Educational Technologies Center (ETC) will be compromised of three allied groups: the Center for Distributed Learning, the Center for Teaching, Learning, and Faculty Development, and Instructional Technologies. These three groups will primarily serve and support faculty in transforming courses and developing curricular initiatives. The mission and contributions of the ETC staff relates closely to the library faculty as they incorporate current information resources and technologies into their new programs of distributed learning. Instructional Technologies staff and facilities provide equipment and expertise for the Center for Distributed Learning and the Center for Teaching, Learning, and Faculty development as well as for FLITE.

To achieve its aims, the FSU Library for Information, Technology, and Education will include three major sets of services, information access, patron facilities, and instructional resources.

Information Access:

- Technologies to enable the transmission and utilization of both local and remote multimedia.
- Local and remote digital information resources.
- Local browsing of print collections, supplemented by extensive document delivery services.
- Direct access to the State Library, Library of Congress and other university and state/federal electronic resources.

Patron Facilities:

- Study and work areas serving the increased demand for team-based learning in a technological environment.
- Digital conference rooms, classrooms, multi-purpose meeting rooms, and collaboration with network connectivity.
- Public computers and computer-equipped rooms for research, learning, and instructional activities.
- Server identification of remote patrons to enable access to license-restricted information resources.

Instructional Resources:

- Teaching and production areas for faculty to learn to use and develop instructional media.
- Support services for the creation of media.
- Support services and space for providing distance learning.

II. Background Information Relative to the Engineering Unit

A. Engineering Educational Unit

1. Organization: Refer to the attached chart.

2. The Surveying Engineering program is located in the College of Technology. The college consists of the Construction and Facilities Department, the Transportation and Electronics Department, and the Design, Manufacturing and Graphic Arts Department. Surveying Engineering is a part of the Construction and Facilities Department.

   The College of Technology has a long, successful history of preparing graduates in a number of selected fields where there is a shortage of skilled technical and technological workers and managers. Ferris is known nationally for its Surveying Engineering program and other strong programs such as Construction Management, HVACR, and Plastics.

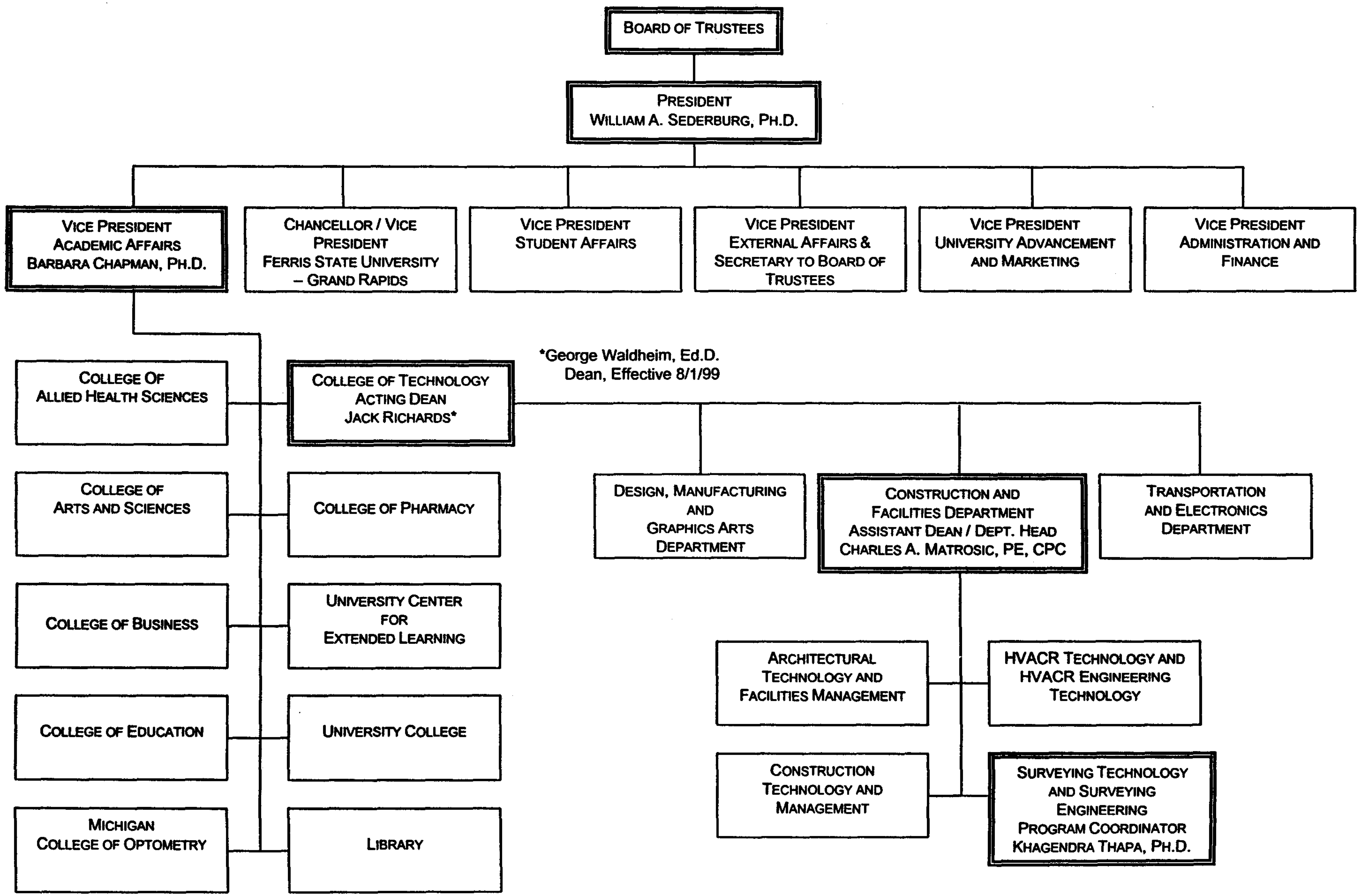
   Each program in the college is carefully developed with the help and advice of the advisory committee. Members of this committee are selected from leading businesses and industries. Continued advice is sought from the members of the advisory committee to ensure that the programs are current and relevant.

3. George P. Waldheim, Ed.D, is the Dean, College of Technology, effective August 1, 1999.

   Jack Richards is the Acting Dean, College of Technology.

   Charles A. Matrosic, P.E. is an Assistant Dean and the Head of the Construction and Facilities Department.

Ferris State University



3/99

4. College of Technology Mission

The mission of the College of Technology is to educate students in a spectrum of technical programs critical to Michigan's economic future and to provide technical support to business and industry. This curricula spectrum of engineering, engineering technology, technology management, and technical specialty programming integrates the appropriate general education courses needed to prepare today's graduates with a foundation of knowledge required to cope with advancing technology within their professional careers.

The College of Technology is committed to providing its diverse student body with strong technical curricula emphasizing practical usable skills that prepare the graduate to analyze, synthesize and problem-solve within their discipline. This is accomplished in an environment which is one of respect for our students and their field of study. Students are perceived as being customers who have enrolled in programs to become employable and prepared for advancements in their chose careers after graduation. The College takes this trust seriously, and provides curriculum laddering options for two-year A.A.S. degree program graduates to transfer into four-year B.S. degree programs.

B. Programs Offered and Degrees Granted

The B.S., Surveying Engineering is the only engineering degree granted by Ferris State University.

C. Information Regarding Administrators

Administrator resumes follow.

RESUME OF

Lester J. Richards (Jack)
Home 616-796-9426 Office 616-592-2895

EXPERIENCE

- July 1998 – Present
  Acting Dean, College of Technology, Ferris State University
- August 1996 – July 1998
  Assistant Dean/Department Head for the Transportation and Electronics department in the College of Technology, Ferris State University.
- January 1995 - August 1996
  Acting Department Head, Automotive and Heavy Equipment department, College of Technology, Ferris State University.
- August 1986 - January 1995
  Program Director, Automotive department, College of Technology, Ferris State University
- 1981 - August 1986
  Associate professor in the Automotive department, School of Technology, Ferris State University
- 1975 - 1981
  Assistant professor in various courses in the Automotive Service, Heavy Equipment Service and Automotive Management programs at Ferris State University
- 1974 - 1975
  Administrative assistant to the Dean, School of Technology, Ferris State University
- 1970 - 1974
  Instructor in the Automotive department, Ferris State University
- 1957 - 1970
  Service manager and automotive service technician in a franchised automotive dealership

EDUCATION

- MS, Occupational Education and Administration, University of Michigan
- Leadership Dealership Program, School of Education, University of Michigan
- BS Trade -Technical Education, Ferris State University
- Numerous classes and seminars on computer software use and applications

ORGANIZATIONS AND AFFILIATIONS

- Member - Immanual Lutheran Church, Big Rapids
- Iota Lambda Sigma - Professional Fraternity (past president, local chapter)
- North American Council of Automotive Teachers
- Michigan Association of College Automotive Teachers (past president)
- UATA (University Automotive Technology Association)
- Rails to Trails support group
- Big Rapids Amateur Radio Club (past president)
- Member – West Michigan Mustang Club
- Various university committees

ADDITIONAL INFORMATION

- Reviewed and evaluated Marine Corps automotive and truck training at Camp Lejeune for the American Council on Education (August 1995)
- Reviewed and evaluated Chrysler educational material for the American Council on Education (April 1990)
- Campaign Manager for the successful election of our county sheriff (1984 and 1988)
- Served on the local property tax review board for three years
- Hobbies include golf, amateur radio, winter sports, bicycling and automotive projects
- Currently chairman of the automotive advisory committee for the local career center

CHARLES A. MATROSIC, PE, CPC

CAREER HISTORY:

Over thirty-five years of diversified experience in engineering, construction, management and education positions of steadily increasing scope and responsibility. Includes seventeen years of university level teaching and administrative experience.

HIGHER EDUCATION EXPERIENCE:

Assistant Dean, College of Technology and Head, Construction and Facilities Department (1996-present); Professor with tenure (1992-1996), Associate Professor with tenure (1990-1992), Associate Professor (1986-1990) of Construction Technology and Management; Program Coordinator, Construction Technology and Management (1991-1993); Director, Institute for Construction Education and Training (1991-1993); Assistant Professor of Mechanical Engineering Technology (1985-1986), Ferris State University, Big Rapids, MI.

Assistant Professor of Military Science (1969-1972), Michigan Technological University, Houghton, MI.

PROFESSIONAL EXPERIENCE:

Lieutenant Colonel, U.S. Army Corps of Engineers (1964-1985), retired. Assignments included Director, Facilities Engineering; Executive Officer, Defense Contract Administration Services Region Dallas; Staff Engineer; Engineer Battalion Executive Officer; Assistant to the Resident Engineer; Construction Engineer.

EDUCATION:

MS, Civil Engineering, Michigan Technological University, Houghton, MI (1973).

47 quarter hours, MSBA program, Michigan Technological University, Houghton, MI (1970-1972).

BS, Metallurgical Engineering, Michigan Technological University, Houghton, MI (1964).

PROFESSIONAL:

Registered Professional Engineer, Michigan (1974-present).

Certified Professional Constructor (1996-present).

Member, American Council for Construction Education (1992-present). Vice President (1996-1998). Trustee (1996-present). Chair, Accreditation Committee (1998-present). Qualified visiting team member/chair. Member of four visiting teams, chair of one.

Academic Senate, Ferris State University (1988-1993, 1995-1996). Vice President three years, Information Officer one year, Executive Committee four years, Appointments Committee chair three years. Senate Ad Hoc Committee to Review Course Availability (1996). Chair, Joint Academic Program Review Procedures Committee (1988).

D. Supporting Academic Departments

The following academic departments support the Surveying Engineering program:

1. Physical Sciences
2. Mathematics
3. Social Sciences
4. Humanities.
5. Languages and Literature.
6. Management

Refer to Table II-2.

E. Engineering Finances

Refer to Appendix I, Table 5.

F. Engineering Personnel and Policies

1. Personnel

   Refer to Table II-3.

2. Faculty Salaries, Benefits, and Other Policies

   Initial faculty salaries are established at the time of hire. Subsequent salary adjustments are included in the collective bargaining agreement. Refer to Table II-4.

   Promotion and tenure policies are governed by the collective bargaining agreement. A copy of the college promotion policy and the department tenure policy follow.

COLLEGE OF TECHNOLOGY

PROMOTION/MERIT POLICY

I. INTRODUCTION

It is the intent of this policy to recognize the unique nature of the programs within the College of Technology and the diversity of the experiential backgrounds of the faculty involved in these programs. In keeping with the diversity, this policy contains less structured criteria than a policy that may be applicable in a more "traditional" educational setting.

The Ferris philosophy places emphasis on teaching and advising; therefore, in the process of reviewing faculty being considered for promotional recommendations, emphasis will be placed on the teaching and advising capabilities of the faculty. Additional emphasis will be given to areas of professional development and contributions to Ferris. This policy was developed for full-time teaching faculty in the College of Technology as they become eligible for promotional consideration in the following academic ranks: Assistant Professor, Associate Professor, Professor, and merit within rank.

When a person meets the minimum qualifications for a special instructional rank, it should not be assumed nor construed that the person will be appointed or advanced automatically to that rank. Rather, the intent of this policy is that all eligible persons (i.e., persons who meet the minimum qualifications) will be considered for promotion upon submission of a portfolio to the Promotion Committee; however, promotion in rank will be a selective process from among the candidates, to identify and advance those individuals who are judged to be best qualified to hold the higher rank. Applicants will request consideration for either promotion or merit, but not both.

A. Committee Membership

1. The College of Technology Promotion Committee will consist of seven members. A minimum of two members and no more than three members from one department may serve on the Committee at any one time.

[a]. Five of the Committee members will be tenured bargaining unit members from the College of Technology, selected at large by the College of Technology.

[b]. Two Committee members will be appointed by the Dean. One member will be appointed to a two-year term annually by the Dean following the yearly election. At least one of the appointed members shall be a tenured bargaining unit member.

[c]. Elected terms shall be for two years.

[d]. Election of members will occur during April of each year.

[e]. A Committee member will be ineligible for promotion consideration during the term of Committee membership.

[f]. In the event of an elected member being unable to complete a term, an election will be held to fill the vacancy.

2. The chairman of the Promotion Committee will be elected from the bargaining unit members of the Committee.

B. Promotion Review Process

1. The candidate is responsible to present a portfolio, consisting of no more than a one-inch thick three-ring binder to the Committee by October 15. Since it is possible that some accomplishments or eligibility requirements may have been met prior to the last promotion/merit increase, the candidate must document these achievements within the portfolio. **Consideration will be given only to accomplishments of the applicant since his/her last promotion or merit increase, or date of hire, whichever is more recent. The candidate will date all material submitted. If material is not dated, it will be disregarded.**

2.

[a]. This portfolio will include information and data pertinent to the candidate's professional qualifications, demonstrating achievement in the following areas: teaching, work experience, professional development, contributions to Ferris beyond teaching, involvement in professional organizations/activities, innovative educational activities, publications, research, and other relevant information. (Candidates are to refer to the Appendix on page 6 in preparing their portfolio according to the defined sequence and section areas.)

[b]. A request for waiver of eligibility requirements is to be submitted on the Waiver Request form with justification and/or supporting statements attached and shall be submitted no later than September 15. The criteria will be waived for the candidate upon a majority vote of the Promotion Committee. The committee determines eligibility for promotion based on the materials provided within the portfolio. It is in the best interest of the applicant to apply for a waiver if he/she has any doubts regarding eligibility. (See "Waiver Procedures" section on page 4).

[c]. The Committee will administer the Post Tenure Review Course Reaction Card as a standardized student evaluation form to the candidate's classes between the 10th and 13th weeks of fall semester, or during weeks 4 or 5 of a double paced course. The results of the student evaluations with comments will be made available to the faculty member at the close of the promotion review process. Evaluations from courses taught fall semester of the year in which promotion is requested will be taken.

[d]. The candidate must have four (4), and only four (4), Colleague Evaluation forms from selected individuals sent directly to the Committee.

(1) Two evaluations from faculty in the candidate's department. (Candidate must have 1, but not more than 2, from his/her own program).
(2) One evaluation from outside the candidate's department within the College of Technology.
(3) One evaluation from outside the candidate's college.

[e]. The candidate must request his/her Department Head to submit an evaluation statement to the Committee.

[f]. It is the candidate's responsibility to follow up on the submittal of colleague and department head evaluations.

[g]. All information forwarded to the Promotion Committee will be held in confidence and the candidate's portfolio will be returned to the candidate upon completion of the promotion process. Recommendations, student evaluations, and colleague evaluations sent directly to the Committee will not be returned. The

summary of student evaluations (the computer print-out) will be returned to the candidate.

2. The Promotion Committee will undertake the review process of all candidates and shall transmit a ranked list to the Dean indicating:

   [a]. The individuals applying for promotion within the College that it recommends for promotion/merit. The number of recommendations shall be equal to or less than the number of promotions/merits available for the College. If the number of promotions/merits is less than the number of promotions/merits available in the College, the unused promotions/merits may be carried forward for use in future years.

   [b]. A rank ordering (extra list) of the additional individuals approved for promotion/merit within the College that the Committee decides to recommend.

   [c]. The Promotion Committee will, at this time, notify the individual candidates whether they were or were not on the lists of candidates transmitted to the Dean.

   [d]. The Dean may add persons to the extra list in any position order which he/she believes is appropriate, but not altering the relative order established by the Promotion Committee. The Dean shall forward the lists to the Vice President for Academic Affairs.

II. ELIGIBILITY

A. To be eligible for promotional consideration, candidates must meet all of the following criteria <u>prior to application</u>. "Professional experience" refers to years of work experience, teaching, military service, or administrative duties, which can be documented and are significantly relevant to the individual's teaching assignment.

1. <u>INSTRUCTOR OR TECHNICAL INSTRUCTOR TO ASSISTANT PROFESSOR</u>

   [a]. Baccalaureate degree.

   [b]. Five years of professional experience, at least three of which must be in teaching.

   [c]. Three years at the rank of technical instructor or instructor at Ferris State University.

2. <u>ASSISTANT PROFESSOR TO ASSOCIATE PROFESSOR</u>

   [a]. Masters degree.

   [b]. Ten years of professional experience, at least five of which must be in teaching.

   [c]. Four years at the rank of Assistant Professor at Ferris State University.

   [d]. Four years since last merit increase.

3. <u>ASSOCIATE PROFESSOR TO PROFESSOR</u>

   [a]. Masters degree plus 30 semester/45 term hours of structured courses or a planned program to support your area of expertise. Time spent in professional development activities may apply towards the semester hours at the rate of 8

contact hours equaling .5 semester credit hours. Time spent in professional development activities may include seminars, workshops, and instructional activities provided by industry, educational institutions, and professional organizations. Participation and completion must be documented.

[b]. Fifteen years of professional experience, at least ten of which must be in teaching.

[c]. Four years at the rank of Associate Professor at Ferris State University.

[d]. Four years since last merit increase.

4. <u>MERIT INCREASES</u>

[a]. Merit increases are an addition to advancement in rank, but not a substitute for such advancement. Hence, the criteria and procedures for merit increases are the same as for promotion with the following additions:

[b]. Merit increases can only be given to those who have been advanced in rank to the maximum rank consistent with their promotion credentials as defined by the appropriate college/university/unit promotion policy.

[c]. A tenured bargaining unit member is eligible to apply for a merit increase only after a minimum of four years since his/her last advancement in rank or prior merit increase.

[d]. Consideration will be given only to accomplishments of the applicant since his/her last promotion or merit increase, or date of hire, whichever is more recent.

B. <u>WAIVER PROCEDURES</u>

1. The Promotion Committee may waive any eligibility requirements by a majority vote. Recommendations for exceptions to academic requirements will be considered when other conditions warrant (e.g., license or certification, additional professional experience, related professional recognition or achievement).

2. Requests for consideration for this waiver must be in writing to the Promotion Committee, submitted on the <u>Promotion Policy Waiver request</u> form with justification and/or supporting statement attached. Also attach a copy of the <u>Information Request</u> form (see page 8).

3. If the request for waiver is approved, the approval letter must be submitted along with and in the front of the portfolio. An approved waiver is valid for one year.

4. If a candidate's request for a waiver is denied based on an application for promotion, that candidate does not automatically become eligible for consideration for a merit award; the candidate may then submit his or her portfolio with an application for merit award if he/she meets those requirements.

CALENDAR

A.	**NO LATER THAN** Election of the College of Technology Promotion Committee and voting on any changes in Promotion Policy	**END OF SECOND WEEK OF APRIL**
B.	**NO LATER THAN** Dean's Office will call first organizational meeting to elect chairperson	**LAST TUESDAY IN APRIL**
C.	**NO LATER THAN** Candidate submits waiver request (if needed) to Committee	**SEPTEMBER 15**
D.	**NO LATER THAN** Promotion Committee acts on waiver requests and notifies the candidates	**OCTOBER 1**
E.	**NO LATER THAN** Candidate submits portfolio to Promotion Committee Candidate requests Department Head and Colleague Evaluations	**OCTOBER 15**
F.	**NO LATER THAN** Fall semester student evaluations taken by Promotion Committee Committee between the 10th and 13th weeks of fall semester, or during weeks 4 or 5 of a double paced course.	Between the 10th and 13th weeks of fall semester, or during weeks 4 or 5 of a double paced course.
G.	**NO LATER THAN** Department Head evaluations and colleague evaluations due to Promotion Committee	**DECEMBER 1**
H.	**NO LATER THAN** Promotion Committee forwards recommendations to Dean	**JANUARY 24**

NOTE: **If any of the above dates shall fall on a weekend, then the deadline shall be moved to the next business day.**

FERRIS STATE UNIVERSITY
COLLEGE OF TECHNOLOGY

PROMOTION PORTFOLIO APPENDIX

The evaluation of meritorious service in the promotion review process will be concerned only with activities and efforts since the candidate's last promotion/merit. To qualify, the promotion portfolio is to contain information and documentation (where appropriate) concerning the following nine categories, and presented in this order: Where applicable, each Section must begin with a Summary followed by support material.

SECTION A. Background Information
Information Request Form
Waiver Approval Letter (if required)

SECTION B. Teaching Experience since last promotion (Ferris and other)
Program area at FSU
courses taught after last promotion
courses developed after last promotion
seminars, workshops, etc., developed and/or presented since last promotion

SECTION C. Related work experience other than teaching since last promotion
work experience after last promotion/merit

SECTION D. Educational experience (credit and non-credit)
Highest degree awarded
Degree(s) awarded since last promotion
Credit Course Work since last promotion
Non-credit course work since last promotion

SECTION E. Contributions to Ferris beyond teaching, since last promotion:
Program responsibilities
Curriculum development
Committee participation (departmental/college/university)
Department responsibilities
Involvement in student activities (alumni, student recruitment, student associations, etc).

SECTION F. Involvement in professional organization/activities since last promotion:
Membership in organizations
Offices held in organizations
Participation in organizations (attending meetings, organizing programs, etc.)
Recognition and honors

SECTION G. Innovative educational activities since last promotion:
In classroom/lab setting
Other
Since receipt of last promotion/merit

SECTION H. Publications and presentations since last promotion:

Books

Papers, articles, monographs etc. (indicate if refereed)

Presentations

SECTION I. Any other relevant information to assist the Promotion Committee in its evaluation and review process since receipt of last promotion/merit, i.e., abbreviated vitae, etc.

FERRIS STATE UNIVERSITY
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INFORMATION REQUEST

This form must be submitted with your waiver request (if applicable), and also is to be inserted in the front of your portfolio.

NAME ____

DATE ____________________

PRESENT RANK _____________ PROGRAM _______________

RANK APPLYING FOR _________________________________

EDUCATIONAL BACKGROUND (Highest Degree Held) _____________

YEAR IN WHICH LAST PROMOTION TOOK EFFECT ____________

YEAR IN WHICH LAST MERIT INCREASE TOOK EFFECT _________

YEARS AT FERRIS STATE UNIVERSITY _____________________

FERRIS STATE UNIVERSITY
COLLEGE OF TECHNOLOGY

PROMOTION POLICY WAIVER REQUEST

I hereby request consideration for a waiver as stipulated in the Promotion Policy.

Criteria to be waived: ______________________________

____

For which rank: ______________________________

Request for waiver can be based on all or some of the following:

Degrees, licenses and certification obtained since last promotion

Related work experience since last promotion

Classes or seminars attended since last promotion

Other reasons in support of this request

Submit Information Request Form (Page 8 of this Policy) with Waiver Request.

Attached justification and/or supporting statements to this form.

Any waiver request approval must be submitted along with and in the front of the portfolio.

Denial of this waiver request for promotion does not automatically make the applicant eligible for merit.

DATE: ____________ SIGNATURE: ______________________

FERRIS STATE UNIVERSITY
COLLEGE OF TECHNOLOGY

DEPARTMENT HEAD EVALUATION FORM FOR PROMOTION

DATE: __________

CANDIDATE: ____
(Name)

is seeking promotion from ____________________________________
(Current Rank)

to ____
(Rank Applied For)

effective academic year _______________.

Each candidate for promotion has been requested by the Promotion Committee to solicit a number of colleague evaluations. These evaluations, as well as other supportive data, will be used by the Committee to help determine the rank order of the various applicants for promotion.

You are requested to be candid and straightforward in your appraisal so that the evaluation presented will not overstate or understate the applicant's attributes.

This evaluation will be placed in the candidate's promotion folder and will be viewed as confidential and privileged information available only to those currently involved in the promotion review process. Further, upon completion of the promotion process for this year, this evaluation will be destroyed. It will not be returned to you or the candidate.

The Promotion Committee considers the various aspects of professional activities and asks that you include areas of teaching, professional development, and the impact of candidates in program/department/college/university activities.

PLEASE SUBMIT YOUR EVALUATION NO LATER THAN DECEMBER 1 DIRECTLY TO THE COLLEGE OF TECHNOLOGY PROMOTION COMMITTEE SECRETARY, JOHNSON HALL 200.

FERRIS STATE UNIVERSITY
COLLEGE OF TECHNOLOGY

COLLEAGUE EVALUATION FORM

Date: ____________

TO: ____
(Name of Evaluator - Please print or type)

______________	____________	__________________
(College)	(Department)	(Position)

A. Candidate _________________________ is seeking

promotion from ________________ to ________________
(Current Rank) (Rank Applied For)

effective academic year ______________.

B. Evaluator:
Each candidate for promotion **is required** by the Promotion Committee to solicit a number of colleague evaluations. These evaluations, as well as other supportive data, will be used by the Committee to help determine the rank order of the various applicants for promotion.

You are requested to be candid and straightforward in your appraisal so that the evaluation presented will not overstate or understate the applicant's attributes. Please either type or write legibly.

C. Signature and Date:
In order to add validity to this process, you are requested to sign and date your appraisal.

D. Confidentiality:
This evaluation will be placed in the candidate's promotion folder and will be viewed as confidential and privileged information available only to those directly involved in the promotion review process. Further, upon completion of the promotion process for this year, this evaluation will be destroyed. It will not be returned to you or the candidate.

E. **PLEASE SUBMIT THIS FORM NO LATER THAN DECEMBER 1 DIRECTLY TO THE COLLEGE OF TECHNOLOGY PROMOTION SECRETARY, JOHNSON HALL 200.**

COLLEAGUE EVALUATION FORM - COLLEGE OF TECHNOLOGY

CANDIDATE: ______________________ DATE:__________

The following items reflect some of the ways candidates can be described. For the candidate named above, please circle the number which indicates the degree to which you feel each item is descriptive of your colleague. As appropriate, put an "X" for "not known."

		High Low	Not Known
1.	Is well read in and knowledgeable about the subject matter and related fields	5 4 3 2 1	( )
2.	Is interested in teaching	5 4 3 2 1	( )
3.	Is active in developing teaching skills	5 4 3 2 1	( )
4.	Actively participates in departmental and/or college meetings, and makes positive contributions to improve departmental or college operation and to solve departmental or college problems	5 4 3 2 1	( )
5.	Keeps up with current developments in the appropriate field	5 4 3 2 1	( )
6.	Does professional work that is respected by others in the field	5 4 3 2 1	( )
7.	Expresses consideration of and constructive interest in the work of colleagues	5 4 3 2 1	( )
8.	Is conscientious about appointments	5 4 3 2 1	( )
9.	Is friendly toward and interested in colleagues	5 4 3 2 1	( )
10.	Encourages student to discuss student/advisor matters	5 4 3 2 1	( )
11.	Plays an important role in advising and counseling students	5 4 3 2 1	( )
12.	How does this instructor compare with other instructors in this department	5 4 3 2 1	( )

(OVER)

13. Other general comments: ______________________________

____

14. What is your professional relationship with this candidate?

15. What has his/her work meant to you?

16. What qualities best describe this individual's professional behavior?

Date: ________________ Signature: ________________________

D:\PROMOTION\POLICY.DOC

Construction and Facilities Department Tenure Policy

Revised January 12, 1999

I. Tenure Attainment Criteria

A. Primary responsibility of a candidate for tenure.

1. The primary professional responsibility is to attain excellence in teaching.

2. The candidate shall have demonstrated superior qualities as a teacher. Note: Evaluation of teaching for tenure purposes shall not infringe on academic freedom.

3. The candidate shall have demonstrated continuing professional competency.

4. The candidate is to have met all academic requirements agreed to in writing at the time of hire, such as completion of advanced degrees, registration, licensure, etc.

B. Secondary responsibilities of a candidate for tenure.

1. During the period of employment at Ferris, the candidate shall have performed in a satisfactory manner assigned and customary professional responsibilities, including but not limited to:

   active membership in professional organizations;

   research;

   consulting;

   publications and/or presentations;

   advising;

   participation in university committees;

   participation in professional committees;

   attendance at professional meetings, seminars, workshops, etc.

2. Other items which may influence the tenure decision are as follows:

   Demonstration of a willingness to join with colleagues in advancing the common interest of the university; demonstration of a sense of civic responsibility by using his/her professional skills for the benefit of the community and his/ her students.

II. Tenure Committees

A. Candidate Tenure Committee.

1. Each probationary faculty member shall have his/her own Candidate Tenure Committee until such time as the tenured department faculty vote to grant or deny tenure. This committee exists not only to evaluate the effectiveness of the candidate but also to assist the candidate as he/she assimilates into the academic environment

2. The committee shall have three voting members, tenured in the department, who will serve during the probationary period, chosen as follows:

   a. The committee's chair shall be the candidate's mentor for the first year. If the mentor is a non-tenured member of the department, the committee chair will be selected from elected members of the candidate's tenure committee. The selection will be done by the Departmental Tenure Committee. After that first year, the candidate will select the chair who will then serve the remaining probationary period.

   b. A member shall be elected by the tenured and tenure-track members of the candidate's curriculum/seniority unit.

   c. A member from the department at large shall be elected by the department tenured faculty.

3. Any vacancy in the Candidate Tenure Committee shall be filled in the same manner as the individual being replaced was selected.

4. If the candidate's curriculum/seniority unit does not have enough tenured faculty to fill the committee as outlined in Section II. A.2., then the committee will consist of other tenured faculty from the Construction and Facilities Department.

B. Departmental Executive Tenure Committee.

1. The Construction and Facilities Department faculty shall elect a Department Executive Tenure Committee to supervise the actions of the various Candidate Tenure Committees and assure that they operate in conformity with the provisions and timetable of this policy.

2. This committee shall have a rotating membership of three tenured department members. Thus, one committee member will be elected or re-elected each year to a three-year term.

3. To implement this policy, the tenured members of the Construction and Facilities Department, after the first meeting of the department following the adoption of the policy, shall separately elect three tenured members to be the Department Executive Tenure Committee. The first elected member or chairman shall serve a term of one year, the second or vice-chairman - a term of two years, and the third, at large member - a term of three years.

4. The chair of the Department Executive Tenure Committee shall be the member whose term expires first.

5. A vacancy in the Department Executive Tenure Committee shall be filled by another tenured member of the department elected by the tenured members of the department.

III. Procedures

A. If new, probationary tenure-track faculty have been employed, the Department Executive Tenure Committee shall hold a special meeting with all these individuals no later than the end of the first full week of classes in October.

B. The Department Executive Tenure Committee shall provide the following to all new non-tenured, tenure-track faculty members:

1. A copy of this document, the Construction and Facilities Department Tenure Policy.

2. The form for faculty evaluation adopted by the department.

3. The form for student evaluation adopted by the department.

4. A time schedule, contained at the end of this document, which shows the dates when each phase of the tenure evaluation must be completed.

C. The Departmental Executive Tenure Committee shall inform the department faculty, program director or coordinator, department head, and the dean, of the names of non-tenured, tenure-track faculty members and ask for written comments which the Committee might consider in its evaluation process. Such comments are to be submitted to the Committee no later than the end of the first full week of the winter semester.

D. The Department Executive Tenure Committee shall conduct student evaluations of the candidate which the Committee will consider in its evaluation process. These evaluations will be conducted between the ninth and tenth week of each semester. A compilation of the results of the student evaluation will be made available to the candidate before the end of the first week of the following semester.

E. The Department Executive Tenure Committee shall maintain a chronology of the status of each non-tenured, tenure-track faculty member.

F. The Department Executive Tenure Committee shall be provided with a locked file, in the office of the department head, for storage of all documents, evaluations, and findings of the committee and those submitted by the Candidate Tenure Committees, tenured members of the department, the department head, and the dean. Files of any probationary member shall be available for inspection in the department office by any tenured department member. Probationary faculty members shall have access only to their own files in the presence of at least two members of their Candidate Tenure Committee.

G. The recommendation to grant or deny tenure shall be based on a vote by secret ballot of the Construction and Facilities Department tenured faculty. A simple majority of those tenured faculty members present and voting shall determine whether to recommend the granting or denial of tenure. A move to table consideration of a candidate for tenure shall not cause a delay in tenure proceedings in excess of ten (10) calendar days.

H. In the event of a vote by the department tenured faculty against recommending the granting of tenure, the candidate for tenure shall have five (5) calendar days to appeal the decision and to submit evidence to support such an appeal to a committee of the whole of the tenured faculty of the department. A final decision by this committee of the whole of the tenured faculty of the department shall be reached by the first regularly scheduled department meeting date of the month, following receipt of the appeal. A decision by the committee of the whole to recommend the granting or denial of tenure shall require the same vote of the department tenured faculty as defined in the preceding paragraph.

I. If tenured is granted, the candidate's tenure review file shall be destroyed.

J. If tenure is denied, the candidate's tenure review file shall be kept for three consecutive years after the date of denial.

IV. <u>Time Schedule for Tenure Evaluation</u>

<u>SEPTEMBER</u>

A. During the first department meeting in September, all tenured

Construction and Facilities Department faculty shall adopt any needed procedure or policy changes.
-and-
Elect new annual member(s) to Department Executive Tenure Committee to replace any retiring member(s). This committee will meet with all new tenure-track faculty members, if any, and inform these new faculty members of the tenure procedures and provisions as described in this policy document.

<u>OCTOBER</u>

A. Oct. 1: Last day for bargaining unit member applying for tenure to submit credentials to the Candidate~~'s~~ Tenure Committee.

<u>NOVEMBER</u>

A. Nov. 1: Candidate Tenure Committee advises applicant applying for tenure of evaluation and intended recommendation.

B. Nov. 1: Candidate Tenure Committee advises tenure-track faculty of evaluation and recommendation for re-appointment/non-reappointment.

C. Nov. 15: Tenure applicant and tenure track faculty given opportunity to meet with Candidate Tenure Committee by this date.

D. Nov. 20: Candidate Tenure Committee forwards final evaluations and recommendations to tenure track faculty and Department Head.

<u>DECEMBER</u>

A. Dec. 10: Department Head provides written copy of Department Head evaluation and recommendation of reappointment/non-reappointment to tenure track faculty and Dean.

B. Dec. 15: Final report and recommendation by Departmental Executive Tenure Committee presented to tenure applicant and department head. Department Head evaluations and all recommendations forwarded to Dean by Jan. 14.

<u>JANUARY</u>

A. Jan. 14: Department Head recommendation for application year faculty to Dean.

B. Jan. 15: Review Department Tenure Policy for possible amendments.

C. Jan. 15: Formal notice of reappointment or non-reappointment for subsequent year of tenure track faculty. (after first year of service.)

D. Jan. 23: Tenure recommendations due from Dean to Vice President at a date established by the VPAA.

FEBRUARY

A. Feb. 15: Tenure Track Faculty (in 2^{nd} and subsequent years) may appeal a non-reappointment decision to the President on or before February 15.

MARCH

A. Mar. 15: Appeal of tenure denial due to the President on or before March 15.

B. Mar. 15: Formal notice of reappointment or non-reappointment for first year of service tenure track faculty.

APRIL

A. Apr. 15: Tenure track faculty in their first year may appeal non-reappointment decision to the President on or before Apr. 15.

V. Review and Amendment

A. Tenure evaluation procedure and criteria shall be reviewed annually by the Department Executive Tenure Committee for the purpose of making recommendations to the department if revisions are needed.

B. This policy may be amended by majority vote of those tenured members of the Construction and Facilities Department present and voting at a scheduled department meeting, provided written copies of the proposed amendment have been distributed at least two weeks prior to the meeting and upon compliance with the appropriate FSU/FFA Agreement (para 3.4A. in 1997-2002 agreement pages 12 and 13). Candidates already placed in a tenure-track position are not bound to follow any amended tenure policy adopted after they begin their tenure-track position but they may elect to do so.

3. Faculty Workload

   A full faculty workload is 12 credit hours/18 contact hours per semester. Loads above this standard are annualized and compensated according to the college bargaining agreement.

4. Supervision of Part-time Faculty

   Part-time faculty are supervised by the Assistant Dean/Department Head of the Construction and Facilities Department with the assistance of the Surveying Engineering Program Coordinator.

G. Engineering Enrollment and Degree Data

Refer to Table II-5.

H. Definition of Credit Unit

All credits offered in the degree programs are expressed in semester hours. One semester hour of credit is granted for the successful completion of one hour per week of lecture or two or more hours (three hours for surveying engineering field courses) per week of laboratory, for a period of fifteen weeks excluding exam week.

1. Admission of Students

   a. Admissions Policies

University Admissions Statement

Woodbridge N. Ferris founded Ferris Industrial School in 1884 on three basic educational principles; today they are still a part of the University's philosophy. These ideas are that higher education should be available to anyone wishing to profit from it; that students should be counseled so they can be helped to make the most of their abilities; and that while college admission should pose few obstacles to students, the institution should not compromise the quality of work it expects once the student is enrolled.

In keeping with this philosophy, Ferris State University is dedicated to educating the student who possesses the requisite capacity to learn. The purpose of its educational programs is to prepare a student with the skills needed for a chosen occupation or profession and to help fulfill career objectives. Ferris State also seeks, through its educational programs, applied research and expertise, to support and strengthen the economy of Michigan and the nation.

Admissions Policy: General

Ferris State University has an open admissions policy that, within the limits of its resources, allows applicants, including some with marginal academic records, the advantage of being able to achieve a university education. That policy is backed by the University's commitment to provide a student with the opportunity for a successful experience by offering provisional admission and making developmental classes available.

Aimed at serving a diverse student population, the admissions policy grants University admission to an applicant who has graduated from an accredited high school, or is 18 years of age or older and has passed the GED examination. To be considered for admission, an applicant below the age of 18 who has passed the GED test, but has not completed high school, must have the recommendation of a high school and the approval of a parent or guardian. These latter requirements are waived for a student with an "emancipated" legal status, giving full adult legal rights and responsibilities, or for the student whose application is filed after the graduation date of the high school class of which the student would normally have been a part.

Admission to the University does not guarantee admission to individual programs, many of which have additional entry requirements. Acceptance in a particular program is based upon an individual's qualifications, and an applicant should refer to the Academic Program section in the University Catalog or contact the office of admissions for specific requirements. In most instances where enrollment demand for an undergraduate program exceeds capacity, the date on which the University receives the paid application of a qualified applicant serves as the determining factor for admission to the program. Applicants are advised that the Colleges of Pharmacy and Optometry and graduate-level programs have separate admission criteria and application deadlines. Applicants are specifically requested to contact the office of admissions and consult the University Catalog for additional information.

Under some circumstances, admission decisions may also involve other considerations. An applicant, particularly a non-traditional student, may have acquired competencies beyond those reflected in the high school grade point average, ACT score, or previous college-level work. For that reason, consistent with the University's role and mission, an applicant may be admitted on the basis of an assessment of the skills and knowledge acquired outside of the traditional educational setting.

The University reserves the right to deny admission to an applicant who, in the judgment of the admissions staff, is not prepared to benefit from the course of study offered. An applicant denied admission may appeal to the Admissions Review Committee by submitting a letter requesting reconsideration to the dean of enrollment services. The decision to admit or uphold denial of admission is based on the individual merits of each case and is presented to the applicant, in writing, within seven working days of the date of receipt of the appeal whenever possible.

In most undergraduate programs, a student may enter the University at the beginning of any regular enrollment period: fall, winter, or summer semester. However, the University cannot guarantee completion of the admissions process in time for enrollment unless the application is received at least 30 days prior to the beginning of the desired semester. Even though the normal application deadline for on-campus associate degree or bachelor's degree program admission is 30 days prior to the first day of classes for the semester, the University reserves the right to establish earlier application dates, by program or university-wide, as necessary.

A graduate or first professional degree applicant should refer to the appropriate section of the University Catalog and be advised to contact the office of admissions for specific application deadlines.

Admission and enrollment are privileges bearing certain responsibilities. The University reserves to itself, and the student concedes to the University, the right to cancel admission and/or enrollment and to require withdrawal whenever evidence indicates the student has not satisfied the University's established standards of scholarship or conduct.

Admissions Policy: First-Year Students

The first-year student admissions policy pertains to an applicant who has not attended any college or university, and may apply to an applicant (see the Admissions Policy: Transfer Students section) who has successfully completed fewer than thirty semester or forty-five quarter hours of college-level work. Applications may be submitted only after completion of the junior year of high school.

A first-year student applicant is admitted to the University and considered in good standing if a high school grade point average (GPA) of 2.0 or better on a 4.0 scale was earned, as determined by the University. Some academic programs have additional admission requirements. Consequently, an applicant should refer to the appropriate academic program section in the University Catalog and consult the office of admissions. An applicant who does not meet the 2.0 GPA minimum for admission in good standing may be considered for provisional admission.

An applicant is also required to submit the results of the American College Test (ACT) Student Profile Report prior to the time of registration for classes. Test data are not required for admission purposes, so applicants are encouraged to begin the application process as early as possible, even if the ACT has not been taken.

b. Admissions History:

Refer to Table II-6.

c. Advanced Placement

Credits from any source are evaluated on a case by case basis.

d. Special Admissions Policies

Former Students

A student formerly enrolled at Ferris must file a "readmission application" if an interruption in enrollment has occurred. An interruption in enrollment occurs whenever a student withdraws from the University or fails to enroll for a succeeding semester, not including summer semester. Admission consideration of a re-entering student's academic standing is based on all courses attempted at Ferris and at other colleges and universities attended. An applicant must meet the same academic requirements expected of new applicants or obtain special admission permission from the dean of the College where admission is sought.

Depending on individual circumstances, certain other conditions may apply to the readmission process.

1. If a student seeking readmission has attended another college or university since leaving Ferris, an official transcript from that institution must be submitted as part of the readmission application.
2. 2.If during a previous enrollment the student was suspended or dismissed from Ferris, or disciplinary proceedings are pending, the student is subject to the criteria and standards of the program where admission is sought.
3. If the student returns to the University after an interrupted enrollment (not including summer semester), normally the requirements of the curriculum which are in force at the time of the return must be met, not the requirements which were in effect when originally admitted.
4. A readmission applicant, though not required to submit the application processing fee, is subject to the same application deadlines as a new student applicant, except when the office of admissions determines that an exemption from such a deadline is in the best interest of the University's overall enrollment plan.

e. Transfer Students

Students transferring to Ferris State from other institutions of higher education may be granted transfer credit. Transfer credit is subject to the following criteria.

General Considerations

1. If FSU has an institutional articulation agreement with the student's prior institution, that agreement governs the student's transfer determination if covered by the articulation agreement. Otherwise, the student's transfer determination is governed by individual course equivalency evaluations and Ferris State University's transfer policies or as determined by FSU in its sole discretion.
2. Institutional articulation agreements will focus on conditions for accepting students (with specific degrees and GPA's) and transferring them into Ferris State's programs, not determining course-by-course equivalencies.
3. Credits are considered for transfer upon presentation of official evidence of completion (i.e. official transcripts, DD214, etc.).
4. College-level coursework taken at a regionally accredited institution is transferable to Ferris State University. An applicant with a cumulative

GPA of 2.0 or higher is admissible, and Ferris accepts transfer courses in which the student earned a grade of "pass," "credit," or a letter grade of "D" or better. An applicant with a cumulative GPA of less than 2.0 may be admitted in the sole discretion of Ferris. For these students, Ferris accepts transfer courses in which the student earned a grade of "C" (2.0) or better. Individual Ferris Colleges or programs, however, may have more stringent program-specific requirements for a GPA in courses that are related to the major emphasis within a program area, a program core, a minor, and/or established prerequisites to Ferris State courses. Consistent with program progression policies, identified required courses with earned grades below a "C" (2.0) may need to be repeated even though transfer credit has been granted. All references to a 2.0 GPA are on a 4.0 scale.

5. Additional information concerning the transferability of college credit is included in the sections of this catalog which describe the degree programs offered through a specific Ferris College. Under special circumstances after twelve semester credits of work at Ferris have been successfully completed, the appropriate college dean's office may accept coursework from institutions which are not regionally accredited, according to the guidelines of this policy.
6. Credit may be granted for military training courses, group study, or correspondence work if the course(s) or other work is recommended for credit by the American Council on Education or approved through an appropriate Ferris competency assessment process.
7. Credits from transferred coursework are recorded on the Ferris State University transcript, but do not count toward the FSU cumulative GPA or academic honors computations.

Admissions Policy: Transfer Students (MACRAO)

The Michigan Association of Collegiate Registrars and Admissions Officers (MACRAO) Agreement applies to students entering bachelor's degree programs only.

1. Students who transfer to Ferris State University from a Michigan community college with a MACRAO-stamped associate of arts (A.A.) degree or an associate of science (A.S.) degree, and with a cumulative GPA of 2.0 or better based on a 4.0 scale are admitted with junior standing and lower-division general education requirements are considered to have been fulfilled. To graduate with a Ferris State bachelor's degree, these students are required to fulfill the following additional general education requirements: three semester credits in advanced communication competence, MATH 115 or proficiency, three semester credits in an upper-level social awareness course, and a total of thirty-seven credits of general education coursework at Ferris or transferred.

2. Students who transfer to Ferris State from a Michigan community college with an associate of applied arts (A.A.A.) degree or an associate of science (A.S.) degree, and with a cumulative GPA of 2.0 or better based on a 4.0 scale are admitted to Ferris with junior standing. If the pre-transfer curriculum fulfills all of the general education requirements established for a MACRAO-stamped associate of arts (A.A.) degree or an associate of science (A.S.) degree, the student is considered to have fulfilled the lower-division general education requirements. Additional general education requirements necessary to graduate with a bachelor's degree are as indicated in #1 above.
3. Students who transfer to Ferris from a Michigan community college with a MACRAO-stamped transcript who do not possess an associate degree are considered to have fulfilled the lower-division general education requirements. Additional general education requirements necessary to graduate with a bachelor's degree are as indicated in #1 above.

Transfer Students: Course and Transcript Evaluation

1. Transcripts of transfer students are evaluated by the dean's office of the College in which the student enrolls.
2. 2.Transfer course equivalency evaluations are determined by the Ferris State department with comparable coursework as indicated by the Ferris course designator. These evaluations represent an institutional determination and will not be independently renegotiated by each Ferris State University College. That is, if a transfer student enters Ferris State and then changes program and College, the initial transfer course equivalent determination is not changed.
3. Course evaluations allow equivalency determination where courses are at least 75% the same content. Course equivalency is not denied simply on the basis of differences in course numbering. For instance, a community college adolescent psychology course at the 200 level is not denied equivalency for a 300-level Ferris adolescent psychology course, if the two courses are substantially the same in content.
4. In those cases where specific course equivalents are not transferred, prerequisite course requirements may be waived and the course equivalency granted when the transfer student completes the next course in a sequence with a grade of "C" or better, demonstrating prior preparation equivalent to preceding courses in the sequence. Failure to achieve a grade of "C" or better in the latter course indicates that the student needs to take the appropriate Ferris prerequisite course.
5. Course sequences or clusters may be evaluated for Ferris State course equivalency in toto rather than course-by-course. For example, when a community college "packages" its course sequence differently but covers substantially the same content as the Ferris course sequence, the

entire sequence of transfer courses may be evaluated as a whole, rather than course-by-course.

Transfer Students: Credits in Residency Policy

1. To fulfill the residency requirement for an associate or bachelor's degree, a student must earn a minimum of thirty semester credit hours from Ferris State. The University expects that these hours are the final credits earned for the degree.
2. It is expected that a maximum of one-half of the total hours required for completion of the degree at Ferris may be transferred from non-bachelor degree granting institutions. An exception is made for institutions which have articulation agreements with Ferris. In such a case, additional lower-division courses required for a Ferris bachelor's degree may be transferred.
3. Approved off-campus degree programs may be exempted from portions of this policy. The appropriate Ferris State College dean's office should be consulted for specific requirements.

f. History of transfer engineering student statistics.

Refer to Table II-7.

2. Requirements for Graduation

a. A semester prior to completion of the requirements for graduation, a student is required to complete an application for graduation. This form must be signed by both the student's academic adviser and the student. In addition, the form must be accompanied by the program check sheet. The program check sheet must have grades for each course. A copy of the application and the checksheet are at the end of Appendix II.

b. The student must achieve an overall GPA of 2.00/4.00 in order to graduate.

J. Non-academic Support Units

There are no units that support only the Surveying Engineering program.

Table II-1. Faculty and Student Count for Institution
School Year: Fall 1998

	HEAD COUNT		FTE	TOTAL STUDENT CREDIT HOURS
	FT	PT		
Tenure Track Faculty	427	85	NA	
Other Teaching Faculty (excluding student assistants)	NA	NA	NA	
Student Teaching Assistants	NA	NA	NA	
Undergraduate Students	7,124	2,122	7,436	115,270
Graduate Students	255		123	1,470
Professional Degree Students	150		151	2,781

Table II-2. Supporting Academic Departments
For Academic Year: 1998-1999

Department or Unit	1 Full-time Faculty Head Count	2 Part-time Faculty Head Count	3 FTE Faculty	Teaching Assistants	
				4 Head Count	5 FTE
1. Physical Science	16	1	16.5		
1. Social Science	24	12	27.5		
1. Humanities	24	6	26.4		
1. Mathematics	36	10	41.35		
1. Languages and Literature	35	5	39.0		
1. Management	19	3	21.0		
1.					
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Table II-3. Personnel and Students

Construction & Facilities Department

Year: Fall 1998

	HEAD COUNT FT	HEAD COUNT PT	FTE	RATIO TO FACULTY
Administrative (4)	2			
Faculty (tenure-track)	28		28	
Other Faculty (excluding student Assistants)		1	1	
Student Teaching Assistants				
Student Research Assistants				
Technicians/Specialists	1			
Office/Clerical Employees	4			
Others (5)				

Undergraduate Student enrollment (see Note 6)	568			
Graduate Student enrollment				

Surveying Engineering

Year: Fall 1998

	HEAD COUNT FT	HEAD COUNT PT	FTE	RATIO TO FACULTY
Administrative (4)				
Faculty (tenure-track)	5		5	
Other Faculty (excluding student Assistants)		1	1	
Student Teaching Assistants				
Student Research Assistants				
Technicians/Specialists	1			
Office/Clerical Employees				
Others (5)				

Undergraduate Student enrollment (see Note 6)	92			
Graduate Student enrollment				

Table II-4. Faculty Salary Data

Academic Year 1998-99 (May 1999)

1. For the Institution as a Whole

	Professor	Associate Professor	Assistant Professor	Instructor
Number	142	144	115	8
High	$83,000	$67,000	$59,000	$43,000
Mean	$64,000	$52,000	$45,000	$37,000
Low	$45,000	$37,800	$31,000	$31,000

2. For the Engineering Educational Unit as a Whole (Construction & Facilities Department)

	Professor	Associate Professor	Assistant Professor	Instructor
Number	8	8	11	1
High	$67,795	$58,222	$50,792	
Mean	$57,875	$51,778	$47,918	$41,590
Low	$54,019	$47,785	$45,778	

3. Average Percent Salary Raises Given to Continuing Faculty Members for the Past Six (6) Years.

Unit	Year 93-94	Year 94-95	Year 95-96	Year 96-97	Year 97-98	Year 98-99
Institution as a Whole	7.0%	0%	1.5%	1.5%	2.0%	2.0%
Engineering Education Unit as a Whole	7.0%	0%	1.5%	1.5%	2.0%	2.0%

4. For Each Program Submitted for Evaluation

Program		Professor	Associate Professor	Assistant Professor	Instructor
Surveying Engineering	Number	4	0	1	
	High	$67,795			
	Mean	$58,864		$50,688	
	Low	$55,062			

Table II-5. Engineering Enrollment and Degree Data

Engineering education unit as a whole: **Construction & Facilities Department**

	Academic Year		Enrollment Year					Total Undergrad	Total Grad	Degrees Conferred			
			1st	2nd	3rd	4th	TBD			Bachelor	Master	Doctor	Other
CURRENT 98-99		FT	124	165	130	149	0	568		73			
		PT											
1 97-98		FT	129	124	79	156	70	558		97			
		PT											
2 96-97		FT	110	99	103	136	62	510		81			
		PT											
3 95-96		FT	96	107	75	148	72	498		85			
		PT											
4 94-95		FT	88	117	95	137	67	504		83			
		PT											
5 93-94		FT	169	125	110	128	0	532		84			
		PT											

Program: **Surveying Engineering**

	Academic Year		Enrollment Year					Total Undergrad	Total Grad	Degrees Conferred			
			1st	2nd	3rd	4th	TBD			Bachelor	Master	Doctor	Other
CURRENT 98-99		FT	18	13	14	47	0	92		20			
		PT											
1 97-98		FT	7	10	14	54	13	98		21			
		PT											
2 96-97		FT	12	18	21	46	11	108		20			
		PT											
3 95-96		FT	16	18	16	48	17	115		17			
		PT											
4 94-95		FT	13	8	22	41	25	109		27			
		PT											
5 93-94		FT	36	14	25	39	0	114		18			
		PT											

NOTE: Includes on-campus students only. Does not include pre-tech students. Does not include AAS degrees. Program data includes surveying technology students.

Table II-6. History of Admissions Standards for Freshmen

Academic Year	Composite ACT		Composite SAT		Percentile Rank in High School		Number of New Students Enrolled
	MIN.	AVG.	MIN.	AVG.	MIN.	AVG.	
Fall 98	21	24					5
97	20	23					3
96	18	23					7
95	20	20					3
94	19	23					6
93	22	24					2

Table II-7. History of Transfer Engineering Students

Academic Year	Number of Transfer Students Enrolled
98-99	8
97	10
96	9
95	10
94	17
93	3