

Nebraska Business Requirements for Educational Services in Engineering: A Statewide Study

A report compiled by the
Applied Information Management Institute



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Executive Summary

In the fall of 1995 and summer of 1996, the Applied Information Management (AIM) Institute completed two studies of Nebraska Business Requirements for Educational Services in Engineering. The greater Omaha study included 55 firms and the greater Nebraska study included 66 firms. The total employment from these 121 employers was 32,399 including 2,483 engineers.

A. Significant Findings

- Similarities between greater Omaha and Lincoln companies were very high in terms of Education training budgets and important Academic Disciplines.
- Greater Nebraska companies, excluding Lincoln, had significantly lower employee training budgets. This reflects, in part, poor access.
- 72% of engineers taking courses were on tuition reimbursement programs in greater Nebraska compared to 95% for greater Omaha engineers.
- Both greater Omaha and greater Nebraska employers were expecting engineering employment to grow more rapidly than total employment over the next five years.
- Statewide, employers ranked the following Academic Disciplines as most important:
 - Civil
 - Structural
 - Environmental, Sanitary, Technical, General
 - Construction/Architectural
 - Electrical/Power
 - Electrical/Computer
 - Mechanical
- Industrial/Manufacturing was ranked very high by greater Nebraska employers. Its low rank in greater Omaha reflects the most significant difference between these two markets.
- Statewide, electrical/computer was ranked as second most important. This discipline had the highest employment now and, with the fastest growth rate, will continue to have the highest employment in five years.
- Local delivery of educational services is highly preferred, but any option is welcome in some of the least served areas of the state.
- The number of graduating (baccalaureate plus masters) engineers will fail to meet the demand of Nebraska employers for the foreseeable future.
- Continued industry trends toward increased requirements for annual license renewal plus validation of professional continuing education programs create training opportunities for universities.

B. Recommendations

There are two predominate themes - Access and Content

Access

- 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.
- Consider unconventional class settings related to work schedules, business locations, etc.
- Consider outsourcing instruction via National Technology University (NTU) and/or certify Internet-based engineering and business courses.
- Develop partnerships, increase education access such as firm based labs/classrooms, develop agreements with cable suppliers to carry courses, etc.
- Create an effective presence and programs in Omaha - over 75% of the state's engineers live in the Omaha/Lincoln corridor.
- Develop partnerships with community colleges and other state colleges to use their facilities to deliver engineering content.

Content

- Content should focus on the following academic disciplines:
 - Civil
 - Structural
 - Environmental, Sanitary, Geotechnical, General
 - Electrical/Power
 - Electrical/Computer
 - Mechanical
 - Industrial/Manufacturing
- Focus courses and programs related to Nebraska's business industry-
- 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

In the fall of 1995, the Applied Information Management (AIM) Institute completed a study of Greater Omaha Business Requirements for Educational Services in Engineering. This study included 55 greater Omaha employers with total employment of 16,125 including 1,866 engineers.

In the summer of 1996, AIM, working with the College of Engineering at the University of Nebraska at Lincoln, completed a similar study of 66 Greater Nebraska employers with total employment of 16,274 including 617 engineers.

Research methodologies were identical for both studies. Questionnaires requesting information about employment levels, training budgets, rankings for Academic Disciplines, Applied Areas, and various Business Issues were mailed to employers in Greater Nebraska and Greater Omaha. The two studies had no overlapping of respondents.

The following analysis represents the composite results of these two studies. This analysis provides a statewide view of engineering education and employment requirements of Nebraska employers of engineers.

The Nebraska State Board of Examiners for Professional Engineers & Architects record the personal address and engineering disciplines of all professional engineers licensed to practice in Nebraska. In cooperation with the Nebraska Board of Examiners, this study shows geographic distribution of registered engineers across the state. These data document that the distribution of employers in the AIM studies match closely with the residence or business addresses of registered engineers across Nebraska.

Findings - A Statewide View

In the fall of 1995, AIM completed a study of Greater Omaha Business Requirements for Educational Services in Engineering. During the spring of 1996, a similar survey of Greater Nebraska businesses was completed. The following data presents a story of great similarity of market conditions and need between these two major Nebraska “markets” for engineers and their employers.

There were 121 employers in the study - 55 Greater Omaha firms and 66 Greater Nebraska employers.

Total employment from both surveys was 32,399 with a nearly equal distribution between Omaha and Greater Nebraska employers.

Engineers totaled 2,483 or 7.7% of the total workforce. The Omaha firms, however, employed 1,866 engineers or 11.6% of their workforce. Greater Nebraska employers have 617 engineers or 3.8% of their workforce. This difference appears to reflect the difference in the composition of employers in the two markets.

Omaha includes several large consulting engineering companies with large numbers of engineers relative to their total labor force.

Greater Nebraska employers include proportionally more manufacturing companies with relatively large production staffs to build products and goods.

**Table 1
Nebraska Statewide Engineering Study Findings**

	Nebraska Statewide Companies	Omaha Companies	Greater Nebraska Companies
Firms	121	55	66
All Employees	32,399	16,125	16,274
Engineering Professionals	2,483	1,866	617

1. Projected Growth in Employment

Table 2 documents very similar growth patterns. Both Greater Omaha and Greater Nebraska employers project growth for all employees over five years with statewide gains of nearly 20%.

The projected growth rate in engineering employment exceeds that of all employees in both markets. Statewide, employers project a 30.3% growth in the number of engineers, or a compound annual growth rate over 5% for five years.

Table 2
Projected Five-Year Growth in Employment

	Nebraska Statewide Companies	Omaha Companies	Greater Nebraska Companies
All Employees	18.9%	22.9%	15.0%
Engineering Professionals	30.3%	25.3%	45.5%

2. Projected Growth in Training Budgets

Once again, Table 3 shows that the patterns of growth in employee training expenditures are similar between the two markets.

Training budgets for all employees are expected to grow 27.2% for Greater Omaha employers. The growth rate for Greater Nebraska employers is 51.3%.

The training budgets for engineering professionals are projected to grow at even faster rates than for all employees in both markets.

Table 3
Projected Five-Year Growth in Training Budgets

	Nebraska Statewide Companies	Omaha Companies	Greater Nebraska Companies
All Employees	31.6%	27.2%	51.3%
Engineering Professionals	48.1%	41.4%	111.2%

3. Training Budgets Per Employee

The per person expenditure for training is expected to increase for all employers and engineers over the next five years. Table 4 shows, however, that the level of training expenditures for Greater Nebraska employers is approximately one-third that of the Greater Omaha companies.

For engineers, the difference in per capita training budgets is less, but Greater Nebraska employers will spend 25% less than their Omaha counterparts. The regional analysis shows that per capita training budgets for Lincoln employers are very close to the levels in Greater Omaha. When the thirteen Lincoln employers' training budgets are removed from the Greater Nebraska data, the remaining 53 Greater Nebraska per capita budgets drop to \$167 for all employees and \$589 for engineers. This difference appears to reflect the lack of availability of baccalaureate and graduate offerings in engineering disciplines outside the Lincoln and Omaha metropolitan areas.

To a lesser extent, it also reflects limited choice for graduate degrees in other business disciplines.

The reasons for these lower per capita expenditures are varied and may include:

- Fewer engineering and graduate programs available
- Limited choice for graduate degrees in business disciplines
- Fewer local continuing education, short courses and seminars
- Small training budgets of some greater Nebraska employers

Table 4 Training Budgets Per Employee			
	Nebraska Statewide Companies	Omaha Companies	Greater Nebraska Companies
All Employees			
1995	\$486	\$659	\$221
In Five Years	\$565	\$770	\$280
Engineering Professionals			
1995	\$1,315	\$1,359	\$1,008
In Five Years	\$1,556	\$1,617	\$1,259

4. Engineering Employees Taking Courses

The percent of engineering employees taking college courses for credit is similar for both Omaha and Greater Nebraska firms.

Those engineers on employer paid tuition reimbursement programs were very high with Omaha firms paying the tuition for 95% of their employees/students compared to 72% for Greater Nebraska employers.

When asked “the number of engineering employees you feel should be taking academic courses,” the number doubled to 21.5% for Omaha employers and nearly tripled to 29.2% for Greater Nebraska employers. These employers’ desire for more educational opportunities would translate to over 580 employees/students statewide today.

That is a 335-person increase for the 121 employers in this study. If the study respondents are representative of all employers, and if these study respondents employ 20% of the state’s engineers, then the potential market for those employees/students could exceed an additional 1,600 students. Assuming, of course, courses and programs are locally accessible and with sufficiently motivated employees.

Table 5
Engineering Professional Employees Currently:

	Nebraska Statewide Companies	Omaha Companies	Greater Nebraska Companies
Engineering professional employees currently taking courses for credit	9.9%	9.5%	11.0%
% of those on tuition-reimbursement programs	88.7%	95.0%	72.0%
% Engineering employees employers feel should be taking academic courses	23.4%	21.5%	29.2%

5. Important Academic Disciplines

There were six Academic Disciplines that were ranked as most important (Table 6).

This analysis showed regional differences between the Omaha and Greater Nebraska markets.

For Greater Nebraska, Industrial/Manufacturing (1.71) and Mechanical (1.67) were ranked as most important, followed by Electrical/Computer (2.02).

For Omaha employers, however, Industrial/Manufacturing was ranked as unimportant (3.01). This is the only discipline in which there is a strong regional difference between the two surveys.

As mentioned earlier, these differences seem to reflect, in part, the different characteristics of employers between Greater Omaha and Greater Nebraska.

The Environmental Engineering discipline (Appendix A) was ranked fairly high statewide (2.19) with ranks of 2.20 for Omaha and 2.11 for Greater Nebraska employers. Total employment from the 121 statewide survey respondents was only 81 environmental engineers, or only 3.3% of all engineering employees in these two studies.

Table 6
Most Important Academic Disciplines

	Nebraska Statewide Companies	Omaha Companies	Greater Nebraska Companies
Civil			
Structural	1.97	1.91	2.28
Environmental, Sanitary, Geotechnical, General	1.91	1.87	2.18
Construction/Architectural	2.08	1.98	2.61
Electrical/Power	1.95	1.81	2.51
Electrical/Computer	1.91	1.88	2.02
Industrial/Manufacturing	2.71	3.01	1.71
Mechanical	1.79	1.82	1.67

6. Key Applied Areas

Table 7 shows 29 Applied Areas within the most important Academic Disciplines. Applied Areas were selected for Table 7 if they:

Scored 2.25 or higher statewide

OR

Scored 2.00 or higher by either Omaha or Greater Nebraska employers

This table documents further the Industrial/Manufacturing and Mechanical focus of Greater Nebraska employers. It also documents the high and consistent needs in all other disciplines between the two major markets in civil engineering.

Table 7 Applied Areas within Key Academic Disciplines Scoring 2.25 or More Important Statewide or Scoring 2.00 or More Important by Either Omaha or Greater Nebraska Companies			
Academic Discipline	Nebraska Statewide Companies	Omaha Companies	Greater Nebraska Companies
Civil			
Structural	1.66	1.63	1.86
Construction	1.87	1.91	1.56
Geotechnical	2.00	2.02	1.85
Infrastructure/Utilities	1.67	1.66	1.78
Surveying	2.28	2.34	1.77
Construction/Architectural			
Building Structures and Foundation	1.99	1.97	2.09
Heating, Ventilating and Air Conditioning	2.13	2.09	2.38
Fire Protection Systems	2.19	2.10	2.78
Lighting Design and Application	2.21	2.13	2.76
Building Electrical Systems	2.13	2.09	2.39
Cost/Quality/Time Management	2.14	2.14	2.19
Electrical/Power			
Low Voltage Signal Communications Systems	2.24	2.28	1.93
Control Systems	2.24	2.28	1.93
Electric Power (emergency/standby/etc.)	2.07	2.07	2.06
Electric Materials/Equipment	2.27	2.31	1.98
Electronic/Computer			
Computer Systems/Architecture	2.16	2.13	2.29
LAN/WAN Networks, Architecture and Design	2.21	2.22	2.20
CAD/CAM and Other Industry	2.05	2.15	1.72
Electronic Devices/Circuits & Circuit Theory	2.58	2.76	1.85

Table 7
Applied Areas within Key Academic Disciplines
Scoring 2.25 or More Important Statewide or Scoring 2.00 or More Important
by Either Omaha or Greater Nebraska Companies

Academic Discipline	Nebraska Statewide Companies	Omaha Companies	Greater Nebraska Companies
Industrial/Manufacturing			
Process Flow Design	2.96	3.27	1.71
Manufacturing Automation & Assembly	3.24	3.64	1.71
Human Machine Interface	3.05	3.32	1.77
Mechanical			
Manufacturing Process	2.97	3.32	1.65
Operation & Environmental Design	2.54	2.69	1.90
Fluid Power and Control	2.23	2.28	1.97
Machines & Systems	2.52	2.70	1.75
Power Generation	2.01	1.91	2.52
Engineering Measurements and Instrumentation	2.31	2.40	1.96
Heat Transfer/Energy Systems	2.07	2.04	2.21

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

7. Other Applied Areas

Table 8 shows other Applied Areas scoring as important in either Greater Nebraska and/or the Omaha markets. The requirements for Agricultural Engineering Disciplines are higher in Greater Nebraska than Omaha. Water/Waste Water Treatment scored high in both markets.

Table 8
Other Selected Areas Scoring 2.25 or More Important Statewide
or Scoring 2.00 or More Important
by Either Omaha or Greater Nebraska Companies

Academic Discipline	Nebraska Statewide Companies	Omaha Companies	Greater Nebraska Companies
Agriculture			
Power Machinery	3.75	3.91	1.92
Environmental			
Emissions/Effluent Control	2.21	2.26	1.95
Solid Waste Handling/Recycling	2.09	2.14	1.81
Water/Waste Water Treatment	1.89	1.89	1.88

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

8. Engineering Business Issues

There are several business issues in engineering that are independent of specific engineering disciplines. Table 9 documents these.

Professional Ethics was the highest scoring issue in both markets.

Generally, the Greater Omaha employers scored these fifteen issues more important than did Greater Nebraska employers. Since both markets scored these topics as important, however, the data suggests these are important academic and short course topics for further consideration.

Table 9
Engineering Business Issues

Business Issue	Nebraska Statewide Companies	Omaha Companies	Greater Nebraska Companies
Personal Characteristics/Skills			
Professional Ethics	1.18	1.09	1.46
Preparation/Maintenance re: Professional Registration	2.14	1.97	2.73
Specification/Technical Report Writing	1.87	1.79	2.14
Project Management			
Life Cycle Cost Analysis	1.98	1.85	2.40
Client/Engineering Management	1.90	1.77	2.37
Quality/Assurance Management Programs	1.68	1.70	1.61
Business Development and General Management			
Business Development/Marketing	1.70	1.62	1.97
Employee Recruitment and Retention	1.51	1.38	1.96
Contractual Law and Responsibilities	2.15	1.96	2.81
Industry Computer Software	2.06	2.06	2.09
Technology Transfer	2.00	1.99	2.01
Industry Standards and Regulations			
Industry Codes and Standards (ISO, ASTM, UL, ANSI, UBC/BOCA, Federal, Military, etc.)	1.89	1.85	2.01
Regulatory Impacts (OSHA, EPA, ADA, etc.)	1.74	1.70	1.84
Safety	1.55	1.57	1.47
Hazardous Waste Management/Regulation	2.07	2.06	2.10

*Rank 1=Most Important 4=Least Important

Professional Engineers Registered to Practice in Nebraska

1996 data from the Nebraska State Board of Examiners for Professional Engineers and Architects indicate there are over 4,800 engineers registered to practice their profession in Nebraska. Those who live in Nebraska constitute 42% of the engineers.¹

These resident engineers and their Engineering Discipline are not equally distributed across the state, however. Figure 1 shows that there are 4 major clusters of registered engineers – Omaha, Lincoln, Columbus/Norfolk, and Grand Island/Hastings/Kearney. In addition, Figure 1 shows the distribution of all registered engineers in the state by zip code. Table 1 shows the number of professional engineers registered to practice in Nebraska and residing in Nebraska by discipline by zip code. Table 2 summarizes the number of registered engineers residing in select Nebraska cities.

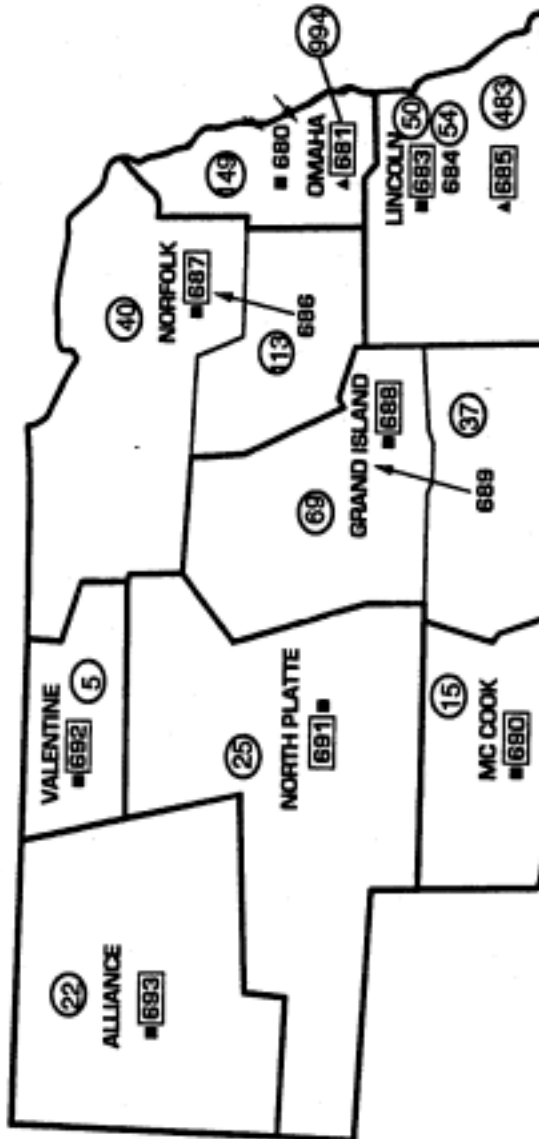
Civil engineering accounts for nearly 48% of all registered engineers followed by mechanical (19.4%), electrical (16.8%), structural (8.0%), and agricultural (2.9%) The engineering discipline ‘unknown’ accounted for 2.4% of the Nebraska registered engineers.

Table 3 summarizes the state location of the engineers registered to practice in Nebraska but reside outside the state. States adjoining Nebraska have the greatest number of engineers registered to practice in Nebraska. They include Colorado (329), Kansas (232), Iowa (224), and Minnesota (211).

The engineering disciplines of these non-resident engineers are comparable to the engineering disciplines of resident engineers (Table 4).

¹ Nebraska State Board of Examiners for Professional Engineers and Architects

Professional Engineers Registered to Practice in Nebraska and Residing in Nebraska by Zip Code July 1, 1995, to June 30, 1996



○ Number of Professional Engineers Registered to practice by Zip Code

Table 1
Professional Engineers Registered to Practice in Nebraska
and Residing in Nebraska by Discipline
 July 1, 1995, to June 30, 1996

Zip Code	Total	Civil	Mechanical	Electrical	Structural	Agricultural	Chemical	Industrial	Environmental	Metallurgical	Nuclear	Fire Protection	Manufacturing	Control Systems	Architectural	Aerospace	Petroleum	NA/Unknown
East Central Nebraska	149	70	24	24	13	8	5	2	1	1	0	0	0	1	0	0	0	2
Omaha	994	486	216	152	91	5	13	11	3	2	3	4	2	1	0	0	0	18
Beatrice	50	24	8	11	3	2	0	1	0	0	0	0	0	0	0	0	0	1
South East Nebraska	54	18	16	13	3	3	0	0	0	0	0	0	0	0	0	0	0	1
Lincoln	483	254	90	57	38	21	5	7	4	1	1	0	0	0	0	1	0	11
Columbus	113	18	20	54	6	6	2	1	0	0	0	0	0	0	0	0	0	7
Norfolk	40	27	4	4	1	1	1	0	0	0	0	0	0	0	1	0	0	1
Grand Island/Kearney	69	37	7	11	6	4	0	1	0	0	0	0	0	0	0	0	0	3
Hastings	37	12	7	9	2	6	0	0	0	0	0	0	0	0	0	0	0	1
McCook	15	12	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
North Platte	25	13	4	3	0	3	0	0	0	0	0	0	0	0	0	0	1	1
Valentine	5	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Alliance	22	12	3	5	1	0	0	0	0	0	0	0	0	0	0	0	0	1
	2056	986	399	345	164	59	26	23	8	4	4	4	2	2	1	1	1	50

Note: The sum of the Number of Engineers by discipline (2079) exceeds the number of registered engineers (2056) because 23 Engineers were registered in 2 disciplines.

Source: Nebraska State Board of Examiners for Professional Engineers and Architects, July 1, 1995, to June 30, 1996, Lincoln, Nebraska.

Table 2
Registered Professional Engineers Residing in Nebraska by City

Region	July 1, 1992- June 30, 1993	July 1, 1995- June 30, 1996	% Change
Greater Omaha			
Omaha	889	883	
Bellevue	26	34	
Elkhorn	22	26	
Papillion	18	20	
Ralston	13	73	
Total Greater Omaha	968	1,036	2.1%
Lincoln	467	483	3.4%
Northeast Nebraska			
Columbus	112	105	
Norfolk	27	29	
Total Northeast Nebraska	139	134	-3.6%
Central Nebraska			
Grand Island	37	38	
Hastings	22	19	
Kearney	20	20	
Total Central Nebraska	79	77	-2.5%
Other Cities			
York	17	15	
North Platte	16	16	
Auburn	13	7	
Fremont	10	15	
McCook	10	12	
Scottsbluff	10	10	
Total Other Cities	76	75	
All Other*	117	250	

**This very large growth in All Other reflects in part the location of engineers in small communities outside the zip code areas of major centers of employment like Omaha, Lincoln, etc.*

Table 3
Engineers Registered in Nebraska
Not Residing in Nebraska (by State)

State	Number of Engineers	State	Number of Engineers
Alabama	24	Missouri	190
Alaska	6	Montana	14
Arizona	64	Nevada	25
Arkansas	25	New Hampshire	4
California	141	New Jersey	19
Colorado	329	New Mexico	9
Connecticut	6	New York	40
Delaware	1	North Carolina	22
Florida	77	North Dakota	13
Georgia	44	Ohio	58
Hawaii	5	Oklahoma	70
Idaho	24	Oregon	20
Illinois	150	Pennsylvania	42
Indiana	30	Rhode Island	3
Iowa	224	South Carolina	10
Kansas	232	South Dakota	73
Kentucky	14	Tennessee	52
Louisiana	12	Texas	193
Maine	2	Utah	27
Maryland	16	Vermont	3
Massachusetts	20	Virginia	39
Michigan	46	Washington	40
Minnesota	211	West Virginia	0
Mississippi	7	Wisconsin	56
		Wyoming	40

**Table 4
Engineers Registered in Nebraska by Engineering Discipline**

Discipline	Nebraska Residents		Not Residing in Nebraska	
	Number	Percent of Total	Number	Percent of Total
Civil	986	48.0%	1194	42.5%
Mechanical	399	19.4%	510	18.2%
Electrical	345	16.8%	374	13.3%
Structural	164	8.0%	347	12.4%
Agricultural	59	2.9%	38	1.4%
Chemical	26	1.3%	28	1.0%
Industrial	23	1.1%	14	0.5%
Control Systems	2	0.1%	2	*
Metallurgical	4	0.2%	3	*
Nuclear	4	0.2%	0	0.0%
Architectural	1	*	0	0.0%
Environmental	8	0.4%	8	0.3%
Petroleum	1	*	1	*
Manufacturing	2	0.1%	1	*
Aeronautics	1	*	0	0.0%
Fire Protection	4	0.2%	8	0.3%
Mining	0	0.0%	4	0.1%
Construction	0	0.0%	1	*
Not Applicable/Unknown	50	2.4%	277	9.9%
Total	2056	2.4%	277	9.9%
Multi-disciplinary	23		37	

**Less than 0.1 percent*

Source: Nebraska State Board of Examiners for Professional Engineers and Architects, July 1, 1995 to June 30, 1996, Lincoln, Nebraska

**Comparison of Place of Residents for Registered Engineers
with Survey Respondents' Business Addresses**

Location	Nebraska Statewide Companies Omaha Companies	Greater Nebraska Companies
Greater Omaha	51.4%	45.8%
Lincoln	23.5%	10.8%
Grand Island/Hastings/Kearney	3.7%	11.7%
Columbus/Norfolk	6.6%	7.5%
Balance of State	14.8%	24.2%

The distribution of AIM survey respondents' business addresses matched fairly close with the personal addresses of Nebraska resident engineers' addresses as reported by the Nebraska State Board of Examiners for Professional Engineers & Architects. The under-representation of Lincoln probably reflects the relatively large number of engineering faculty not included in the AIM survey (the University was not sent an AIM Greater Nebraska Engineering Survey).

High response to the AIM survey for the Grand Island/Hastings/Kearney area reflects concerted efforts by these communities to encourage participation in the AIM survey.

Conclusions

The Engineering surveys included 55 Greater Omaha and 66 Greater Nebraska employers with 16,125 and 16,274 employees respectively. There were 1,866 engineers employed by the Greater Omaha firms and 617 engineers employed by Greater Nebraska employers. The issues and opportunities were very consistent between the two major markets. The composite 121 employers with 32,399 employees and 2,483 engineers documents a significant demand for educational services in engineering in Nebraska.

Other significant survey findings include:

- 2,091 or 6.5% of all employees from responding firms are currently taking academic courses.
- 69.4% of employees taking academic courses are in tuition reimbursement programs.
- The total training budget for the 67 employers statewide that provided these data is nearly \$6,644,900 and is projected to approach \$8,741,500 in five years.
- For the 67 firms reporting training budgets, the per employee training cost are:

Training Budgets Per Employee		
	Current	Five Years
All Employees (67 firms reporting)	\$ 486	\$ 565
Engineering Employees (48 firms reporting)	\$1,315	\$1,556

With only about half of the firms reporting training budgets for all employees and for engineers, the values reported above will substantially understate the composite training budgets for all firms.

The above analysis misses, however, the lack of access outside the Omaha/Lincoln corridor. As shown below, the lower of training budgets for Greater Nebraska less Lincoln reflects, in part, the absence of opportunities for many employers across the state. The fact that these employers believe nearly three times as many employees should be taking academic courses (compared to about two times for Omaha/Lincoln firms) also reflects a general lack of educational opportunity.

Nebraska Statewide Per Employee Education Budgets

	Statewide	Greater Omaha	Lincoln	Greater Nebraska Less Lincoln
All Employees				
No. Employers Reporting	67	42	6	19
Current	\$486	\$659	\$411	\$169
In Five Years	\$565	\$769	\$549	\$191
Engineering Professionals				
No. Employers Reporting	48	33	5	10
Current	\$1,315	\$1,357	\$1,364	\$575
In Five Years	\$1,556	\$1,613	\$1,573	\$597

The study methodology also does not provide estimates of Nebraska's statewide engineering employment. However, estimates from secondary data sources show Nebraska statewide engineering employment between 7,000 and 7,600. In 1993, the University of Nebraska graduated 287 bachelors and 132 masters and Ph.D.s. An estimated 50% of all graduates leave the state upon graduation.

Numerous additional conclusions are appropriate:

1. For reporting firms, expenditures for training and education will increase faster than total employment. (Employment up 18.9% in five years with training budgets up 31.6%.)
2. Firms will increase internal training budgets (43.3%) twice as fast as the same rate for external seminars (24.1%) and for tuition reimbursement (29.4%), creating growing market opportunities for providers delivering educational services at the firm level.
3. Engineering positions will grow more rapidly (30.3%) than for all employees (18.9%).
4. Training budgets per engineering employee are nearly three times larger than the amount for non-engineering employees now and in five years. This creates a very fast growth industry for engineering training at all levels.
5. Combined industry trends toward increased requirements for annual license renewal plus validation of professional continuing education programs will create training opportunities for universities.

6. The strongest demand for curriculum and programs included:
 - Civil
 - Structural;
 - Environmental, Sanitary, Geotechnical, General;
 - Construction/ Architectural;
 - Electrical/Computer;
 - Electrical/Power;
 - Industrial/Manufacturing;
 - Mechanical

Industrial/Manufacturing was ranked very important (1.72) by the 66 Greater Nebraska employers but was ranked much lower (3.01) by the 55 Greater Omaha firms. This result documents the higher focus on manufacturing by Greater Nebraska employers than for Omaha firms.
7. The number of new engineering graduates from Nebraska universities will be less than the demand for such employees by Nebraska firms statewide 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 by many greater Nebraska employers.
10. Once hired, most firms seek graduate opportunities for employees with Baccalaureate degrees. The difference between the 9.9% of engineering employees statewide now taking academic courses and the 23.4% employers think “should be taking academic courses,” creates a substantial unmet local market for graduate and undergraduate programs.
11. Many greater Nebraska locations have few master degree programs available in any discipline adding to recruiting problems for new and experienced engineers.
12. 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.
13. 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.
14. Local delivery of educational services is highly preferred to distance learning technologies.
15. Focus group discussions in Greater Nebraska suggest a low awareness of distance learning technologies such as CorpNet, National Technological University (NTU) and courses available over the Internet. Generally, Greater Omaha firms were more aware of these options.
16. 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.

Recommendations

The findings and conclusions from the Greater Nebraska and Greater Omaha business requirements for engineering education leads to one predominant recommendations: The State must find a better way to meet the unmet demand for engineering education from the states' employers, working professionals and traditional students.

This will require the creative use of scarce budgets, faculty, facilities and emerging technologies to meet education demand statewide. Specific recommendations may be helpful.

These studies raised two predominant themes – Access and Content.

Access

Access is the most compelling issue.

- review the CorpNet model to consider to undergraduate courses/degree programs.
- review the CorpNet model to consider delivery to individuals and very small companies (the present model focuses on larger employers missing large numbers of potential users).
- consider unconventional classroom schedules, i.e., all day classes - weekday or Saturdays that meet once a month at a central site in key markets like Grand Island or Columbus.
- consider Internet based courses - developed by UNL Engineering faculty or by other schools - that are approved by UNL.
- consider delivery of courses and programs by National Technological University or other such suppliers.
- consider agreements with cable suppliers to deliver engineering programming to the home or small firms.
- consider partnership with the Nebraska State Communications Division to utilize their frame relay and other emerging protocols negotiated with the state's 42 telephone companies.
- develop partnership with companies to make available/develop a community based site that meets educational requirements for lab based courses.
- complete the Omaha facility providing greater engineering content.
- consider all forms of teaching/learning technologies including:
 - CD ROM
 - Internet
 - Mobile faculty
 - Visiting professor to area community college/state college

- develop partnership with community colleges and other state colleges to use their facilities to deliver engineering content.
- think virtual in terms of facilities and faculty.

Content

- content should focus on the following academic disciplines:
 - Civil
 - Structural
 - Environmental, Sanitary, Geotechnical, General
 - Electrical/Power
 - Electrical/Computer
 - Mechanical
 - Industrial/Manufacturing
- industrial/manufacturing represents a major market need for Greater Nebraska employers that has a low priority in greater Omaha.
- electrical/computer was viewed as very important in both greater Omaha and greater Nebraska employers, creating a unique opportunity for partnership with other state colleges and community colleges.
- consider partnerships to offer strong Information Technology degrees with engineering content (bachelors and masters) at area colleges and universities.
- enhance career development, promotion and professionalism by creating specially designed career development courses for the “street smart - highly competent - working engineers without degrees.
- other state and private institutions should consider more MBA or master level business degrees to enhance career development, promotion and professional growth of area employees.
- promote courses and matriculation agreements with community colleges and state colleges to develop 2 + 2 type feeder program for Lincoln/Omaha based engineering programs.

Appendix A

Nebraska Statewide Engineering Curriculum Needs Survey Company Education/Training Profile 121 Employers

	Now	In Five Years	Percent Change
1. Number of All Employees (Greater Nebraska)	32,399	38,530	18.92%
2. Number of All Employees Now Taking Academic Credit Courses	2,091		
3. Number of All Employees You Feel Should Be Taking Academic Courses	5,317		
4. Number of Those Employees Taking Academic Credit Courses Who Are on a Company Tuition Reimbursement Program.	1,452		
5. Education/Training Budget - Nebraska Employers	\$6,644,905	\$8,741,500	31.55%
Amount of Training Budget for:			
a. Internally Provided Training Programs	\$2,165,000	\$3,103,000	43.33%
b. External Seminars & Workshops	\$3,201,000	\$3,973,000	24.12%
c. Tuition & Cost for College Courses	\$1,227,300	\$1,588,000	29.39%
d. Other	\$51,600	\$78,000	51.16%

Greater Nebraska Engineering Employees

6. Number of Engineering Employees	2,483	3,236	30.33%
7. Number of Engineering Employees Now Taking Academic Credit Courses	246		
8. Number of Engineering Employees You Feel Should be Taking Academic Courses	582		
9. Number of Those Engineering Employees Taking Academic Credit Courses Who Are On a Company Tuition Reimbursement Program	218		
10. Education/Training Budget - Engineering Employees Only	\$2,177,750	\$3,224,475	48.06%

**Nebraska Statewide
Profile of Academic Disciplines for Engineering Employees
121 Firms**

Academic Disciplines	Rank* Importance of Discipline to Your Firm	% Employees with These Disciplines	% Registered Engineers**	% Employees with These Disciplines in Five Years
Aerospace	3.76	0.12	0.00	0.21
Agricultural	3.74	1.41	34.29	1.49
Chemical	2.88	1.97	12.24	2.03
Civil - Structural	1.97	11.56	48.43	10.98
Civil - Environmental, Sanitary, Geotechnical, General	1.91	16.04	66.33	13.67
Construction/Architectural	2.08	10.68	30.57	11.37
Electrical/Power	1.95	11.48	24.56	12.31
Electrical/Computer	1.91	19.14	2.95	22.07
Environmental	2.19	3.26	50.62	3.21
Industrial/Manufacturing	2.71	6.41	12.58	6.58
Mechanical	1.79	14.34	27.25	13.37
Mining	4.00	0.40	0.00	0.39
Nuclear	3.31	1.09	7.41	0.73
Petroleum	3.97	0.00	0.00	0.00
Other				
% Baccalaureate		59.71	26.57	42.21
% Graduate		11.32	6.81	11.98

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	3.76	3	0	7	133.33%
Agricultural	3.74	35	12	49	40.00%
Chemical	2.88	49	6	67	36.73%
Civil - Structural	1.97	287	139	362	26.13%
Civil - Environmental, Sanitary, Geotechnical, General	1.91	398	264	451	13.32%
Construction/Architectural	2.08	265	81	375	41.51%
Electrical/Power	1.95	285	70	406	42.46%
Electrical/Computer	1.91	475	14	728	53.26%
Environmental	2.19	81	41	106	30.86%
Industrial/Manufacturing	2.71	159	20	217	36.48%
Mechanical	1.79	356	97	441	23.88%
Mining	4.00	10	0	13	
Nuclear	3.31	27	2	24	
Petroleum	3.97	0	0	0	0.00%
Other		50	3	52	4.00%

*Rank 1=Most Important 4=Least Important

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

**Nebraska Statewide Importance of Academic Discipline
121 Employers**

Academic Disciplines ● Applied Area	Rank to Each Applied Area		***Differences
	*Importance to Your Firm	**Need Met by Colleges & Universities	
Aerospace			
● Aero and Gas Dynamics	3.96	3.74	0.22
● Propulsion	3.96	3.74	0.22
● Aerospace Structures	3.96	3.71	0.25
● Flight Mechanics	3.98	3.74	0.24
● Spacecraft Systems	3.96	3.74	0.22
● Flight Control systems	3.96	3.74	0.22
● Aero Elasticity	4.00	3.74	0.26
● Other			
Agricultural			
● Biosystems Engineering	3.91	3.39	0.52
● Food engineering	3.94	3.35	0.59
● Power and Machinery	3.75	3.02	0.73
● Structures and Environment	3.58	2.70	0.88
● Process Engineering	3.68	2.76	0.92
● Water and Environment	3.51	2.84	0.67
● Waste Management	3.66	2.86	0.80
● Soil Management	3.79	2.59	1.20
● Other			
Chemical			
● Process Control	2.93	3.13	-0.20
● Process and Plant Design	2.99	3.13	-0.14
● Polymers and Polymer Engineering	3.73	2.78	0.95
● Petroleum Production and Refining	3.78	2.68	1.10
● Transport Operations	3.75	2.42	1.33
● Biochemical Engineering	3.81	2.73	1.08
● Other			
Civil			
● Structural	1.66	1.86	-0.20
● Construction	1.87	2.26	-0.39
● Geotechnical	2.00	1.87	0.13
● Geological	2.60	1.75	0.85
● Oceanography	3.90	2.78	1.12
● Transportation	2.44	2.33	0.11
● Infrastructure/Utilities	1.67	2.15	-0.48
● Surveying	2.28	1.82	0.46
● 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	1.99	1.72	0.27
● Heating, Ventilating and Air Conditioning	2.13	2.22	-0.09
● Plumbing/Drainage Systems	2.33	2.18	0.15
● Fire Protection Systems	2.19	2.16	0.03
● Lighting Design and Application	2.21	2.41	-0.20
● Building Acoustics	2.88	2.38	0.50
● Building Electrical Systems	2.13	2.14	-0.01
● Cost/Quality/Time Management	2.14	1.75	0.39
● Environmental Control Systems	2.27	2.25	0.02
● Process Piping	2.27	2.34	-0.07
● Other			
Electrical/Power			
● Low Voltage Signal Communications Systems	2.24	2.25	-0.01
● Control Systems	2.24	2.25	-0.01
● Electric Power (emergency/standby/cogeneration/ prime power generation and distributing)	2.07	2.22	-0.15
● Electric Materials and Equipment	2.27	2.35	-0.08
● Other			
Electronic/Computer			
● Computer Systems/Architecture	2.16	2.38	-0.22
● Directories, Circuits, and Systems	2.71	2.35	0.36
● Communications, Control and Signal Processing	2.55	2.44	0.11
● LAN/WAN Networks, Architecture and Design	2.21	2.34	-0.13
● Wireless, Telephone, Fiber Optics	2.66	2.49	0.17
● CAD/CAM and Other Industry Design and Manufacturing Technology	2.05	2.09	-0.04
● Electronic Devices/Circuit and Circuit Theory	2.58	2.24	0.34
● Bio-computing	3.77	2.71	1.06
● Other			
Environmental			
● Emissions/Effluent Control	2.21	2.38	-0.17
● Solid Waste Handling/Recycling	2.09	2.45	-0.36
● Water/Waste Water Treatment	1.89	2.22	-0.33
● Hazardous/Toxic/Radioactive Waste Management/Cleanup	2.34	2.61	-0.27
● Impact Assessment Studies/Statements	2.40	2.68	-0.28
● Underground Storage Facilities/Tanks	2.51	2.72	-0.21
● Water Management/Flood Control	2.77	2.27	0.50
● 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	2.96	2.04	0.92
● Manufacturing Automation and Assembly	3.24	2.07	1.17
● Human-Machine Interface	3.05	2.06	0.99
● Electronic Packaging	3.66	1.97	1.69
● Integrated Circuit Manufacturing	3.74	1.91	1.83
● Other			
Mechanical			
● Manufacturing Processes	2.97	2.50	0.47
● Operation & Environmental Consideration in Design	2.54	2.32	0.22
● Industrial Ventilation Systems	2.52	2.34	0.18
● Fluid Power and Control	2.23	2.30	-0.07
● Machine and Systems	2.52	2.17	0.35
● Power Generation	2.01	2.31	-0.30
● Engineering Measurements and Instrumentation	2.31	2.11	0.20
● Heat Transfer/Energy Systems	2.07	2.25	-0.18
● Materials Science/Metallurgy	2.68	2.15	0.53
● Hydraulics	2.48	2.12	0.36
● Bio-Technical/Robotics	3.53	2.58	0.95
● Other			
Mining			
● Rock Mechanics	3.78	2.85	0.93
● Rock Fragmentation	3.78	2.85	0.93
● Mine Health, Safety and Regulation	3.76	2.85	0.91
● Solution Mining	3.98	3.81	0.17
● Geostatistics	3.98	3.81	0.17
● Mineral Economics	3.99	3.81	0.18
● Hazardous Waste Control and Reclamation	3.54	2.48	1.06
● Other	4.00	3.54	0.46
Nuclear			
● Transport Theory and Computational analysis	3.38	3.70	-0.32
● Reactor Dynamics and Safety	3.38	3.70	-0.32
● Materials for Reactors and Radiation Effects	3.38	3.70	-0.32
● Reactor thermal-Hydraulics	3.38	3.70	-0.32
● Health Physics	3.35	3.71	-0.36
● Waste (high and low level)	3.08	3.49	-0.41
● Other	4.00	3.52	0.48
Petroleum			
● Drilling, Production and Operations	3.98	3.76	0.22
● Petrophysics	3.98	3.76	0.22
● Recovery	3.98	3.76	0.22
● Transportation	3.98	3.76	0.22
● 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.

**Nebraska Statewide Engineering Business Issues
121 Employers**

Business Issues	Rank* the Importance to Your Company	
	Currently	In Five Years
Life Cycle Cost Analysis	1.98	1.77
Client/Engineering Management	1.90	1.50
Professional Ethics	1.18	1.16
Business Development/Marketing	1.70	1.36
Quality/Assurance Management Programs	1.68	1.52
Employee Recruitment and Retention	1.51	1.49
Preparation/Maintenance re: Professional Registration	2.14	1.86
Contractual Law and Responsibilities	2.15	1.87
Specification/Technical Report Writing	1.87	1.71
Industry Computer Software	2.06	1.86
Industry Codes and Standards (ISO, ASTM, UL, ANSI, UBC/BOCA, Federal, Military, etc.)	1.89	1.82
Regulatory Impacts (OSHA, EPA, ADA, etc.)	1.74	1.68
Safety	1.55	1.46
Hazardous Waste Management/Regulation	2.07	1.91
Technology Transfer	2.00	1.83
Other		

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

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	\$1,191,605	\$1,802,500	51.27%
Amount of Training Budget for:			
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%

**Greater Nebraska
Profile of Academic Disciplines for Engineering Employees
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	45.00	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	
Other					
		% Baccalaureate	84.28	62.42	78.11
		% Graduate	11.18	12.75	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%
Other					

*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 to Each Applied Area		***Differences
	*Importance to Your Firm	**Need Met by Colleges & Universities	
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	0.00
● 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	0.90
● 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	4.00	4.00	0.00
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.

**Nebraska Statewide Engineering Business Issues
121 Employers**

Business Issues	Rank* the Importance to Your Company	
	Currently	In Five Years
Life Cycle Cost Analysis	2.40	2.36
Client/Engineering Management	2.37	2.27
Professional Ethics	1.46	1.40
Business Development/Marketing	1.97	1.75
Quality/Assurance Management Programs	1.61	1.45
Employee Recruitment and Retention	1.96	1.87
Preparation/Maintenance re: Professional Registration	2.73	2.51
Contractual Law and Responsibilities	2.81	2.52
Specification/Technical Report Writing	2.14	2.11
Industry Computer Software	2.09	1.93
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
Hazardous Waste Management/Regulation	2.10	2.09
Technology Transfer	2.01	1.80
Other		

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

Appendix C

Greater Omaha Engineering Curriculum Needs Survey Company Education/Training Profile 55 Employers – Greater Omaha Only

	Now	In Five Years	Percent Change
1. Number of All Employees (Greater Nebraska)	16,125	19,815	22.88%
2. Number of All Employees Now Taking Academic Credit Courses	1,255		
3. Number of All Employees You Feel Should Be Taking Academic Courses	3,178		
4. Number of Those Employees Taking Academic Credit Courses Who Are on a Company Tuition Reimbursement Program.	883		
5. Education/Training Budget - Nebraska Employers	\$5,453,300	\$6,939,000	27.24%
Amount of Training Budget for:			
a. Internally Provided Training Programs	\$1,641,300	\$2,389,000	45.56%
b. External Seminars & Workshops	\$2,804,800	\$3,344,000	19.22%
c. Tuition & Cost for College Courses	\$956,200	\$1,129,000	18.07%
d. Other	\$50,900	\$77,000	51.28%

Greater Omaha Engineering Employees

6. Number of Engineering Employees	1,866	2,338	25.29%
7. Number of Engineering Employees Now Taking Academic Credit Courses	178		
8. Number of Engineering Employees You Feel Should be Taking Academic Courses	402		
9. Number of Those Engineering Employees Taking Academic Credit Courses Who Are On a Company Tuition Reimbursement Program	169		
10. Education/Training Budget - Engineering Employees Only	\$1,969,000	\$2,783,700	41.38%

**Greater Omaha
Profile of Academic Disciplines for Engineering Employees
55 Employers**

Academic Disciplines	Rank* Importance of Discipline to Your Firm	% Employees with These Disciplines	% Registered Engineers**	% Employees with These Disciplines in Five Years
Aerospace	3.79	0.05	0.00	0.17
Agricultural	3.93	0.16	33.33	0.25
Chemical	2.93	1.18	13.64	1.21
Civil - Structural	1.91	13.08	47.95	12.55
Civil - Environmental, Sanitary, Geotechnical, General	1.87	18.39	65.60	15.30
Construction/Architectural	1.98	12.28	33.62	13.05
Electrical/Power	1.81	12.06	19.11	13.47
Electrical/Computer	1.88	19.89	0.81	22.77
Environmental	2.20	3.59	61.19	3.34
Industrial/Manufacturing	3.01	2.09	23.08	2.29
Mechanical	1.82	12.55	32.48	11.88
Mining	4.00	0.54	0.00	0.54
Nuclear	3.32	1.45	7.41	1.00
Petroleum	3.97	0.00	0.00	0.00
Other		2.68	6.00	2.17
% Baccalaureate		80.93		83.17
% Graduate		18.45		27.98

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	3.79	1	0	4	300.00%
Agricultural	3.93	3	1	6	100.00%
Chemical	2.93	22	3	29	31.82%
Civil - Structural	1.91	244	117	301	23.36%
Civil - Environmental, Sanitary, Geotechnical, General	1.87	343	225	367	7.00%
Construction/Architectural	1.98	229	77	313	36.68%
Electrical/Power	1.81	225	43	323	43.56%
Electrical/Computer	1.88	371	3	546	47.17%
Environmental	2.20	67	41	80	19.40%
Industrial/Manufacturing	3.01	39	9	55	41.03%
Mechanical	1.82	234	76	285	21.79%
Mining	4.00	10	0	13	30.00%
Nuclear	3.32	27	2	24	-11.11%
Petroleum	3.97	0	0	0	0.00%
Other		50	3	52	4.00%

*Rank 1=Most Important 4=Least Important

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

**Greater Omaha Importance of Academic Discipline
55 Employers**

Academic Disciplines ● Applied Area	Rank to Each Applied Area		
	*Importance to Your Firm	**Need Met by Colleges & Universities	***Differences
Aerospace			
● Aero and Gas Dynamics	4.00	3.33	0.67
● Propulsion	4.00	3.33	0.67
● Aerospace Structures	4.00	3.33	0.67
● Flight Mechanics	4.00	3.33	0.67
● Spacecraft Systems	4.00	3.33	0.67
● Flight Control systems	4.00	3.33	0.67
● Aero Elasticity	4.00	3.33	0.67
● Other			
Agricultural			
● Biosystems Engineering	4.00	3.83	0.17
● Food Engineering	4.00	3.83	0.17
● Power and Machinery	3.91	3.57	0.34
● Structures and Environment	3.66	2.97	0.69
● Process Engineering	3.75	2.99	0.76
● Water and Environment	3.62	2.98	0.64
● Waste Management	3.76	2.99	0.77
● Soil Management	3.85	2.85	1.00
● Other			
Chemical			
● Process Control	3.02	3.17	-0.15
● Process and Plant Design	3.09	3.17	-0.08
● Polymers and Polymer Engineering	3.77	2.73	1.04
● Petroleum Production and Refining	3.78	2.58	1.20
● Transport Operations	3.78	2.30	1.48
● Biochemical Engineering	3.90	2.65	1.25
● Other			
Civil			
● Structural	1.63	1.89	-0.26
● Construction	1.91	2.29	-0.38
● Geotechnical	2.02	1.91	0.11
● Geological	2.56	1.79	0.77
● Oceanography	3.90	2.92	0.98
● Transportation	2.41	2.42	-0.01
● Infrastructure/Utilities	1.66	2.19	-0.53
● Surveying	2.34	1.85	0.49
● Other			

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Academic Disciplines ● Applied Area	*Rank of Area	**Need Met by Colleges & Universities	***Differences
Construction/Architectural			
● Building Structures and Foundation	1.97	1.74	0.23
● Heating, Ventilating and Air Conditioning	2.09	2.29	-0.20
● Plumbing/Drainage Systems	2.30	2.29	0.01
● Fire Protection Systems	2.10	2.20	-0.10
● Lighting Design and Application	2.13	2.47	-0.34
● Building Acoustics	2.80	2.41	0.39
● Building Electrical Systems	2.09	2.18	-0.09
● Cost/Quality/Time Management	2.14	1.78	0.36
● Environmental Control Systems	2.25	2.31	-0.06
● Process Piping	2.27	2.43	-0.16
● Other			
Electrical/Power			
● Low Voltage Signal Communications Systems	2.28	2.28	0.00
● Control Systems	2.28	2.28	0.00
● Electric Power (emergency/standby/cogeneration/ prime power generation and distributing)	2.07	2.26	-0.19
● Electric Materials and Equipment	2.31	2.44	-0.13
● Other			
Electronic/Computer			
● Computer Systems/Architecture	2.13	2.44	-0.31
● Directories, Circuits, and Systems	2.78	2.42	0.36
● Communications, Control and Signal Processing	2.60	2.49	0.11
● LAN/WAN Networks, Architecture and Design	2.22	2.31	-0.09
● Wireless, Telephone, Fiber Optics	2.75	2.45	0.30
● CAD/CAM and Other Industry Design and Manufacturing Technology	2.15	2.04	0.11
● Electronic Devices/Circuit and Circuit Theory	2.76	2.26	0.50
● Bio-computing	3.82	2.78	1.04
● Other			
Environmental			
● Emissions/Effluent Control	2.26	2.41	-0.15
● Solid Waste Handling/Recycling	2.14	2.47	-0.33
● Water/Waste Water Treatment	1.89	2.28	-0.39
● Hazardous/Toxic/Radioactive Waste Management/Cleanup	2.31	2.68	-0.37
● Impact Assessment Studies/Statements	2.38	2.73	-0.35
● Underground Storage Facilities/Tanks	2.49	2.81	-0.32
● Water Management/Flood Control	2.70	2.31	0.39
● Other			

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Academic Disciplines ● Applied Area	*Rank of Area	**Need Met by Colleges & Universities	***Differences
Industrial/Manufacturing			
● Process Flow Design	3.27	2.12	1.15
● Manufacturing Automation and Assembly	3.64	2.04	1.60
● Human-Machine Interface	3.32	2.04	1.28
● Electronic Packaging	3.93	1.68	2.25
● Integrated Circuit Manufacturing	3.88	1.72	2.16
● Other			
Mechanical			
● Manufacturing Processes	3.32	2.65	0.67
● Operation & Environmental Consideration in Design	2.69	2.41	0.28
● Industrial Ventilation Systems	2.55	2.43	0.12
● Fluid Power and Control	2.28	2.37	-0.09
● Machine and Systems	2.70	2.20	0.50
● Power Generation	1.91	2.35	-0.44
● Engineering Measurements and Instrumentation	2.40	2.14	0.26
● Heat Transfer/Energy Systems	2.04	2.26	-0.22
● Materials Science/Metallurgy	2.80	2.15	0.65
● Hydraulics	2.53	2.13	0.40
● Bio-Technical/Robotics	3.63	2.71	0.92
● Other			
Mining			
● Rock Mechanics	3.79	2.80	0.99
● Rock Fragmentation	3.79	2.80	0.99
● Mine Health, Safety and Regulation	3.77	2.80	0.97
● Solution Mining	3.99	3.94	0.05
● Geostatistics	4.00	3.94	0.06
● Mineral Economics	4.00	3.94	0.06
● Hazardous Waste Control and Reclamation	3.59	2.45	1.14
● Other	4.00	3.37	0.63
Nuclear			
● Transport Theory and Computational Analysis	3.43	3.98	-0.55
● Reactor Dynamics and Safety	3.43	3.98	-0.55
● Materials for Reactors and Radiation Effects	3.43	3.98	-0.55
● Reactor thermal-Hydraulics	3.43	3.98	-0.55
● Health Physics	3.40	3.98	-0.58
● Waste (high and low level)	3.13	3.69	-0.56
● Other	4.00	3.52	0.48
Petroleum			
● Drilling, Production and Operations	3.99	3.94	0.05
● Petrophysics	3.99	3.94	0.05
● Recovery	3.99	3.94	0.05
● Transportation	3.99	3.94	0.05
● Other			

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**Greater Omaha Engineering Business Issues
55 Employers**

Business Issues	Rank* the Importance to Your Company	
	Currently	In Five Years
Life Cycle Cost Analysis	1.85	1.59
Client/Engineering Management	1.77	1.29
Professional Ethics	1.09	1.09
Business Development/Marketing	1.62	1.24
Quality/Assurance Management Programs	1.70	1.55
Employee Recruitment and Retention	1.38	1.37
Preparation/Maintenance re: Professional Registration	1.97	1.68
Contractual Law and Responsibilities	1.96	1.68
Specification/Technical Report Writing	1.79	1.59
Industry Computer Software	2.06	1.84
Industry Codes and Standards (ISO, ASTM, UL, ANSI, UBC/BOCA, Federal, Military, etc.)	1.85	1.82
Regulatory Impacts (OSHA, EPA, ADA, etc.)	1.70	1.65
Safety	1.57	1.46
Hazardous Waste Management/Regulation	2.06	1.86
Technology Transfer	1.99	1.83
Other		

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