

Greater Nebraska Business Requirements for Educational Services in Engineering

A report compiled by the
Applied Information Management Institute



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Executive Summary

A survey of greater Nebraska business requirements for educational services in engineering was completed by the Applied Information Management Institute.

This survey included 66 greater Nebraska employers with total employment of 16,274 employees.

Engineering employees totaled 617 or 3.8% of all employees in responding firms.

Other significant survey findings include:

- 836 or 5.1% of all employees from responding firms are currently taking academic courses.
- 68% of employees taking academic courses are in tuition reimbursement programs.
- Total training budgets for the 28 firms reporting these data are nearly \$1.2 million and projected to exceed \$1.8 million in five years.
- For firms reporting these data, the per-employee training cost is:

	1995	Five Years
All Employees	\$ 221	\$ 280
Engineering Employees	\$1,008	\$1,259

The estimated total engineering employment for greater Nebraska is between 3,300 and 3,800.

Numerous additional conclusions are appropriate:

- Engineering employment growth will be three times faster (45.5%) than for all employees (15.0%).
- The number of new engineering graduates from the state's university campuses is less than the demand for such employees by greater Nebraska employers.
- There is little evidence the shortfall in the availability of baccalaureate and master level job applicants will be corrected in the near term, forcing ongoing major recruiting efforts from outside the state.
- A strong demand for educational services exists at both the undergraduate and graduate level.
- The strongest demand for curriculum and programs included:
 - Civil
 - Structural
 - Environmental, Sanitary, Geotechnical, General
 - Construction/Architectural
 - Electrical/Computer
 - Electrical/Power
 - Mechanical

- The largest single problem is the absence of engineering courses or programs of any kind. Business type baccalaureate and masters degree offerings are also few in some regions.
- Local delivery of educational services (within 40-50 miles of student) is highly preferred to distance learning technologies.
- Some focus group participants were unaware of CorpNet and National Technological University (NTU) and Internet as sources of engineering courses.
- Community colleges and state colleges are not effectively used to deliver either continuing education or academic engineering courses or program.
- Continued industry trends toward increased requirements for annual license renewal plus validation of professional continuing education programs may create training opportunities for universities.

Recommendations

1. Business has the opportunity to directly influence the availability of academic programs by:
 - Recreating partnerships between business, local colleges, and UNL to encourage local availability of selected courses/programs.
 - Further define specific needs in the Academic Disciplines and Applied Areas identified as most important to their area.
 - Promote CO-OP programs.
2. The University of Nebraska must seek ways to meet business requirements for engineering education.

There are two predominate themes – Access and Content.

- Solutions must be found to reach unserved markets. Review, reinvent, and develop all delivery media including:
 - Visiting professors to area community/state colleges
 - Mobile faculty
 - CD ROM
 - Internet
 - CorpNet
 - Etc.
- Develop 2+2 programs with community colleges and state colleges.
- Develop strong engineering content in area information technology degree programs.
- Consider unconventional class settings related to work schedules, business locations, etc.
- Develop effective CO-OP programs.
- Consider outsourcing instruction via National Technology University and/or certify Internet-based engineering and business courses.

- Develop partnerships, increase education access such as firm-based labs/classrooms, agreements with cable suppliers to carry courses, etc.
- Focus course and programs related to Nebraska's business industry.
- Develop courses for practicing engineers without degrees.
- Target market industrial/manufacturing engineering to greater Nebraska.
- Electrical/computer is high priority statewide – promote aggressive 2+2 and other programs to enhance availability through use of community and state colleges.
- Other state and private institutions should develop more MBA and other master level business degrees to enhance professional growth opportunities when engineering is absent.

Background

There has been much discussion about engineering educational services required by the Nebraska business community. With engineering labor markets tight (unemployment at 2.65% nationally in 1st Qtr '95)¹ and continued growth of Nebraska firms, the demands for educational services will increase significantly.

The Nebraska State Board of Engineers for professional engineers and architects reported that “4,797 engineers registered to practice this profession in Nebraska” in 1995. This compares to 4,589 in 1994. Of those registered to practice in Nebraska in 1995, 43% or nearly 2,100 were residents of Nebraska.

This data significantly understates the number of engineers in the state. To become a Registered Engineer, the individual must pass:

- Examination in the Fundamentals of Engineering
- Examination in the Principles and Practice of Engineering
- Interview by Board of Examiners including documentation

It is estimated that non-professional engineers employed in industry outnumber professional engineers by 2.5 to 1. Based upon the above data and other secondary sources,² the number of resident Nebraska engineers is estimated at 7,300.

Employers of engineering professionals are keenly interested in the State’s educational infrastructure to assure a continued supply of qualified new employees and to maintain the professional competency of their current engineers.

The demand for educational services takes three basic forms:

- Baccalaureate graduates to fill entry-level positions;
- Graduate programs for existing employees;
- Continuing education required for:
 - registration;
 - annual renewal of registration; and
 - general and specific training for professional growth.

A further dimension of the emerging market for practicing engineers is the convergence and integration of information technologies into historical engineering disciplines. To illustrate, Transcript Inc. of Lincoln is integrating encryption technologies into communication devices used by the police, military, industries, and others in over 100 countries. Other Nebraska manufacturers are increasing the use of robotics in manufacturing. Computer and networking technologies are essential to development, management, and delivery services by the state’s 42

¹ Engineering News Record, July 1995, page 45.

² Applied Information Management Institute, “Greater Omaha Business Requirements for Educational Services in Engineering,” page 22.

telephone companies. Information technologies will increasingly be used to create “smart” structures, devices and processes.

In addition, information technology-based tools for design, modeling, simulation, networked collaboration techniques and other such technologies will only increase in the future.

These forces are combining to make Electrical/Computer Engineering a fast-growth discipline in the greater Nebraska market. The demand is coming from both traditional engineering companies and non-engineering companies that require these academic skills to achieve business objectives.

This discussion suggests that the emerging issues may not just be the local availability of engineering courses and programs. There may also be a gap between future market expectations and the deliverables from Nebraska engineering programs.

To help bring a sharper focus on business needs, the Applied Information Management (AIM) Institute has completed an extensive study of engineering-based educational service needs of greater Nebraska employers of engineers. The following summarizes the findings of this study. The results are designed to provide an informed and documented statement of need to academic institutions providing engineering courses and programs. It will also be instructive in helping greater Nebraska businesses and other employers evaluate their operations and focus their expectations from the University of Nebraska College of Engineering and other providers of engineering courses and seminars.

A. Study Methodology

The study was directed by the University of Nebraska College of Engineering Advisory Committee, composed of senior engineering and business managers from firms across the state. A questionnaire was designed to document greater Nebraska employers’ present and future requirements for employees, training budgets, and curriculum needs. These questionnaires were mailed to greater Nebraska employers that provide engineering services to their customers or use engineers to meet their business objectives.

The study methodology helps sharpen the focus on academic disciplines required by greater Nebraska businesses. It also helps quantify market size and training budgets. Unfortunately, not all respondents reported training budget data. Therefore, the results understate aggregate training budgets for all respondents. For those firms that did report training budgets, however, per capita expenditures provide a good insight into emerging demand for educational services.

The number of greater Nebraska employers with engineers is difficult to estimate. Several types of employers included in this study are shown below:

- Members of the Society of Military Engineers
- Electric Utility Companies

- County Governments
- Cities with population greater than 5,000
- Manufacturers with more than 25 employees plus some selected firms with less than 25 employees
- Consulting Engineers
- Telephone Companies

Over 1,000 greater Nebraska (excluding greater Omaha) employers were identified in the above categories.

Not all respondents provided rankings as requested by the questionnaire. Therefore, composite rankings for Academic Disciplines, Applied Areas, and Business Issues are a weighted-average, computed as:

$$\frac{\sum \text{Number of Engineers Employed by Respondents Who Ranked the Issue} \times \text{Rank}}{\sum \text{Number of Engineers Employed by Respondents Who Ranked the Issue}}$$

Some regional analysis was possible for areas with significant clusters of engineers. Regional summaries were completed for Lincoln; Columbus/Norfolk; Hastings, Kearney and Grand Island.

Finally, this study methodology and questionnaire is the same as a 1995 Study of Business Requirements for Educational Services in Engineering for greater Omaha employers. The use of identical study methodologies allows a comparative and composite analysis of both study findings to paint a more complete picture of statewide requirements for educational services in engineering.

Findings

A. Employment and Training Budgets

1. Employment Levels

Survey forms were completed by 66 employers. Sixty-one responses were from companies and five responses were from city and county governments.

Survey results represent employers with 16,274 employees in greater Nebraska.

During the next five years, employment is expected to reach 18,715 - a 15.0% growth.

836 or 5.1% of present employees are currently taking academic courses for credit.

68% of these employees were on company tuition reimbursement programs.

Firms believed that 2,139 or over 2 1/2 times the employees currently enrolled should be taking academic credit courses.

2. Training Budgets

28 of the respondents reported their training budgets. The total training budgets for these 28 firms was over \$1,191,000, or \$221 for each of their employees. In addition, there were five employers that reported \$0 for training. Of the 33 companies that did not report any data, many have training budgets, but the data was not available to the person completing the study.

29 firms provided training budget estimates for five years hence; these training budgets are projected to increase over 51.3% to \$1,802,500, or \$280 per employee. Five companies reported \$0 for their future training budgets as well.

For those reporting, 44% of their current budget is used for internally-provided training with the balance going to external seminars and workshops (33%) and college tuition (31%).

In five years, internal training budgets are projected to be 40% of the total training budget with 34% going to external training seminars, and 26% for tuition for college courses.

3. Engineering Employment

Engineering employees total 617 or 3.8% of all employees, with engineers increasing to 4.8% of the employee base in five years.

The five-year growth of engineering employees is projected at 45.5% compared to 15.0% for all employees.

11% of all engineering employees are taking academic credit courses; well above the 5.1% rate for all employees.

72% of these engineering employees were on college tuition reimbursement programs.

4. Engineering Training Budgets

Total engineering training budgets for the 18 firms reporting training budgets were \$208,750. The five-year engineering training budgets for the 20 firms providing these data are projected at \$440,775 - an increase of over 111%.

In addition, 11 firms reported \$0 budgets for training their engineers for the present and in 5 years. 36 employers left these questions blank for current budgets while 34 failed to provide any five year projections.

For firms reporting the data, engineering training averaged \$1,008 per employee and is projected to increase to \$1,259 in five years. While engineering employees account for 3.8% of all employees, engineering accounts for 17.5% of the training budgets. That is expected to grow to over 24.5% in five years.

Note: These training budgets - both at the employer level and per employee - probably understates actual expenditures. Frequently training budget data was not available to the individual completing questionnaires. Also, focus group respondents noted that budgets understated their company training program.

B. Academic Disciplines

Respondents were asked to rank specific *Academic Disciplines*. They were also asked to report the number of employees in each discipline and project their requirements five years hence. They also reported on the percent of registered engineers in each Academic Discipline. Finally, respondents were asked to estimate what percent of their workforce had educational achievement at the baccalaureate or graduate level.

In this survey thirteen Academic Disciplines were considered, including:

- Aerospace
- Agricultural
- Chemical
- Civil –
 - Structural
 - Environmental, Sanitary, Geotechnical, General
- Construction/Architectural
- Electrical Power
- Electrical/Computer
- Environmental
- Industrial/Manufacturing
- Mechanical
- Mining
- Nuclear
- Petroleum

1. Most Important Academic Disciplines

The survey data shows that the greatest numerical growth in corporate employment will be concentrated in Civil, Construction/Architectural, Electrical/Power, Electrical/Computer, Mechanical, and Industrial Manufacturing. Total engineering employment for the survey

participants in these fields is expected to grow by 46.3% or 250 new employees in the next five years.

When asked to rank the above thirteen Academic Disciplines, Mechanical was ranked most important followed by Industrial/Manufacturing; Electrical/Computer; Environmental; Civil (environmental, sanitary, geotechnical, general); Civil (structural); Electrical/Power; Chemical; Construction/Architectural; and Agricultural. Table 1 shows composite ranking, employment, and percent registered engineers.

Table 1
Most Important Academic Disciplines for Employers of Engineers
66 Greater Nebraska Employers

	Rank*	Current Employment	Employment in 5 Years	% Change	% Reg'd Engineers
Civil					
• Structural	2.28	43	61	41.9	51.2
• Environmental, Sanitary, Geotechnical, General	2.18	55	84	52.7	70.9
Construction/Architectural	2.61	36	62	72.2	11.1
Electrical Power	2.51	60	83	38.3	45.0
Electrical/Computer	2.02	104	182	75.0	10.6
Industrial/Manufacturing	1.71	120	162	35.0	9.2
Mechanical	1.67	122	156	27.9	17.2

*Rank 1=Most Important 4=Least Important

The Disciplines shown in Table 1 account for 87.5% of the present engineering employment for all respondents.

Mechanical and Industrial/Manufacturing has a total employment of 242. It is expected to increase to 318 in five years.

Electrical/Computer and Construction/Architectural have the fastest projected rate of growth for engineering employees over the five year period with Electrical/Computer projected to have 182 engineers in five years.

2. Rank of Other Academic Disciplines

Academic disciplines ranked as least important to greater Nebraska employers are shown below. Total engineering employment by survey respondents was relatively low for these additional engineering disciplines. The data shows modest five-year growth in employment in these disciplines.

Employment			
	Rank*	Now	Five Years
Aerospace	3.45	2	3
Agricultural	2.66	32	43
Chemical	2.60	27	38
Environmental	2.11	14	26
Mining	4.00	0	0
Nuclear	3.13	0	0
Petroleum	3.89	0	0
Totals		75	110

**Rank 1=Most Important 4=Least Important*

3. Engineering and Information Technology - A Note

The demand in this discipline seems to be rooted in several places.

- Computers and related information technologies are becoming increasingly important to the practice of engineering. Computer-aided design, modeling, and other technologies place increased training and skill requirements on practicing engineers from all disciplines.
- Information technologies are increasingly being designed into structures, devices, and processes. Structures such as medical facilities, schools, and business are being redesigned around present and future capabilities of information technologies. At a minimum, wiring and other physical needs of information technology must be designed into new structures. More important, however, the increasing demand for “smart” structures and devices will accelerate the demand for electrical engineering/computer skills.
- Classic business users of information technologies also have an increasing demand for personnel rooted in electrical engineering/computers. In colleges and universities across the country, the intellectual roots for information technology curriculums are frequently found in three colleges:
 - Engineering
 - Business Administration
 - Liberal Arts (usually the Math Department)

Across Nebraska, most academic programs for information technology have a strong business or liberal arts heritage. Electronic engineering-based computer courses or programs are generally not available at most state colleges and universities, except UNL.

4. Degree Levels

For all employers, 84% of all engineering employees held baccalaureate degrees and 11% held graduate degrees. Aside from internship positions, virtually all firms require degrees in-hand before employment offers are made. As mentioned elsewhere in this report, this creates a strong demand for both local undergraduate and graduate programs – undergraduate programs to swell the ranks of locally educated engineers and graduate programs for continued advancement after their employment.

Respondents reported that 68 of their engineering employees, or 11% were taking academic courses. When asked “the number of engineering employees you feel should be taking academic courses?” they reported 180, a potential for an additional 112 students.

If 180 engineers were enrolled in college courses, it would represent 29.26% of the engineering workforce reported by the 66 survey firms.

As noted earlier, secondary data suggests there are an estimated 7,000 to 7,600 engineers in Nebraska with 3,500 to 3,800 located in greater Nebraska cities and towns. If all employers’ needs matched the survey respondents, these data translate to a potential very large student base. To illustrate, 11% of engineers in responding firms are enrolled in college courses. Based on a population of engineers at 3,500 to 3,800 in greater Nebraska, that would translate to 380 to 420 engineers would be now enrolled in college courses of some type. Firms reported they would like to have 29% of their engineers in classes. That suggests a market potential of 1,000 to 1,100 employees/students.

This represents a sizable unmet market demand that might respond well to creatively designed and targeted baccalaureate and graduate programs presented locally for currently employed engineers.

C. Applied Areas and Needs Met by Area Universities

Respondents were asked to rank specific Applied Areas within each Academic Discipline. In addition, they were asked to rank how well area universities were meeting their needs in each Applied Area. Values shown in this report are weighted averages based upon:

$$\frac{\sum \text{Number of Engineers Employed by Respondents Who Ranked the Applied Area} \times \text{Rank}}{\sum \text{Number of All Engineers Employed by Respondents Who Ranked the Applied Areas}}$$

The ranking scale was: 1=Most Important, 4=Least Important. The midpoint value on such a scale would be 2.50. The total number of Applied Areas in the survey was 92.

1. Highest Ranked Applied Areas within the Highest Ranked Academic Disciplines

Table 2 shows the 35 Applied Areas that ranked 2.5 or better within the six key Academic Disciplines.

2. Other High-Ranked Applied Areas

Of the seven Academic Areas judged of lesser importance by survey respondents, there were 24 Applied Areas that scored 2.5 or better. Appendix B documents these Applied Areas.

3. Needs Met by Area Universities

Of the 59 Applied Areas that scored 2.50 or higher, the respondents judged the university as not meeting their needs in 28 of the areas.

Of the 35 Applied Areas ranking 2.50 or higher shown in Table 2, the respondents judged the university as not meeting their needs in 17 of these areas.

Further analysis notes that the three most important Academic Disciplines (Mechanical, Industrial/Manufacturing, and Computer/Electronics) contain 20 important Applied Areas of which the respondents judged the university of not meeting their need in 12.

Table 2
Most Important Applied Areas within Key Academic Disciplines
66 Greater Nebraska Employers

Academic Disciplines ● Applied Area	*Rank of Area	**Need Met by Colleges & Universities	***Differences
Civil			
● Structural	1.86	1.68	0.18
● Construction	1.56	2.06	-0.50
● Geotechnical	1.85	1.51	0.34
● Infrastructure/Utilities	1.78	1.86	-0.08
● Surveying	1.77	1.60	0.17
Construction/Architectural			
● Building Structures and Foundation	2.09	1.60	0.49
● Heating, Ventilating and Air Conditioning	2.38	1.81	0.57
● Building Electrical Systems	2.39	1.93	0.46
● Cost/Quality/Time Management	2.19	1.64	0.55
● Environmental Control Systems	2.42	1.89	0.53
● Process Piping	2.28	1.77	0.51

Academic Disciplines ● Applied Area	*Rank of Area	**Need Met by Colleges & Universities	***Differences
Electrical/Power			
● Low Voltage Signal Communications Systems	1.93	2.11	-0.18
● Control Systems	1.93	2.11	-0.18
● Electric Power (emergency/standby/cogeneration/prime power generation and distributing)	2.06	1.97	0.09
● Electric Materials and Equipment	1.98	1.78	0.20
Electronic/Computer			
● Computer Systems/Architecture	2.28	2.12	0.16
● Directories, Circuits, and Systems	2.38	2.04	0.34
● Communications, Control and Signal Processing	2.30	2.20	0.10
● LAN/WAN Networks, Architecture and Design	2.19	2.51	-0.32
● Wireless, Telephone, Fiber Optics	2.24	2.69	-0.45
● CAD/CAM and Other Industry Design and Manufacturing Technology	1.71	2.23	-0.52
● Electronic Devices/Circuit and Circuit Theory	1.83	2.17	-0.34
Industrial/Manufacturing			
● Process Flow Design	1.72	1.84	-0.12
● Manufacturing Automation and Assembly	1.70	2.12	-0.42
● Human-Machine Interface	1.78	2.10	-0.32
● Electronic Packaging	2.47	2.46	0.01
Mechanical			
● Manufacturing Processes	1.65	2.17	-0.52
● Operation and Environmental Consideration in Design	1.90	1.97	-0.07
● Industrial Ventilation Systems	2.36	1.89	0.47
● Fluid Power and Control	1.97	1.98	-0.01
● Machine and Systems	1.75	2.08	-0.33
● Engineering Measurements and Instrumentation	1.96	2.0	-0.04
● Heat Transfer/Energy Systems	2.21	2.21	0.00
● Materials Science/Metallurgy	2.16	2.13	0.03
● Hydraulics	2.28	2.09	0.19

*Rank 1=Most Important 4=Least Important

**Rank 1=Meets Needs 4=Does Not Meet Needs

***A positive value suggests needs are not being met. A negative value suggests needs are being met.

D. Technology Areas

There is an array of engineering business issues that transcend the various Academic Disciplines and Applied Areas. In many cases they are emerging issues within engineering. These business issues will provide focus to any of the Academic Disciplines and Applied Areas.

Table 3 shows engineering business issues that respondents ranked as most important with scores ranging between 1.0 and 2.0 today or in five years. These business issues are grouped into four classes:

- Personal Characteristics/Skills
- Project Management
- Business Development and General Management
- Industry Standards and Regulations

Business Ethics, ranked at 1.46, was the most important. With 1.0 as the highest possible score, 1.46 suggests many respondents ranked this issue as most important.

Respondents seem to be saying that any academic program at the bachelor's or master's level that does not provide some business focus will be lacking. These topics also provide fertile ground for continuing education programs and seminars.

Table 3
Engineering Business Issues
66 Greater Nebraska Employers

Business Issues	Currently	In Five Years
Personal Characteristics/Skills		
• Professional Ethics	1.46	1.40
Project Management		
• Quality/Assurance Management Programs	1.61	1.45
Business Development and General Management		
• Business Development/Marketing	1.97	1.75
• Employee Recruitment and Retention	1.96	1.87
• Industry Computer Software	2.09	1.93
• Technology Transfer	2.01	1.80
Industry Standards and Regulations		
• Industry Codes and Standards (ISO, ASTM, UL, ANSI, UBC/BOCA, Federal, Military, etc.)	2.01	1.84
• Regulatory Impacts (OSHA, EPA, ADA, etc.)	1.84	1.76
• Safety	1.47	1.45

**Rank 1=Most Important 4=Least Important*

E. Focus Groups

Survey respondents were asked if they would like to participate in a Focus Group discussion. Focus group meetings were held in Grand Island, Columbus, and Lincoln. The following three questions were posed.

- What is your reaction the survey findings?
- What are the requirements for engineering education at your firm?
- In which academic disciplines would you like to see baccalaureate and graduate degrees offered? How should these programs be delivered?

There was a high degree of consistency in comments from the three groups. There were also differences attributed, in part, to the educational opportunities that exist in each community. Business leaders were the primary participants.

1. Comments about Survey Findings

Business participants concurred with the statistical findings of the surveys. Typical comments about the results included:

“The numbers seem about right. We need them to make comparisons and informed comment.”

“Seems about right. Electrical/Computer is right – especially to programming and setup for Robotics.”

“This is the first time I have seen this type of data. Should be done on a regular basis.”

“Ethics was scored as most important, but I would have expected it to be high.”

“Surprised that only 72% of engineers received tuition reimbursement. Would have expected higher.”

“CAD/CAM needs to be applied to Industrial/Manufacturing.”

“I know why engineers are not taking classes. The classes they need to take are only offered during working hours.”

“Address does not equal access if the content is not relevant and courses are not available when employees can take them.”

2. Requirements for Engineering Education

There were several themes that developed around these questions. Most dealt with the lack of availability – particularly in the Grand Island and Columbus focus group meetings.

It is hard to hire graduate engineers in many greater Nebraska locations. “We hire three to four engineers a year. Most are new graduates that grew up in Nebraska and want to stay here. It would be extremely difficult to hire experienced engineers that were not from rural areas.”

Not only was job location a challenge, but the absence of educational opportunities was considered important. “I was able to get an MBA at Kearney, therefore, I was willing to relocate from Idaho.” A Columbus employer noted that at their corporate headquarters in Connecticut:

- 95% of new employees have baccalaureate
- 25% have masters

At their Nebraska plant:

- 25% of new employees have baccalaureate
- 0% have masters

Greater Nebraska employees seek educational opportunities. At Central Community college campus in Columbus, it is estimated the average age of their students is 35 years old. 75% of the student body are “non-traditional” students.

Many firms spoke of very good “street smart” engineers with a lot of experience but lacking baccalaureate degrees. A desire was expressed for locally available courses that would help develop these employees professionally. “We have some guys that it would be great if they could pick up four or five engineering course – but it isn’t going to happen.” “We have a lot of people coming up through the ranks. But they just don’t have the opportunity to take just plain vanilla basic engineering courses.”

There were also comments that courses are frequently offered during the day preventing some employees from attending. Also, there were several participants not familiar with CorpNet. Those that had used CorpNet preferred face-to-face instructions.

Other ideas to enhance local availability included “use local schools for early years – then go to Lincoln for last two years.” Exploit CO-OP programs (work six months/school six months) allowing the student to gain work experience in greater Nebraska while getting education.

“Make sure UNK elective (and community college) credits are accepted by UNL.”

“We would like to hire more engineers with masters degrees. Since they are not available, we use internships so we can hire “experienced baccalaureate candidates when they graduate.”

3. Academic Disciplines and Delivery

The Academic Disciplines reported as most important in the body of this report were also viewed as most important by the Focus Groups Those included:

- Civil
- Electronic/Computer
- Electronic/Power
- Mechanical
- Construction/Architectural

One participant commented that the academic rigor of UNL’s engineering program has declined. “UNL is adequate but it is not first class – and it should be.”

The appeal for basic/applied programs was expressed several times. “We hire a lot of Agriculture engineers today – they are all specialist in some unique area – none wants to design relatively simple farm equipment.”

While there was much discussion about delivery – there was little discussion about academic disciplines in the grand Island and Columbus focus group meetings. Strong opinions about content arise when there are programs available. A near complete absence of courses caused participants to focus on “how” to get courses more than “what” the courses should contain.

“We need a lot of short courses. The university does not have them available to we send our employees to Ames (Iowa) or Wisconsin.”

“We use vendor training a lot.”

F. Regional Analysis

Nebraska has four major urban areas that have relative high concentrations of engineers – Omaha, Lincoln, Columbus/Norfolk, and Grand Island/Hastings/Kearney. There were not sufficient numbers of survey respondents to complete a comprehensive analysis of each urban area. However, some broad general observations are possible.

The analysis was based on zip code addresses of the respondents that reported their address. See Figure 1 mapping survey respondents by zip code.

1. Lincoln

There were thirteen respondents with Lincoln 685xx zip codes.

a. Employment Levels

Thirteen Lincoln Companies Employment Levels			
	Now	In Five Years	% Growth
Total Employment	3,048	3,828	25.6
Engineers	234	401	71.4

Engineers equaled 7.7% of total employment. This level of engineers as a percent of total employment greatly exceeds the other 53 greater Nebraska firms. These 53 firms reported 13,226 employees with 383 engineers accounting for 2.9% of the labor force.

b. Highest Ranking Academic Disciplines

The highest ranking academic disciplines for these thirteen Lincoln firms were:

Academic Discipline	*Rank
Civil – Structural	2.37
Civil – Environmental, Sanitary, Geotechnical, General	1.88
Construction/Architectural	2.35
Electrical/Computer	2.01
Environmental	1.89
Industrial/Manufacturing	2.06
Mechanical	1.99

c. Training Budgets

Six of the thirteen Lincoln companies reported relatively large training budget data. These companies' total training budgets accounted for 40.7% of the reported training budgets for greater Nebraska.

Likewise the engineering training budgets for these Lincoln companies accounted for 73.2% of the total greater Nebraska engineering training budgets.

The training budget designated for “tuition and cost for college courses” by these thirteen Lincoln companies represented 59.3% of that component of the training budget for all greater Nebraska firms in the study.

To summarize:

% of 66 Greater Nebraska Employers	
Thirteen Lincoln Companies	19.7%
Total Training Budgets	40.7%
Set Aside for Tuition Cost	59.3%
Engineer training Budget	73.2%

Thirteen Lincoln Companies		
Training Budget Per Person	Now	In Five Years
Lincoln Companies		
All Employees	\$411	\$549
Engineers	\$1,364	\$1,573
Other Greater Nebraska Companies		
All Employees	\$167	\$191
Engineers	\$589	\$702

These differences may reflect different corporate cultures and attitudes toward education. They more likely reflect access and opportunity for educational services - particularly in engineering and other business and graduate education opportunities compared to other Nebraska communities.

To support this conclusion, the 53 greater Nebraska firms reported that 1,684 employees should be taking courses for credit - nearly three times more than the 595 that are now taking courses. For engineers, the same 53 companies believe 129 engineers should be taking college courses - also nearly three times more than the 46 employees now enrolled.

The thirteen Lincoln companies would like to see about twice the number of employees and engineers enrolled.

2. Southeast Nebraska

There were 21 southeast Nebraska employers that responded to the survey. These companies were located within the area codes 683xx (Beatrice), 684xx (southeast Nebraska), and 685xx (Lincoln). There were six respondents from 683xx, two from 684xx, and thirteen from 685xx.

There was one predominant finding from this analyses of these 21 companies (which includes Lincoln firms discussed above). These 21 employers had 306 engineers representing half of the engineers in the greater Nebraska study.

In addition, growth in the number of engineers is expected to reach 60% compared to 46% for greater Nebraska.

It is also interesting to note that per employee training budgets for southeast Nebraska firms – outside the city of Lincoln – were relatively low. They more nearly compared to other employers across greater Nebraska than to Lincoln employers.

Regional Training Budget Per Person				
	Lincoln	Beatrice/ SE Nebr	Hastings/ GI/Kearney	Columbus/ Norfolk
All Employees	\$411	\$70	255	\$52
Engineers	\$1,364	\$500	\$3	\$571
In Five Years				
All Employees	\$549	\$144	\$250	\$74
Engineers	\$1,573	\$630	\$583	\$886

3. Columbus (686xx) and Norfolk (687xx)

There were nine respondents identified from the Columbus (six) and Norfolk (three) areas.

a. Employment Levels

Nine Columbus/Norfolk Companies Employment Levels			
	Now	In Five Years	% Growth
Total Employment	3,910	4,229	8.2
Engineers	75	104	38.7

Engineers equaled 1.9% of total employment. This level of engineers is far less than the 3.8% of the labor force that are engineers for all greater Nebraska employers.

b. Highest Ranking Academic Disciplines

The highest ranking academic disciplines for these nine Columbus/Norfolk firms were:

Academic Discipline	*Rank
Agricultural	2.17
Chemical	2.06
Civil - Structural	1.87
Civil - Environmental, Sanitary, Geotechnical, General	2.08
Electrical/Computer	1.04
Environmental	2.00
Industrial/Manufacturing	1.47
Mechanical	1.06

c. Training Budgets

Six of the nine Columbus/Norfolk companies reported relatively modest training budgets.

Of the three greater Nebraska concentrations of engineers, the Columbus/Norfolk area probably has the lowest availability of baccalaureate and graduate programs available for practicing engineers. Only one engineer from all six Columbus reporting companies is taking courses for academic credit. In Norfolk, the home of Wayne State College, 5 of 26 practicing engineers at these three reporting companies are taking college courses.

Combined, the nine Columbus/Norfolk employers would like 21 or 28% of their 75 engineers to take college courses. This is more than a threefold increase above those presently enrolled.

To summarize:

% of 66 Greater Nebraska Employers	
Nine Columbus/Norfolk Companies	13.6%
Total Training Budgets	5.7%
Set Aside for Tuition Cost	4.0%
Engineer training Budget	7.7%

Columbus/Norfolk Companies		
Training Budget Per Person	Now	In Five Years
Columbus/Norfolk Companies		
All Employees	\$52	\$74
Engineers	\$571	\$886

4. Grand Island/Kearney (688xx) and Hastings (689xx)

There were fifteen respondents from the Grand Island/Kearney (eleven) and Hastings (four) area that reported their addresses.

a. Employment Levels

Fifteen Grand Island/Kearney/Hastings Companies Employment Levels			
	Now	In Five Years	% Growth
Total Employment	4,115	4,614	12.1%
Engineers	117	166	41.9%

Engineers equaled 2.8% of total employment. This level of engineering employment is less than the 3.8% of the labor force that are engineers for all greater Nebraska employers.

b. Highest Ranking Academic Disciplines

The highest ranking academic disciplines for these nine Columbus/Norfolk firms were:

Academic Discipline	*Rank
Agricultural	2.28
Civil – Structural	1.90
Construction/Architectural	2.44
Electrical/Power	2.51
Electrical/Computer	2.24
Environmental	2.52
Industrial/Manufacturing	1.10
Mechanical	1.13

c. Training Budgets

Five of the fifteen Grand Island/Kearney/Hastings companies reported training budgets. These budgets were relatively modest in amount.

Only two of the fifteen respondents reported their training budgets for engineers. Based upon focus group connections in that area, most companies provide training opportunities for their engineers. The data was frequently not available to the survey enumerator.

There are fourteen engineers now taking college courses. This represents 12.0% of the 117 engineers employed by these fifteen firms. Ten of the fourteen were on corporate tuition reimbursement programs, further suggesting higher training budgets than were reported by respondents.

In response to the question “what number of Engineering Employees do you feel should be taking academic courses?” the responding firms answered 33 or 28% of all engineering employees. This is over twice the number now enrolled.

To summarize:

% of 66 Greater Nebraska Employers	
Fifteen Grand Island/Kearney/Hastings Companies	22.7%
Total Training Budgets	27.4%
Set Aside for Tuition Cost	2.3%
Engineer Training Budget	1.4%

Grand Island/Kearney/Hastings Companies		
Training Budget Per Person	Now	In Five Years
Columbus/Norfolk Companies		
All Employees	\$52	\$74
Engineers	\$571	\$886

Conclusions

The Engineering Survey included 66 greater Nebraska employers with total employment of 16,274 employees.

Engineering employees totaled 617 or 3.8% of all employees in responding firms.

Other significant survey findings include:

- 836 or 5.1% of all employees from responding firms are currently taking academic courses.
- 68% of employees taking academic courses are in tuition reimbursement
- Total training budgets for the 28 firms reporting data are currently over \$1,191,000 and they are projected to exceed \$1.8 million in five years (28 firms provided five-year budget estimates. Five additional employers reported \$0 training budgets).
- For the 28 firms reporting training budgets, the per-employee training cost is:

	1995	Five Years
All Employees (28 firms reporting)	\$ 221	\$ 280
Engineering Employees (18 firms reporting)	\$1,008	\$1,259

With less than 40% of the 66 respondents providing total firm training budgets and engineering training budget information, the values reported above will substantially understate the composite training budget of all survey firms.

The study methodology will not allow use of above values to develop estimates of greater Nebraska's total engineering training budgets and total engineering employment. However, estimates from secondary data sources show total greater Nebraska engineering employment between 3,500 and 3,800.

Numerous additional conclusions are appropriate:

1. For reporting firms, expenditures for training and education will increase faster than employment. (Employment up 15.0% in five years with training budgets up 51.3%.)
2. Firms will increase internal training budgets (35.7%) at about the same rate for external seminars (59.4%) and for tuition reimbursement (70.1%), creating growing market opportunities for providers delivering educational services at the firm level.
3. Engineering positions will grow more rapidly (45.5%) than for all employees (15.0%).

4. Training budgets per engineering employee are approximately five times larger than the amount for non-engineering employees now and in five years. This creates a very fast growth industry for professional engineering training at all levels.
5. Combined industry trends toward increased requirements for annual license renewal plus validation of professional continuing education programs may create training opportunities for universities.
6. The strongest demand for curriculum and programs included:
 - Civil –
 - Structural
 - Environmental, Sanitary, Geotechnical, General
 - Electrical/Power
 - Electrical/Computer
 - Industrial/Manufacturing
 - Mechanical
7. The number of new engineering graduates from Nebraska universities will be less than the demand for such employees by greater Nebraska firms for the foreseeable future.
8. A strong demand for educational services exists at both the undergraduate and graduate level.
9. Courses designed for current practicing engineers with high levels of applied experience but incomplete degree requirements are required at many greater Nebraska locations.
10. Once hired, many firms seek graduate opportunities for employees with baccalaureate degrees. The difference between the 11% of engineering employees now taking academic courses and the 29.2% employers think “should be taking academic courses” creates a substantial unmet local market for graduate and undergraduate services. Many greater Nebraska locations have few master degree programs available in any discipline adding to recruiting problems for new and experienced engineers.
11. Information technologies have a substantial electronic engineering dimension to them - particularly as the computer, communications, audio/visual and other disciplines converge to create new platforms and business applications.
12. The integration of information technologies into structures, products, devices and processes is leading to an applied convergence of most information technologies and many engineering disciplines.

13. Local delivery of educational services is highly preferred to distance learning technologies.
14. Focus group discussions suggest a low awareness of distance learning technologies such as CorpNet, National Technological University (NTU) and courses available over the Internet.
15. Distance and lack of market concentration creates a unique challenge/barrier to deliver both continuing education and academic programs to most greater Nebraska practicing engineers.
16. When asked “How well is the University meeting your needs,” respondents indicated that needs were met in most Applied Areas ranked as least important. For Applied Areas ranked most important, the University met needs only half the time.

Recommendations

1. Business has the opportunity to directly influence academic programs by:
 - creating partnerships between business, local colleges, and UNL to encourage local availability of selected courses. Employers can help define and fill classes negotiated for local delivery.
 - further defining specific needs in the Academic Disciplines and Applied Areas listed as most important to their area. This work should be done in close consultation with the academic community.
 - promoting CO-OP programs to attract student engineers to their firms.
 - working with universities and area high schools to develop creative programs that attract more students into all engineering programs with the objective to close the gap between the growth in demand for engineering professionals and the number of new graduates.

2. To meet greater Nebraska employers' demands for engineering education, the University of Nebraska must:
 - develop high quality, locally available and comprehensive baccalaureate and graduate programs in:
 - Civil Engineering
 - Electrical/Power
 - Electrical/Computer
 - Industrial/Manufacturing
 - Mechanical
 - create a vision for engineering that serves traditional markets while anticipating the convergence of information technology into the structures, devices, and processes of the future.
 - tightly align electronic engineering programs with information technology programs offered by area community colleges and baccalaureate generating institutions to bring greater student “mass” to strengthen programs and optimize faculty resources.
 - establish techniques to partner with business for labs that are productive to both partners.
 - develop techniques to allow greater mobility of academic resources and collegial partnerships between the state's campuses.
 - develop and promote 2+2 type “feeder” programs for Lincoln/Omaha based engineering programs with greater Nebraska community colleges and state colleges.

- consider strategic alliances with cable companies and other in-home providers to offer greater array of educational services.
- three major greater Nebraska concentrations of engineers – Lincoln; Grand Island/Kearney/Hastings; and Columbus/Norfolk – offer concentrated markets for engineering services.
- consider all of teaching/learning technologies including:
 - CD-ROM
 - Internet
 - mobile faculty
 - visiting professors to area firms/community colleges/state colleges
- develop an applied focus
- create career development courses for “street smart” – highly competent working engineers without degrees.
- develop unconventional classroom schedules (i.e., all-day classes on weekdays or Saturdays that meet once a month at a central site in key markets like Grand Island or Columbus).

3. Other Recommendations include:

- other state and private institutions should consider MBA and other master level business degrees to enhance career development, promotion, and professional growth to area employees.
- the vision for CorpNet should be modified to address unmet demand:
 - Individuals and small companies are not now economically served by CorpNet’s corporate customer culture
 - Broaden course offerings to include undergraduate education
 - Develop a continuing education component to support professional registration, license renewal, and engineering short courses and training.

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University of Nebraska, “Strategic Plan for Engineering and Technology Education in Nebraska: Report of the Task Force on Engineering Education,” 1994.

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Appendix A

Greater Nebraska Engineering Survey Participants

AGROMAC International, Inc.	Leon Plastics, Inc.
American Meter Company	LI-COR, Inc.
American Shizuki Corporation	Lincoln Electric System
Ash Grove Cement Company	Lincoln Plating Company
Automatic Equipment Mfg. Co.	Loup Power District
Ayars & Ayars, Inc.	Neapco Inc
Baldwin Filters	ORE-IDA Foods
Becton-Dickinson	Orthman Manufacturing Inc.
Behlen Manufacturing Company	Overhead Door Company
BPW/City of Beatrice	Owen Short, Manufacturing
Chief Agri-Industrial Division	Paulsen Development
Chief Industries (Buildings Division)	Pfizer Animal Health
Chief Industries, Inc.	Phoenix Industries, Inc.
City of Columbus	Pierce Telephone Company, Inc.
City of Grand Island	Red Willow County
City of Ogallala	Reinke Mfg.
Computer Business Services, Inc.	Riser Bond Instruments
Dale Electronics, Inc.	Royal Plastic Mfg.
Department of Public Works	Snyder International
Dutton-Lainson Company	South Central Public Power District
Farmland Industries	Sunstrand Aerospace Corp.
FLEXcon	The Egging Company
Friskies PetCare Company, Inc.	The West Company
Geotechnical Services, Inc.	T-L Irrigation Co.
Gilmore & Associates, Inc.	Transcrypt International
Havelock Shops	Twin Valleys Public Power District
Heminford Loop Telephone Company	Walker Manufacturing
Hornady Mfg.	Wheat Belt Public Power District
Humboldt Specialty Manufacturing, Co.	Unknown Company
HWS Consulting Group, Inc.	Unknown Company
ICSO, Inc.	Unknown Company
J. A. Woollam Co., Inc.	Unknown Company
Lauhoff Grain Company	Unknown Company

Appendix B

Greater Nebraska Engineering Curriculum Needs Survey Company Education/Training Profile 66 Firms

	Now	In Five Years	Percent Change
1. Number of All Employees (Greater Nebraska)	16,274	18,715	15.00
2. Number of All Employees Now Taking Academic Credit Courses	836		
3. Number of All Employees You Feel Should Be Taking Academic Courses	2,139		
4. Number of Those Employees Taking Academic Credit Courses Who Are on a Company Tuition Reimbursement Program.	569		
5. Education/Training Budget - Nebraska Employers Amount of Training Budget for:	\$1,191,605	\$1,802,500	51.27
a. Internally Provided Training Programs	\$528,200	\$717,000	35.74
b. External Seminars & Workshops	\$390,200	\$622,000	59.41
c. Tuition & Cost for College Courses	\$272,800	\$464,000	70.09
d. Other	\$200	\$0	-100.00

Greater Nebraska Engineering Employees

6. Number of Engineering Employees	617	898	45.54
7. Number of Engineering Employees Now Taking Academic Credit Courses	68		
8. Number of Engineering Employees You Feel Should be Taking Academic Courses	180		
9. Number of Those Engineering Employees Taking Academic Credit Courses Who Are On a Company Tuition Reimbursement Program	49		
10. Education/Training Budget - Engineering Employees Only	\$208,750	\$440,775	111.15

**Profile of Academic Disciplines for Engineering Employees
Greater Nebraska
66 Employers**

Academic Disciplines	Rank* Importance of Discipline to Your Firm	% Employees with These Disciplines	% Registered Engineers**	% Employees with These Disciplines in Five Years
Aerospace	3.45	0.32	0.00	0.33
Agricultural	2.66	5.19	34.38	4.78
Chemical	2.60	4.38	11.11	4.22
Civil - Structural	2.28	6.97	51.16	6.78
Civil - Environmental, Sanitary, Geotechnical, General	2.18	8.91	70.91	9.33
Construction/Architectural	2.61	5.83	11.11	6.89
Electrical/Power	2.51	9.72	45.0	9.22
Electrical/Computer	2.02	16.86	10.58	20.22
Environmental	2.11	2.27	0.00	2.89
Industrial/Manufacturing	1.71	19.45	9.17	18.00
Mechanical	1.67	19.77	17.21	17.33
Mining	4.00	0.00	0.00	0.00
Nuclear	3.13	0.00	0.00	0.00
Petroleum	3.89	0.00	0.00	0.00
% Baccalaureate		84.28	62.42	78.11
% Graduate		11.18	12.785	17.44

Estimated Number of Employees by Academic Disciplines

Academic Disciplines	Rank* Importance of Discipline to Your Firm	# Employees with These Disciplines	# Registered Engineers**	# Employees with These Disciplines in Five Years	% Increase
Aerospace	3.45	2	0	3	50.00
Agricultural	2.66	32	11	43	34.38
Chemical	2.60	27	3	38	40.74
Civil - Structural	2.28	43	22	61	41.86
Civil - Environmental, Sanitary, Geotechnical, General	2.18	55	39	84	52.73
Construction/Architectural	2.61	36	4	62	72.22
Electrical/Power	2.51	60	27	83	38.33
Electrical/Computer	2.02	104	11	182	75.00
Environmental	2.11	14	0	26	85.71
Industrial/Manufacturing	1.71	120	11	162	35.00
Mechanical	1.67	122	21	156	27.87
Mining	4.00	0	0	0	0.00
Nuclear	3.13	0	0	0	0.00
Petroleum	3.89	0	0	0	0.00

*Rank 1=Most Important 4=Least Important

**Percent of present Engineering employees that are registered engineers.

**Greater Nebraska Importance of Academic Discipline
66 Employers**

Academic Disciplines ● Applied Area	*Rank of Area	**Need Met by Colleges & Universities	***Differences
Aerospace			
● Aero and Gas Dynamics	2.00	4.00	-2.00
● Propulsion	2.00	4.00	-2.00
● Aerospace Structures	1.94	3.94	-2.00
● Flight Mechanics	3.00	4.00	-1.00
● Spacecraft Systems	2.00	4.00	-2.00
● Flight Control systems	2.00	4.00	-2.00
● Aero Elasticity	4.00	4.00	-2.00
● Other			
Agricultural			
● Biosystems Engineering	2.83	2.57	0.26
● Food engineering	3.07	1.95	1.12
● Power and Machinery	1.92	1.84	0.08
● Structures and Environment	2.32	1.84	0.48
● Process Engineering	2.44	1.88	0.56
● Water and Environment	2.31	2.58	-0.27
● Waste Management	2.62	2.64	-0.02
● Soil Management	2.80	1.69	1.11
● Other			
Chemical			
● Process Control	2.12	2.90	-0.78
● Process and Plant Design	2.21	2.87	-0.66
● Polymers and Polymer Engineering	3.42	3.08	0.34
● Petroleum Production and Refining	3.79	3.36	0.43
● Transport Operations	3.37	3.32	0.05
● Biochemical Engineering	2.91	3.08	-0.17
● Other			
Civil			
● Structural	1.86	1.68	0.18
● Construction	1.56	2.06	-0.50
● Geotechnical	1.85	1.51	0.34
● Geological	3.01	1.37	1.64
● Oceanography	4.00	1.50	2.50
● Transportation	2.71	1.52	1.19
● Infrastructure/Utilities	1.78	1.86	-0.08
● Surveying	1.77	1.60	0.17
● Other			

*Rank 1=Most Important 4=Least Important

**Rank 1=Meets Needs 4=Does Not Meet Needs

***A positive value suggests needs are not being met. A negative value suggests needs are being met.

Academic Disciplines ● Applied Area	*Rank of Area	**Need Met by Colleges & Universities	***Differences
Construction/Architectural			
● Building Structures and Foundation	2.09	1.60	0.49
● Heating, Ventilating and Air Conditioning	2.38	1.81	0.57
● Plumbing/Drainage systems	2.53	1.55	0.98
● Fire Protection Systems	2.78	1.93	0.85
● Lighting Design and Application	2.76	2.04	0.72
● Building Acoustics	3.39	2.17	1.22
● Building Electrical Systems	2.39	1.93	0.46
● Cost/Quality/Time Management	2.19	1.64	0.55
● Environmental Control Systems	2.42	1.89	0.53
● Process Piping	2.28	1.77	0.51
● Other			
Electrical/Power			
● Low Voltage Signal Communications Systems	1.93	2.11	-0.18
● Control Systems	1.93	2.11	-0.18
● Electric Power (emergency/standby/cogeneration/ prime power generation and distributing)	2.06	1.97	0.09
● Electric Materials and Equipment	1.98	1.78	0.20
● Other			
Electronic/Computer			
● Computer Systems/Architecture	2.29	2.13	0.16
● Directories, Circuits, and Systems	2.38	2.05	0.33
● Communications, Control and Signal Processing	2.31	2.22	0.09
● LAN/WAN Networks, Architecture and Design	2.20	2.52	-0.32
● Wireless, Telephone, Fiber Optics	2.25	2.69	-0.44
● CAD/CAM and Other Industry Design and Manufacturing Technology	1.72	2.24	-0.52
● Electronic Devices/Circuit and Circuit Theory	1.85	2.18	-0.33
● Bio-computing	3.45	2.36	1.09
● Other			
Environmental			
● Emissions/Effluent Control	1.95	2.19	-0.24
● Solid Waste Handling/Recycling	1.81	2.31	-0.50
● Water/Waste Water Treatment	1.88	1.97	-0.09
● Hazardous/Toxic/Radioactive Waste Management/Cleanup	2.47	2.31	0.16
● Impact Assessment Studies/Statements	2.48	2.40	0.08
● Underground Storage Facilities/Tanks	2.65	2.16	0.49
● Water Management/Flood Control	3.18	2.07	1.11
● Other			

*Rank 1=Most Important 4=Least Important

**Rank 1=Meets Needs 4=Does Not Meet Needs

***A positive value suggests needs are not being met. A negative value suggests needs are being met.

Academic Disciplines ● Applied Area	*Rank of Area	**Need Met by Colleges & Universities	***Differences
Industrial/Manufacturing			
● Process Flow Design	1.71	1.86	-0.15
● Manufacturing Automation and Assembly	1.71	2.14	-0.43
● Human-Machine Interface	1.77	2.12	-0.35
● Electronic Packaging	2.45	2.47	-0.02
● Integrated Circuit Manufacturing	2.96	2.39	0.57
● Other			
Mechanical			
● Manufacturing Processes	1.65	2.17	-0.52
● Operation & Environmental Consideration in Design	1.90	1.97	-0.07
● Industrial Ventilation Systems	2.36	1.89	0.47
● Fluid Power and Control	1.97	1.98	-0.01
● Machine and Systems	1.75	2.08	-0.33
● Power Generation	2.52	2.07	0.45
● Engineering Measurements and Instrumentation	1.96	2.00	-0.04
● Heat Transfer/Energy Systems	2.21	2.21	0.00
● Materials Science/Metallurgy	2.16	2.13	0.03
● Hydraulics	2.28	2.09	0.19
● Bio-Technical/Robotics	2.97	2.07	0.19
● Other			
Mining			
● Rock Mechanics	3.63	3.31	0.32
● Rock Fragmentation	3.50	3.31	0.19
● Mine Health, Safety and Regulation	3.37	3.31	0.06
● Solution Mining	3.77	3.31	0.46
● Geostatistics	3.40	3.31	0.09
● Mineral Economics	3.63	3.31	0.32
● Hazardous Waste Control and Reclamation	2.00	2.67	-0.67
● Other			
Nuclear			
● Transport Theory and Computational analysis	1.72	1.00	0.72
● Reactor Dynamics and Safety	1.72	1.00	0.72
● Materials for Reactors and Radiation Effects	1.72	1.00	0.72
● Reactor thermal-Hydraulics	1.72	1.00	0.72
● Health Physics	1.72	1.00	0.72
● Waste (high and low level)	1.24	1.48	-0.24
● Other			
Petroleum			
● Drilling, Production and Operations	3.00	1.00	2.00
● Petrophysics	2.80	1.00	1.80
● Recovery	3.00	1.00	2.00
● Transportation	3.00	1.00	2.00
● Other			

*Rank 1=Most Important 4=Least Important

**Rank 1=Meets Needs 4=Does Not Meet Needs

***A positive value suggests needs are not being met. A negative value suggests needs are being met.

Appendix C

Lincoln Engineering Curriculum Needs Survey Company Education/Training Profile 13 Employers Lincoln Zip Codes Starting with 685xx

All Lincoln Employees	Now	In Five Years	Percent Change
1. Number of All Employees (Lincoln)	3,048	3,828	25.59
2. Number of All Employees Now Taking Academic Credit Courses	241		
3. Number of All Employees You Feel Should Be Taking Academic Courses	455		
4. Number of Those Employees Taking Academic Credit Courses Who Are on a Company Tuition Reimbursement Program.	153		
5. Education/Training Budget - Nebraska Employers Amount of Training Budget for:	\$485,105	\$874,500	80.27
a. Internally Provided Training Programs	\$107,700	\$217,000	101.49
b. External Seminars & Workshops	\$215,200	\$376,000	74.72
c. Tuition & Cost for College Courses	\$161,900	\$281,000	73.56
d. Other	\$200	\$0	-100.00
Lincoln Engineering Employees			
6. Number of Engineering Employees	234	401	71.37
7. Number of Engineering Employees Now Taking Academic Credit Courses	22		
8. Number of Engineering Employees You Feel Should be Taking Academic Courses	51		
9. Number of Those Engineering Employees Taking Academic Credit Courses Who Are On a Company Tuition Reimbursement Program	12		
10. Education/Training Budget - Engineering Employees Only	\$152,750	\$352,275	130.62

**Profile of Academic Disciplines for Engineering Employees
13 Employers
Lincoln Zip Codes Starting with 685xx**

Academic Disciplines	Rank* Importance of Discipline to Your Firm	% Employees with These Disciplines	% Registered Engineers**	% Employees with These Disciplines in Five Years
Aerospace	4.00	0.00	0.00	0.00
Agricultural	3.24	1.28	66.67	0.50
Chemical	2.41	3.42	12.50	2.99
Civil - Structural	2.37	1.28	33.33	2.49
Civil - Environmental, Sanitary, Geotechnical, General	1.88	16.67	71.79	15.71
Construction/Architectural	2.35	8.12	5.26	10.47
Electrical/Power	2.67	11.97	57.14	11.22
Electrical/Computer	2.01	32.48	13.16	33.67
Environmental	1.89	2.56	0.00	2.74
Industrial/Manufacturing	2.06	8.55	15.00	9.73
Mechanical	1.99	13.25	6.45	10.47
Mining	4.00	0.00	0.00	0.00
Nuclear	2.44	0.00	0.00	0.00
Petroleum	3.74	0.00	0.00	0.00
% Baccalaureate		80.34	73.44	71.07
% Graduate		16.24	15.63	27.43

Estimated Number of Employees by Academic Disciplines

Academic Disciplines	Rank* Importance of Discipline to Your Firm	# Employees with These Disciplines	# Registered Engineers**	# Employees with These Disciplines in Five Years	% Increase
Aerospace	4.00	0	0	0	0.00
Agricultural	3.24	3	2	2	33.33
Chemical	2.41	8	1	12	50.00
Civil - Structural	2.37	3	1	10	233.33
Civil - Environmental, Sanitary, Geotechnical, General	1.88	39	28	63	61.54
Construction/Architectural	2.35	19	1	42	121.05
Electrical/Power	2.67	28	16	45	60.71
Electrical/Computer	2.01	76	10	135	77.63
Environmental	1.89	6	0	11	83.33
Industrial/Manufacturing	2.06	20	3	39	95.00
Mechanical	1.99	31	2	42	35.48
Mining	4.00	0	0	0	0.00
Nuclear	2.44	0	0	0	0.00
Petroleum	3.74	0	0	0	0.00

*Rank 1=Most Important 4=Least Important

**Percent of present Engineering employees that are registered engineers.

Appendix D

**Columbus/Norfolk Engineering Curriculum Needs Survey
Company Education/Training Profile
9 Employers
Columbus/Norfolk Zip Codes Starting with 686xx and 687xx**

All Columbus/Norfolk Employees	Now	In Five Years	Percent Change
1. Number of All Employees (Columbus/Norfolk)	3,910	4,229	8.16
2. Number of All Employees Now Taking Academic Credit Courses	236		
3. Number of All Employees You Feel Should Be Taking Academic Courses	725		
4. Number of Those Employees Taking Academic Credit Courses Who Are on a Company Tuition Reimbursement Program.	233		
5. Education/Training Budget - Nebraska Employers Amount of Training Budget for:	\$67,500	\$86,000	27.41
a. Internally Provided Training Programs	\$8,400	\$12,000	42.86
b. External Seminars & Workshops	\$48,200	\$58,000	20.33
c. Tuition & Cost for College Courses	\$11,000	\$16,000	45.45
d. Other			
Columbus/Norfolk Engineering Employees			
6. Number of Engineering Employees	75	104	38.67
7. Number of Engineering Employees Now Taking Academic Credit Courses	6		
8. Number of Engineering Employees You Feel Should be Taking Academic Courses	21		
9. Number of Those Engineering Employees Taking Academic Credit Courses Who Are On a Company Tuition Reimbursement Program	6		
10. Education/Training Budget - Engineering Employees Only	\$16,000	\$31,000	93.75

**Profile of Academic Disciplines for Engineering Employees
9 Employers
Columbus/Norfolk Zip Codes Starting with 686xx and 687xx**

Academic Disciplines	Rank* Importance of Discipline to Your Firm	% Employees with These Disciplines	% Registered Engineers**	% Employees with These Disciplines in Five Years
Aerospace	4.00	0.00	0.00	0.00
Agricultural	2.17	0.00	0.00	0.00
Chemical	2.06	8.00	33.33	7.69
Civil - Structural	1.87	13.33	70.00	12.50
Civil - Environmental, Sanitary, Geotechnical, General	2.08	10.67	75.00	9.62
Construction/Architectural	2.73	4.00	33.33	2.88
Electrical/Power	3.39	9.33	42.86	9.62
Electrical/Computer	1.04	16.00	0.00	17.31
Environmental	2.00	2.67	0.00	3.85
Industrial/Manufacturing	1.47	14.67	0.00	17.31
Mechanical	1.06	21.33	31.25	19.23
Mining	0.00	0.00	0.00	0.00
Nuclear	0.00	0.00	0.00	0.00
Petroleum	0.00	0.00	0.00	0.00
		% Baccalaureate	84.00	66.67
		% Graduate	13.33	16.67

Estimated Number of Employees by Academic Disciplines

Academic Disciplines	Rank* Importance of Discipline to Your Firm	# Employees with These Disciplines	# Registered Engineers**	# Employees with These Disciplines in Five Years	% Increase
Aerospace	4.00	0	0	0	0.00
Agricultural	2.17	0	0	0	0.00
Chemical	2.06	6	2	8	33.33
Civil - Structural	1.87	10	7	13	30.00
Civil - Environmental, Sanitary, Geotechnical, General	2.08	8	6	10	25.00
Construction/Architectural	2.73	3	1	3	0.00
Electrical/Power	3.39	7	3	10	42.86
Electrical/Computer	1.04	12	0	18	50.00
Environmental	2.00	2	0	4	100.00
Industrial/Manufacturing	1.47	11	0	18	63.64
Mechanical	1.06	16	5	20	25.00
Mining	4.00	0	0	0	0.00
Nuclear	4.00	0	0	0	0.00
Petroleum	4.00	0	0	0	0.00

*Rank 1=Most Important 4=Least Important

**Percent of present Engineering employees that are registered engineers.

Appendix E

**Grand Island/Kearney/Hastings Engineering Curriculum Needs Survey
Company Education/Training Profile
15 Employers
Grand Island/Kearney/Hastings Zip Codes Starting with 688xx and 689xx**

All Grand Island/Kearney/Hastings Employees	Now	In Five Years	Percent Change
1. Number of All Employees (Columbus/Norfolk)	4,115	4,614	12.13
2. Number of All Employees Now Taking Academic Credit Courses	208		
3. Number of All Employees You Feel Should Be Taking Academic Courses	494		
4. Number of Those Employees Taking Academic Credit Courses Who Are on a Company Tuition Reimbursement Program.	96		
5. Education/Training Budget - Nebraska Employers Amount of Training Budget for:	\$327,000	\$369,000	12.84
a. Internally Provided Training Programs	\$229,300	\$242,000	5.54
b. External Seminars & Workshops	\$91,500	\$103,000	12.57
c. Tuition & Cost for College Courses	\$6,300	\$24,000	280.95
d. Other	\$100	\$0	-100.00

Grand Island/Kearney/Hastings Engineering Employees

6. Number of Engineering Employees	117	166	41.88
7. Number of Engineering Employees Now Taking Academic Credit Courses	14		
8. Number of Engineering Employees You Feel Should be Taking Academic Courses	33		
9. Number of Those Engineering Employees Taking Academic Credit Courses Who Are On a Company Tuition Reimbursement Program	10		
10. Education/Training Budget - Engineering Employees Only	\$3,000	\$7,000	133.33

**Profile of Academic Disciplines for Engineering Employees
15 Employers
Grand Island/Kearney/Hastings Zip Codes Starting with 688xx and 689xx**

Academic Disciplines	Rank* Importance of Discipline to Your Firm	% Employees with These Disciplines	% Registered Engineers**	% Employees with These Disciplines in Five Years
Aerospace	3.18	0.85	0.00	0.61
Agricultural	2.28	13.68	43.75	12.73
Chemical	2.66	4.27	0.00	4.85
Civil - Structural	1.90	23.08	44.44	21.21
Civil - Environmental, Sanitary, Geotechnical, General	3.02	0.85	0.00	1.82
Construction/Architectural	2.44	2.56	33.33	2.42
Electrical/Power	2.51	4.27	60.00	4.85
Electrical/Computer	2.24	1.71	0.00	4.24
Environmental	2.52	1.71	0.00	2.42
Industrial/Manufacturing	1.10	19.66	8.70	20.00
Mechanical	1.13	26.50	19.35	24.85
Mining	4.00	0.00	0.00	0.00
Nuclear	4.00	0.00	0.00	0.00
Petroleum	4.00	0.00	0.00	0.00
% Baccalaureate		84.00	66.67	83.65
% Graduate		13.33	16.67	14.42

Estimated Number of Employees by Academic Disciplines

Academic Disciplines	Rank* Importance of Discipline to Your Firm	# Employees with These Disciplines	# Registered Engineers**	# Employees with These Disciplines in Five Years	% Increase
Aerospace	3.18	1	0	1	0.00
Agricultural	2.28	16	7	21	31.25
Chemical	2.66	5	0	8	60.00
Civil - Structural	1.90	27	12	35	29.63
Civil - Environmental, Sanitary, Geotechnical, General	3.02	1	0	3	200.00
Construction/Architectural	2.44	3	1	4	33.33
Electrical/Power	2.51	5	3	8	60.00
Electrical/Computer	2.24	2	0	7	250.00
Environmental	2.52	2	0	4	100.00
Industrial/Manufacturing	1.10	23	2	33	43.48
Mechanical	1.13	31	6	41	32.26
Mining	4.00	0	0	0	0.00
Nuclear	4.00	0	0	0	0.00
Petroleum	4.00	0	0	0	0.00

*Rank 1=Most Important 4=Least Important

**Percent of present Engineering employees that are registered engineers.