



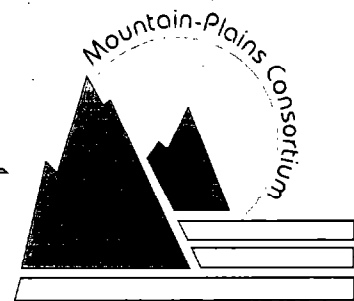
**A CENTER OF EXCELLENCE FOR  
RURAL AND INTERMODAL TRANSPORTATION**

**MPC REPORT NO. 02-134**

**Survey of the Education and Human Capital  
Needs of the Transportation Construction Industry**

Ossama Salem

September 2002



Colorado State University  
Fort Collins, Colorado

North Dakota State University  
Fargo, North Dakota

University of Utah  
Salt Lake City, Utah

University of Wyoming  
Laramie, Wyoming



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*Survey of the Education and Human Capital Needs of the  
Transportation Construction Industry*

**Principle Investigator:**

Ossama Salem, Ph.D., CPC

Assistant Professor

Construction Management and Engineering Division

Civil Engineering & Construction Department

North Dakota State University, Fargo, ND 58105

**Funding Agency:**

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American Road & Transportation Builders Association (ARTBA)

September 2002

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## EXECUTIVE SUMMARY

A major impediment to the development and implementation of new safe and productive techniques and technologies in the U.S. construction industry is the lack of coordinated efforts to define training and research needs, to communicate these needs to education institutions, and to communicate the research outcomes back to the industry.

The main objective of this project is to identify educational and training needs for the U.S. transportation construction industry to accomplish the following goals:

- Determine the level of deficiency in the skilled workers and project management employees market of the construction industry.
- Understand the training and education needs of the construction industry.
- Communicate these needs to trade associations, and education and research communities.

To accomplish these goals, a national survey was conducted and the following tasks were planned and carried out:

- Develop a questionnaire to identify educational and training needs of the U.S. transportation construction industry.
- Work through the American Road and Transportation Builders Association (ARTBA) members (more than 2000 contractors) to ensure a better response rate.
- Form a focus group and evaluate the survey with representatives from ARTBA members and local construction companies.
- Refine and print the survey questionnaire (2,000 copies).
- Send the survey with a cover letter directed from the ART BA to approximately 2,000 transportation contractors.

- Enter and analyze questionnaire results.
- Draw conclusions and recommend actions.

The developed questionnaire is divided into three parts (see the attached questionnaire sample in Appendix A):

1. General information about the company participating in the survey and the nature of its construction activities.
2. Questions about the education and training needs of project management employees.
3. Questions about the education and training needs of non-supervisory workers.

Some of the potential benefits of the survey are:

- developing and implementing a model to communicate industry needs to educational institutions, and in return, communicating research outcomes and training ideas back to the industry
- identifying and prioritizing training, research, and development activities to best fit the industry need
- developing a training and educational improvement program for the transportation constructors through the education and research division of ARTBA

Of the 2,000 questionnaires sent, 218 responded back. The responses were received and statistically analyzed. The survey questionnaire is presented in Appendix A.

## **THE SURVEY**

A 16-item questionnaire was published for online access and mail distribution targeting about 2,000 transportation contractors nationwide.

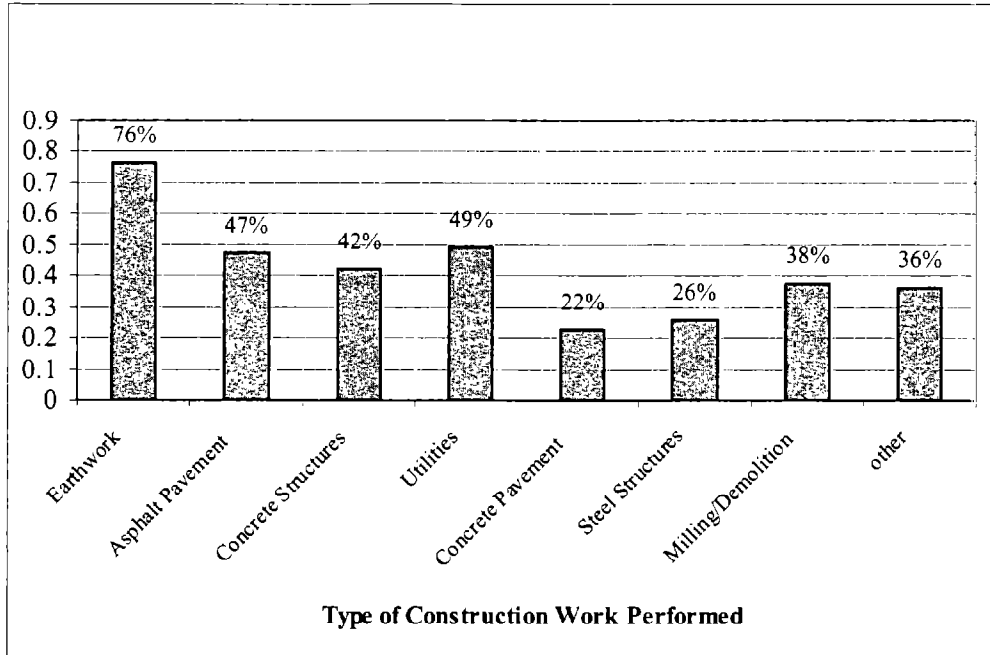
The survey questions were created based on input received from meetings with local contractors in North Dakota and Minnesota, members of the Education and Research Committee with American Road and Transportation Builders Association (ARTBA), and Upper Great Plains Transportation Institute (UGPTI) at North Dakota State University.

Items were organized into three sections: general information about the company participating in the survey and the nature of its construction activities; questions about the education and training needs of project management employees; and questions about the education and training needs of non-supervisory workers.

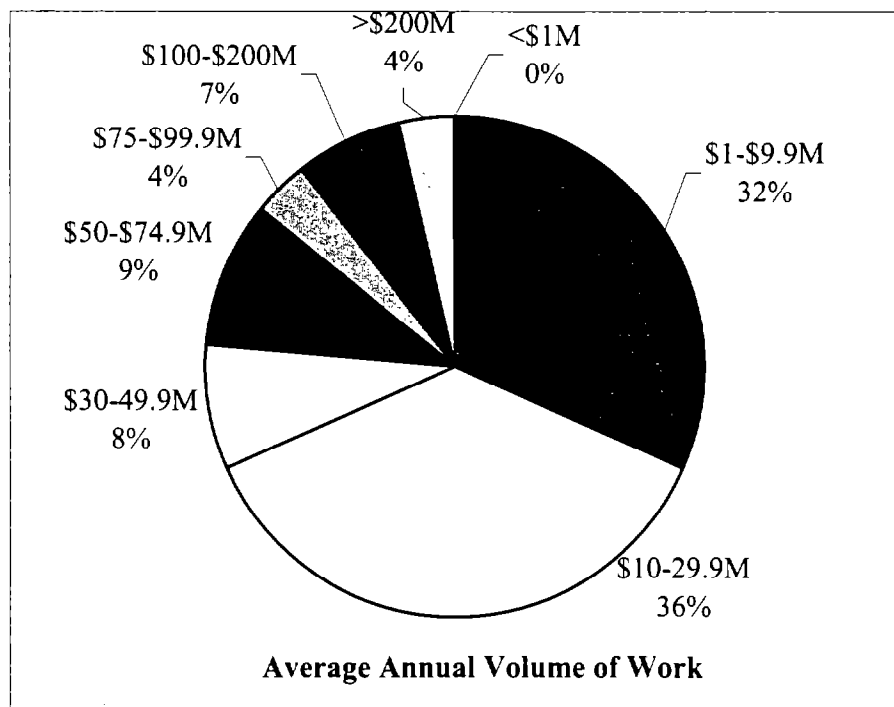
A first draft of the questionnaire was reviewed by members of the Education and Research Committee with the American Road and Transportation Builders Association for errors and needed changes in content and organization. In addition, UGPTI staff members were asked to evaluate the survey prior to its final publication.

### **The Participants**

Two hundred and eighteen contractors responded to the survey (approximately 11 percent of the total who received a copy). Contractor construction specialties were represented as follows:



The respondents were further categorized by their annual volume of work as follows:



In addition, when we asked the question about **the number of project management employees** (e.g. superintendents, project managers, field engineers,

planners, cost estimators, etc.) who are employed by the companies, the following data was collected:

- 23.5 percent of the respondent contractors indicated that they have between 1 and 5,
- 24.7 percent of the respondent contractors indicated that they have between 6 and 10,
- 43.5 percent of the respondent contractors indicated that they have between 11 and 50, and
- 8.3 percent of the respondent contractors indicated that they have more than 50.

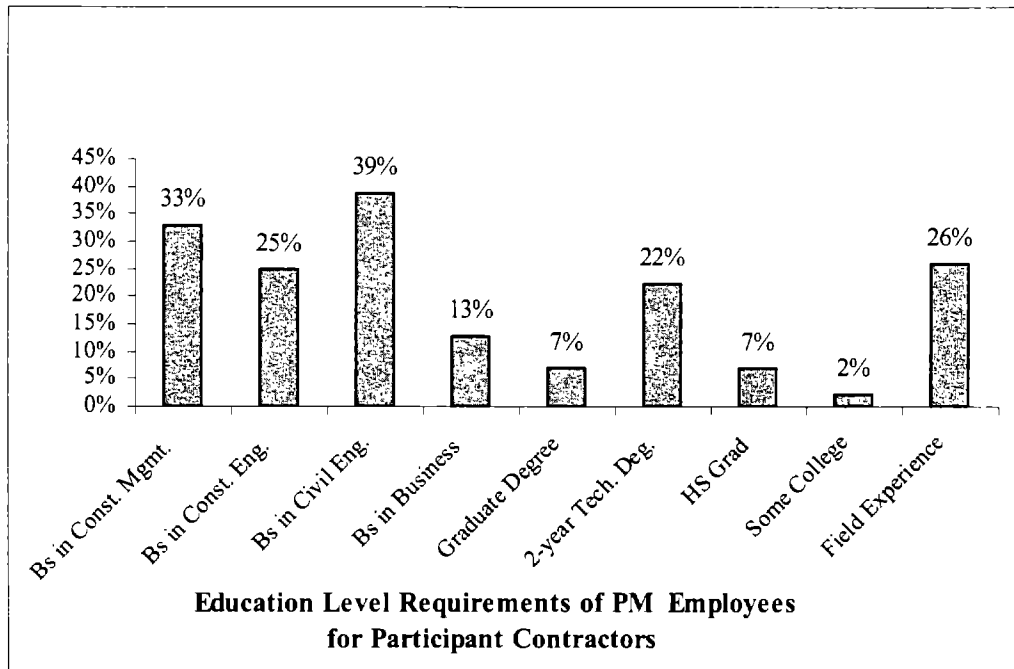
Also, when we asked the question about **the number of full time trade workers** who are employed by the companies, the following data was collected:

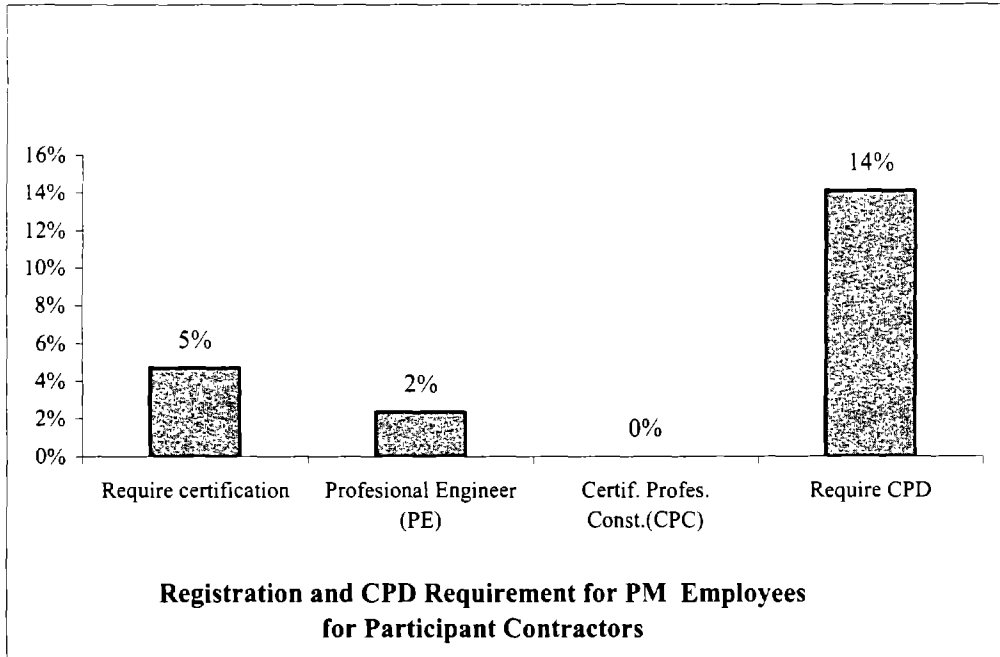
- 43.5 percent of the respondent contractors indicated that they have between 1 and 50,
- 14 percent of the respondent contractors indicated that they have between 51 and 100,
- 40 percent of the respondent contractors indicated that they have more than 100.

## PROJECT MANAGEMENT EMPLOYEES EDUCATION AND TRAINING NEEDS

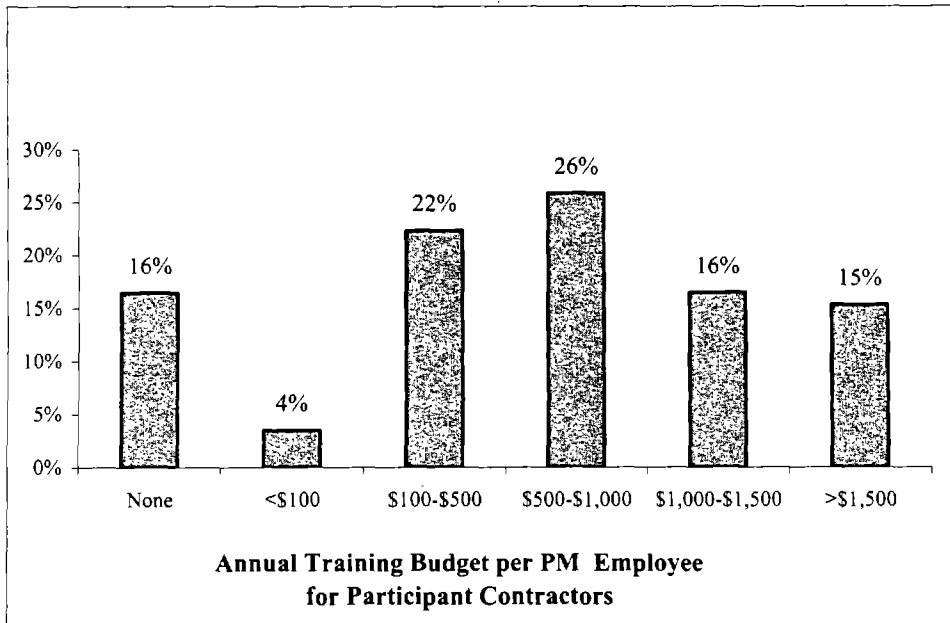
### Overall Data Summary

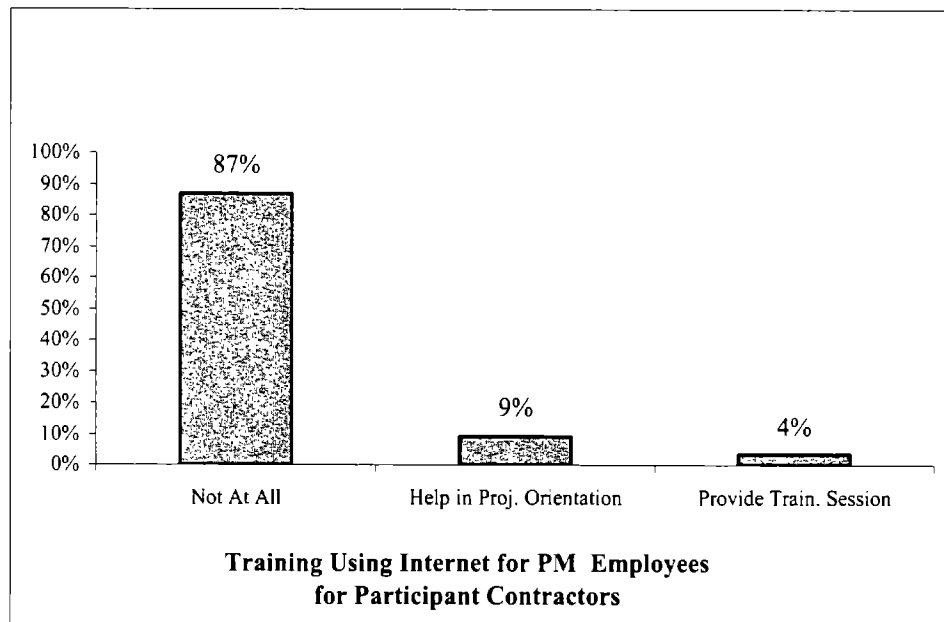
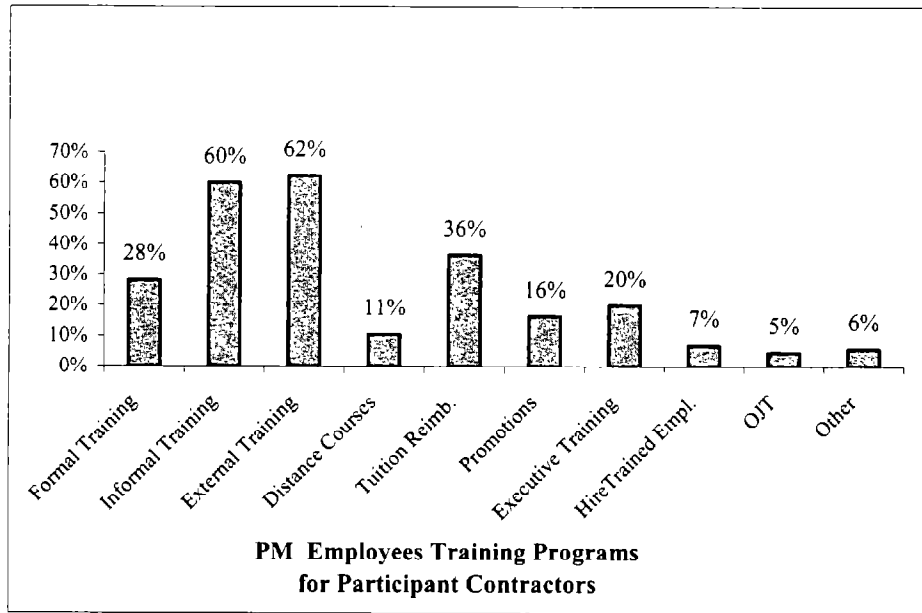
Part two of the questionnaire focused on the qualifications, education, and training needs of project management related personnel. The first set of questions asked the contractors about the level of education, professional registration/ certification and continuing professional development (CPD) that they required from their PM employees. The following figures show responses of the participants:





The second set of questions in this part of the questionnaire (part II - question 4 to 6) asked the contractors about training budgets, training programs, and Internet usage for training purposes. The following three figures summarize responses of the participants:



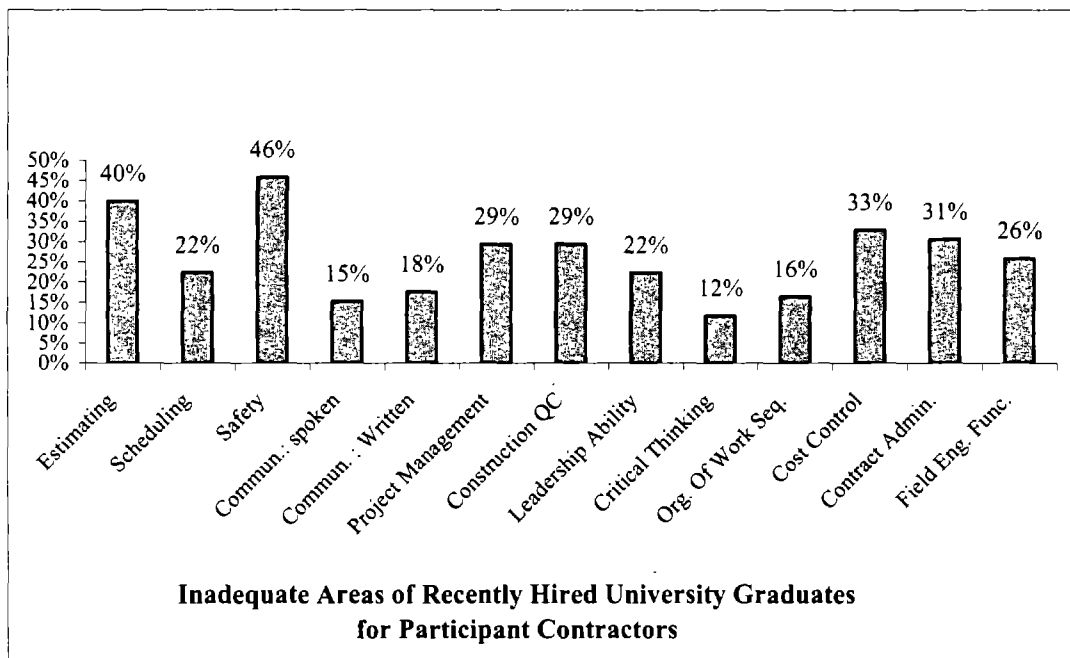


The next question given to participating contractors was regarding how well the recently hired university-graduate personnel prepared for the work place in the areas such as: “Project estimating, scheduling, safety, communication skills, project management,

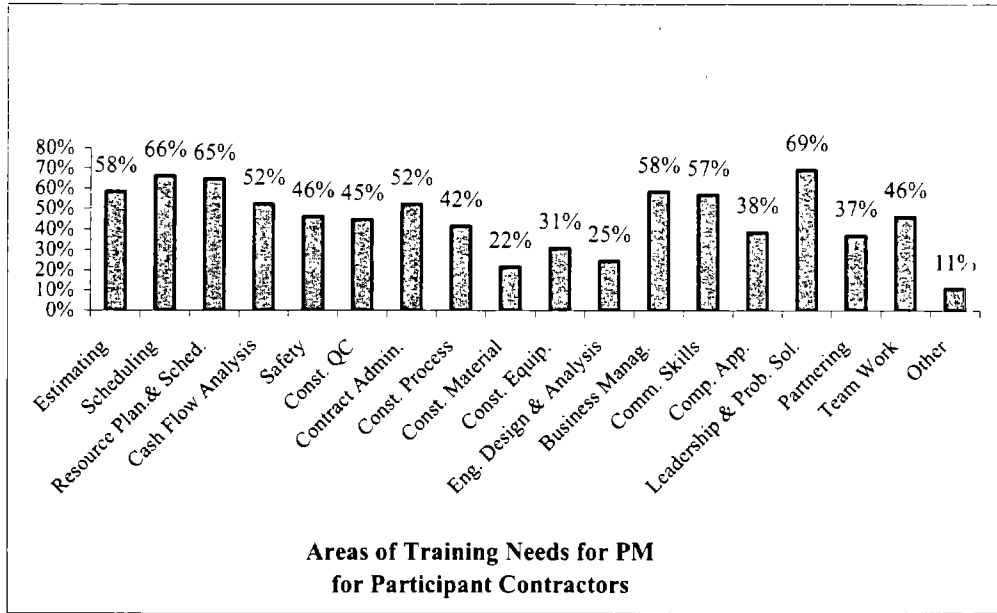


quality control, leadership, critical thinking, organization skills, cost control, contract administration and field engineering functions.”

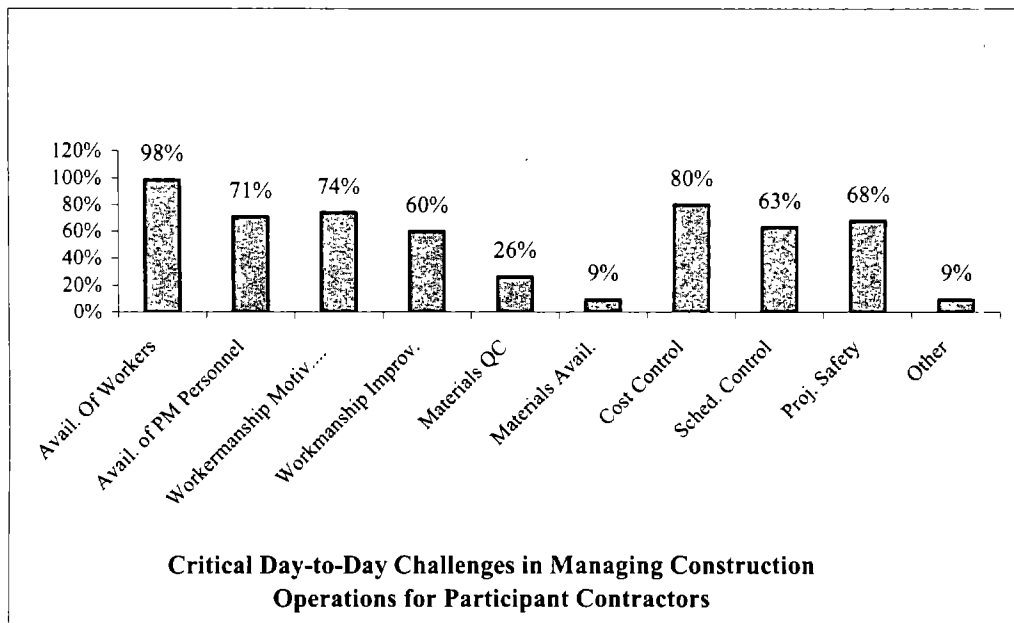
As it can be concluded from the following chart, safety and cost estimating were identified as the areas with the most amount of preparation needed at the university level. Forty-six percent of the participants chose “Safety” as one of the inadequate areas and 40 percent chose “Cost estimating.” At the next level, cost control (33 percent), contract administration (31 percent), project management (29 percent), and quality control (29 percent) were chosen as inadequate areas of preparation for the recently hired university graduates.



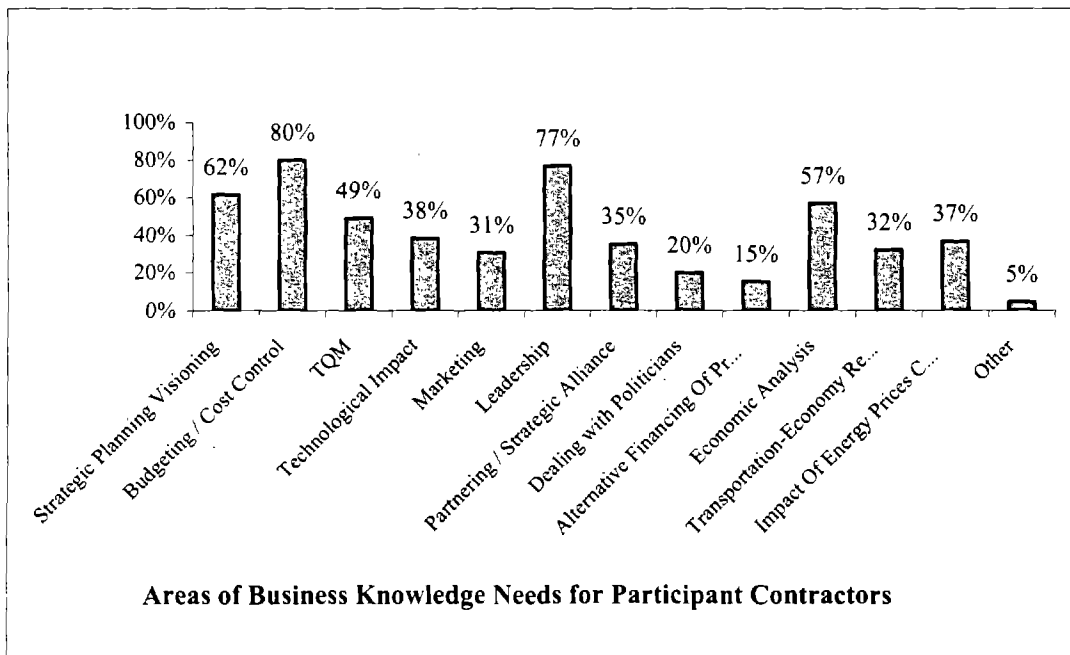
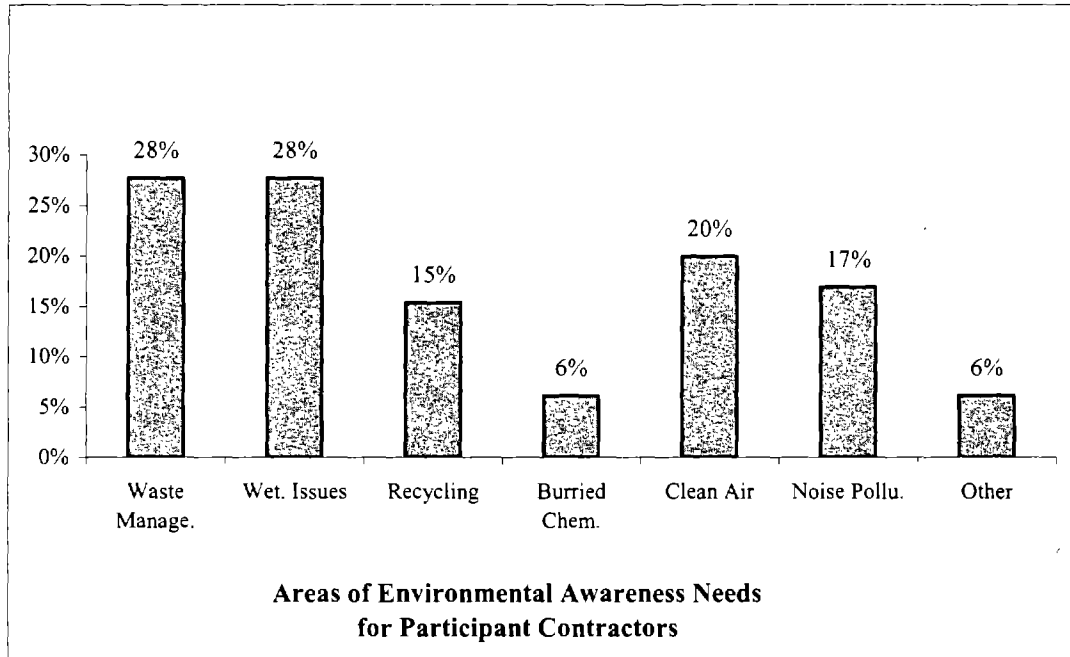
Question 8 - part two, asked participants about project management skills that need more training for all PM employees (including recently hired and senior personnel). Leadership and problem solving, scheduling, resource planning, estimating, business management, and communication topped the list of skills that need training.



Question 9 - part two, asked the contractors about the day-to-day challenges they face in managing construction operations. The following chart summarizes the responses:



The following two questions asked participants to identify the environmental awareness areas and business knowledge areas where project management personnel seem to need additional training. The responses are presented in the following two charts:



The questionnaire responses concerning training needs for PM related personnel were further analyzed by grouping responding companies by their construction specialty, annual volume, and number of project management employees.

### **Analysis of PM Data by Construction Specialty**

All the questions in part two were analyzed separately for each contractor's specialty. These specialties are: Earth work and grading, Pavement (asphalt and concrete), Structures (concrete and steel), and Utility contractors. Appendix B has all the charts that summarize these data.

### **Analysis of PM Data by Company's Annual Volume of Work**

The questions in part two were further analyzed for the following annual volumes: less than \$10 million, \$10 to \$29.9 million, 30 to \$74.9 million, and \$75 million and more. The charts in Appendix C show data for these cases.

### **Analysis of PM Data by Company's Number of PM Employees**

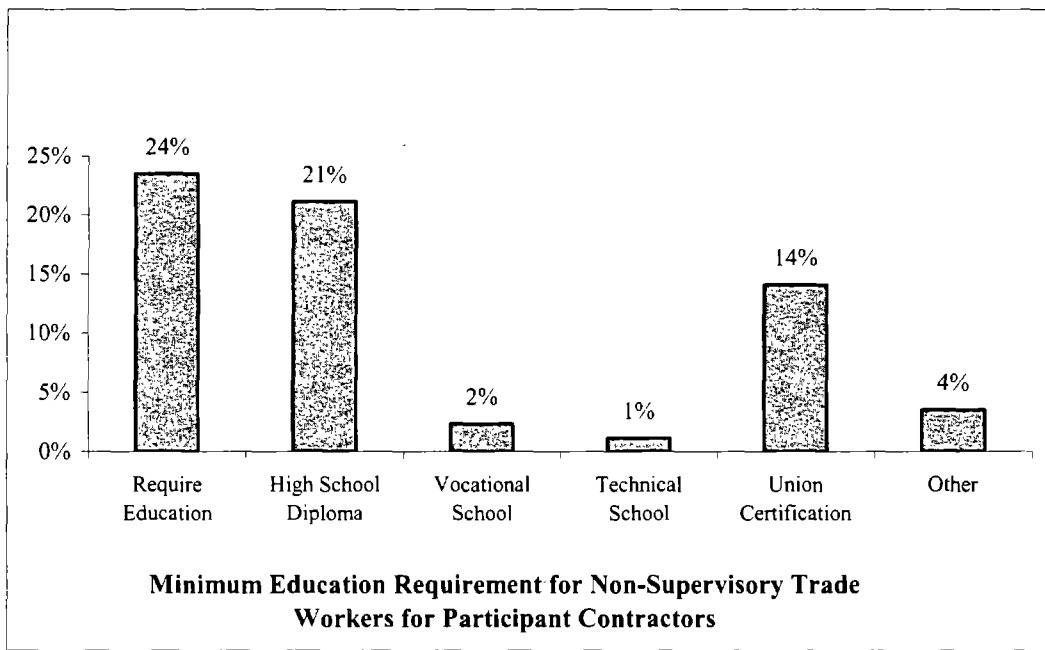
The questions in part two were further analyzed for the following number of PM employees: between 1 and 5, between 6 and 10, between 11 and 50 and more than 50.

The charts in Appendix D show data for these cases.

## NON-SUPERVISORY WORKERS EDUCATION AND TRAINING NEEDS

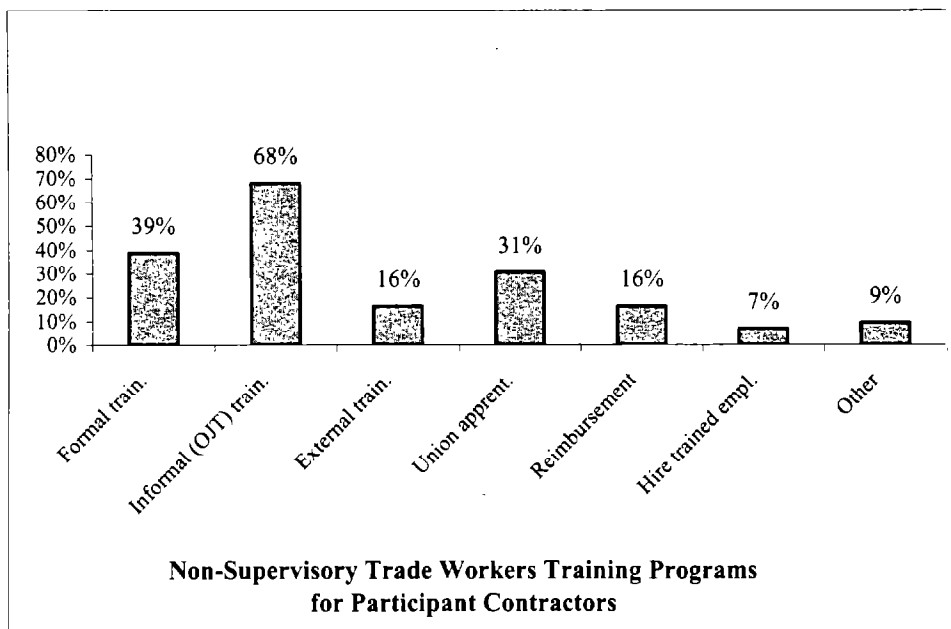
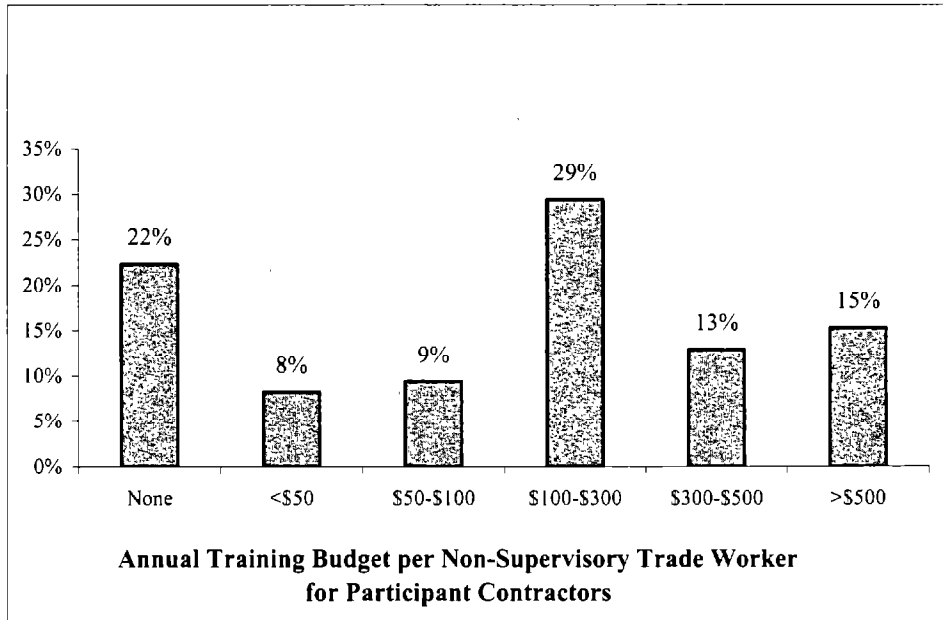
### Overall Data Summary

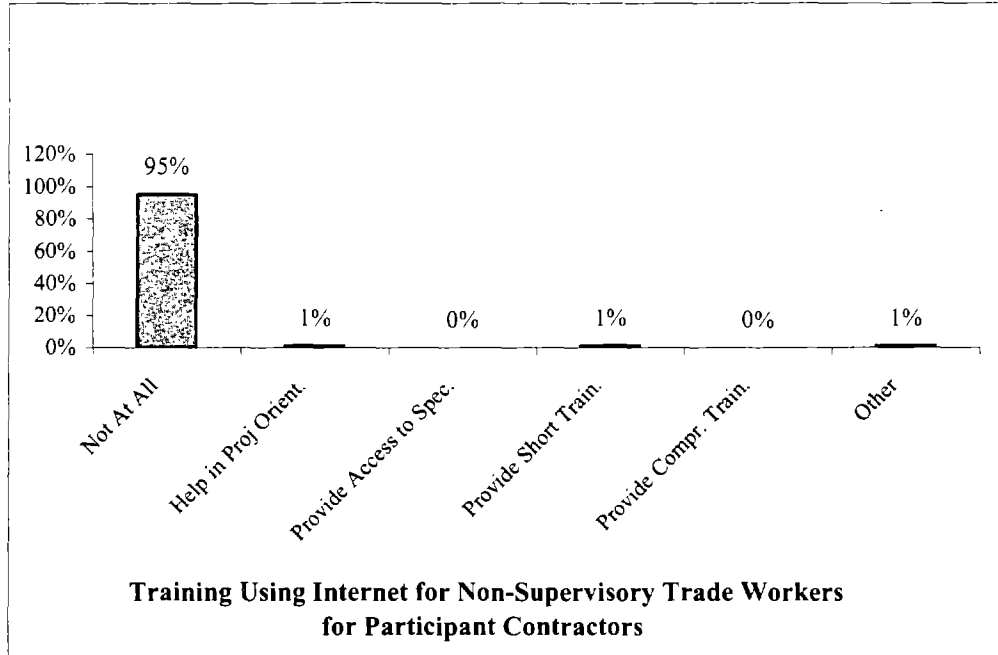
Part three of the questionnaire focuses on qualifications, education, and training needs of non-supervisory workers (i.e., trade workers). The first set of questions asks the contractors about education and certification/training requirements. The following figures show the responses of the participants:



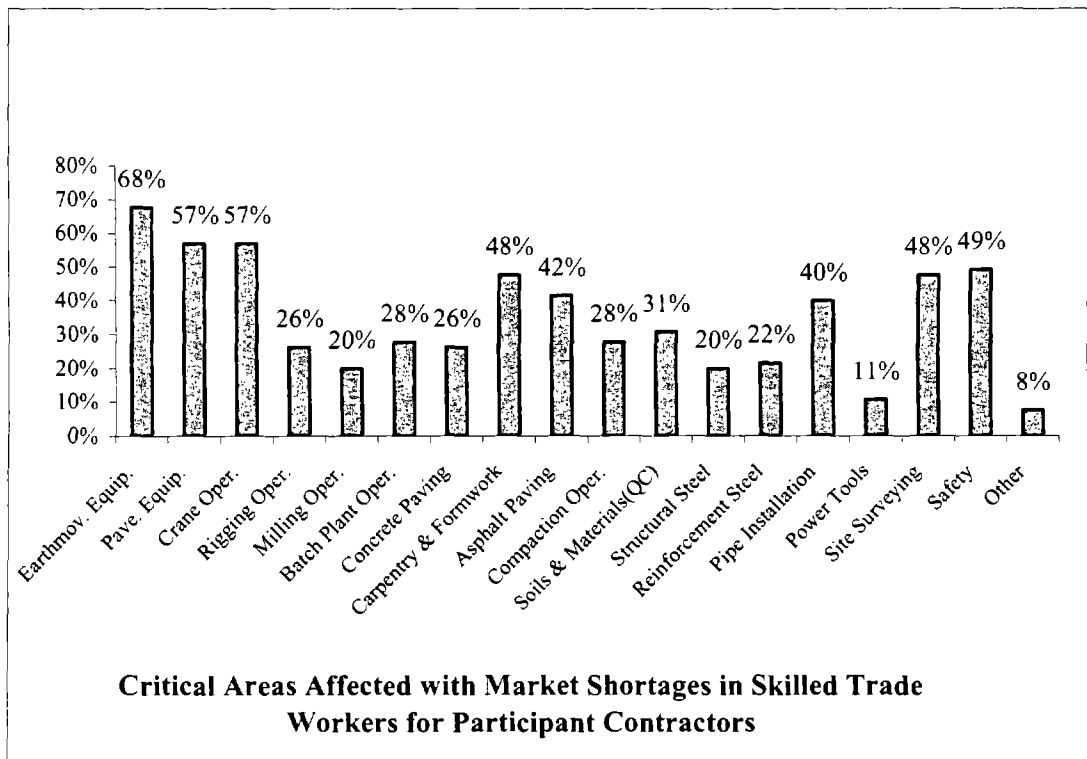
The previous chart shows that only 24 percent of the participants answered “yes” for question number one in part three. In other words, only 24 percent of the contractors responding to the questionnaire have indicated that they have a minimum education requirement to their non-supervisory trade workers (21 percent high school diploma, 2 percent vocational school, and 1 percent technical school). An additional 18 percent of the respondents indicated that they require some sort of certification (14 percent union certification and 4 percent other types).

The second set of questions in part three of the questionnaire (part three – questions 3 to 5) asked the contractors about training budgets, training programs, and Internet usage for training purposes. The following three charts summarize the responses of the participants:





The last question (# 6) in the questionnaire asked contractors about the effect of the market shortage of skilled trade workers on various construction activities. The following chart presents responses:



The questionnaire responses concerning training needs for non-supervisory skilled workers were further analyzed by grouping the responding companies by their construction specialty, annual volume, and number of project management employees.

#### **Analysis of non-supervisory skilled workers Data by Construction Specialty**

All the questions in part three were analyzed separately for each contractor's specialty. These specialties are: Earth work and grading, Pavement (asphalt and concrete), Structures (concrete and steel), and Utility contractors. Appendix E has all the charts that summarize the data.

#### **Analysis of non-supervisory skilled workers Data by company's annual volume of work**

The questions in part three were further analyzed for the following annual volumes: Less than \$10 million, \$10 to \$29.9 million, \$30 to \$74.9 million, and \$75 million and more. The charts in Appendix F show the data for these cases.

#### **Analysis of non-supervisory skilled workers Data by company's number of full time skilled workers**

The questions in part three were further analyzed for the following number of full time non-supervisory skilled workers: between 1 and 50, between 51 and 100, more than 100. The charts in Appendix G show the data for these cases.



## SUMMARY AND CONCLUSIONS

A survey of the education and training needs was conducted and more than 2,000 questionnaire booklets were sent to highway contractors nation wide. Two hundred and eighteen responded. The objective of the survey was to determine the training and education needs of the construction industry and identify the level of deficiency in the skilled workers and project management employees market. Survey questions were organized into three sections. These sections are general information sections that inquire about the company participating in the survey and the nature of its construction activities; a section with questions on the education and training needs of project management employees; and a last section with questions on the education and training needs of non-supervisory workers.

The survey analysis showed the following conclusions:

- The vast majority of contractors indicated that they require at least a Bachelor of Science degree as a minimum requirement for employment in a PM related job. Only 22 percent indicated that they could settle with a two-year technology degree.
- About 26 percent of the participants indicated that they require field experience.
- The vast majority contractors do not require any further registration or professional certification from their PM employees. Only 14 percent indicated that they would require their PM employees to pursue continuing professional development.
- Approximately 16 percent of the respondents indicated that they do not have any training budget in their companies for PM employees. About 57 percent indicated that their company spends more than \$500 per PM employee annually for training purposes.

- Most contractors indicated that they have their PM employees engaged in either informal in-house orientation and training (60 percent) or external training programs such as workshops and seminars (62 percent). Only 28 percent indicated that they have their own formal in-house training program.
- Pavement contractors showed the highest percentage when it comes to providing PM employees with formal in-house training programs (42 percent for concrete pavement and 30 percent for asphalt pavement contractors).
- The vast majority of contractors indicated that they do not use the Internet for any sort of training or job orientation (87 percent for PM employees and 95 percent for non-supervisory trade workers).
- Leadership, scheduling, resource planning, estimating, business management, and communication skills are identified by most contractors as the skill areas with the highest needs for training for PM employees.
- Approximately 22 percent of the respondents indicated that they do not have any training budget in their companies for non-supervisory trade workers. About 67 percent indicated that their company spends more than \$100 per non-supervisory trade worker annually for training purposes.
- Most contractors indicated that they have their non-supervisory trade workers engaged in informal in-house orientation and training (68 percent). Only 39 percent indicated that they have their own formal in-house training program for non-supervisory trade workers.
- Operating earthmoving equipment, pavement equipment, and cranes was identified as the most critical area that is affected by the market shortage in skilled workers.

- Ninety-eight percent of the participants pointed that the biggest challenge in managing day-to-day construction operation is the issue of availability of skilled workers.



**Appendix A**  
**Survey Questionnaire**



# “Survey of the Education and Training Needs of the Transportation Construction Industry”

*sponsored by*

*American Road & Transportation Builders Association  
Education & Research Division*

*and*

*North Dakota State University  
Construction Management & Engineering Division*

*in cooperation with the  
Upper Great Plains Transportation Institute*



**NDSU**

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## I. COMPANY INFORMATION

Company Name: \_\_\_\_\_

Company Address: \_\_\_\_\_

---

**Respondent's Name:** \_\_\_\_\_

**Respondent's Title:** \_\_\_\_\_

**Respondent's Day Phone Number:** \_\_\_\_\_

**Respondent's E-mail Address:** \_\_\_\_\_

**Company Web Page (URL) Address, if any:** \_\_\_\_\_

**Types of construction work performed in the last 5 years (approximate the percent of work for each category).**

- \_\_\_ % Asphalt Pavement
- \_\_\_ % Earthwork/Grading
- \_\_\_ % Milling/Demolition
- \_\_\_ % Sewer and Water/Underground Utilities
- \_\_\_ % Concrete Pavement
- \_\_\_ % Concrete Structures
- \_\_\_ % Steel Structures
- \_\_\_ % Other (please specify) \_\_\_\_\_

**Average annual volume of construction work in the last 5 years (check approximate volume).**

- \_\_\_ Less than \$1M
- \_\_\_ \$10 - 29.9 M
- \_\_\_ \$50 - \$74.9M
- \_\_\_ \$100- \$200M
- \_\_\_ \$1 - \$9.9 M
- \_\_\_ \$30 - 49.9 M
- \_\_\_ \$75 - \$99.9 M
- \_\_\_ More than \$200M



Number of project management employees (e.g., superintendents, project managers, field engineers, planners, cost estimators, etc.): \_\_\_\_\_

Number of Office Support Employees (e.g., secretaries, accountants, sales, etc.): \_\_\_\_\_

Number of Trade Workers and Laborers: Full Time \_\_\_\_\_ Part Time \_\_\_\_\_

Are you a Union Shop Contractor?

\_\_\_\_\_ Union \_\_\_\_\_ Merit (Non-Union) \_\_\_\_\_ Both

On the following U.S. map, mark your state(s) / region(s) of construction operations.



## II. PROJECT MANAGEMENT EMPLOYEES EDUCATION & TRAINING NEEDS

What level of education do you require for hiring project management employees (e.g., superintendents~ project managers, field engineers, planners, cost estimators, etc.)? Check all that apply.

- |  |   |
|--|---|
| <input type="checkbox"/> BS in Construction Mgmt.    | <input type="checkbox"/> BS in Construction Engineering |
| <input type="checkbox"/> BS in Civil Engineering     | <input type="checkbox"/> BS in Business                 |
| <input type="checkbox"/> Graduate degree             | <input type="checkbox"/> 2-year Technology degree       |
| <input type="checkbox"/> Other, please specify _____ |   |

2. Do you require professional registration/certification from your project management employees?

Yes  No

If "yes," what is your registration/certification requirement? Check all that apply.

Professional Engineer (PE)

Certified Professional Constructor (CPC)

Other, please specify \_\_\_\_\_

3. Do you require Continuing Professional Development (CPD) from your project management employees?

Yes  No

If "yes," how many project management employees attended a CPD course(s) last year? \_\_\_\_\_

4. How much do you budget annually per project management employee for training?

None

Less than \$100

\$100-\$500

\$500-\$1,000

\$1,000-\$1,500

More than \$1,500

5. What kind of training program does your company currently use for Project Management employees?  
Check all that apply.

Formal in-house training program, please describe:

\_\_\_\_\_

Informal in-house orientation and training, please describe:

\_\_\_\_\_

External training program (e.g., workshops, seminars), please describe:

\_\_\_\_\_

Distance learning courses and/or seminars, please describe:

\_\_\_\_\_

Tuition reimbursement incentive for credit classes

Promotions/pay raises tied to obtaining certification/training

Executive training program on leadership, strategic planning, etc.

Hire only already-trained employees and provide no training

Other methods, please describe: \_\_\_\_\_

**6. Do you use the Internet to train your project management employees?**

\_\_\_ Not at all

\_\_\_ Only to help with project orientation and to provide access to project specifications, plans, and other related information

\_\_\_ To provide training session(s) on topics such as project scheduling, estimating, project management, etc.

Please describe: \_\_\_\_\_

\_\_\_ Other, please specify \_\_\_\_\_

**7. Based on a 1 to 5 scale, how well have your recently hired university-graduate personnel been prepared for the workplace in the following areas? Check all that apply.**

	Not at All			Excellent	
Project Estimating	1	2	3	4	5
Project Scheduling	1	2	3	4	5
Construction Safety	1	2	3	4	5
Communication: Spoken	1	2	3	4	5
Communication: Written	1	2	3	4	5
Project Management	1	2	3	4	5
Construction Quality Control	1	2	3	4	5
Leadership Ability	1	2	3	4	5
Critical Thinking and Problem-Solving	1	2	3	4	5
Organization of Work Sequences	1	2	3	4	5
Cost Control	1	2	3	4	5
Contract Administration	1	2	3	4	5
Field Engineering Functions	1	2	3	4	5

**8. Based on a 1 to 5 scale, in which of the following areas do your project management employees need training? Check all that apply.**

	No Need			Critical Need	
Cost Estimating	1	2	3	4	5
Project Scheduling	1	2	3	4	5
Resource Planning and Scheduling	1	2	3	4	5
Cash Flow Analysis	1	2	3	4	5
Construction Safety	1	2	3	4	5
Construction Quality Control	1	2	3	4	5
Contract Administration	1	2	3	4	5
Construction Processes	1	2	3	4	5
Construction Materials	1	2	3	4	5
Construction Equipment	1	2	3	4	5
Construction Engineering Design and Analysis	1	2	3	4	5
Construction Business Management	1	2	3	4	5
Communication Skills	1	2	3	4	5
Computer Applications	1	2	3	4	5

Leadership and Problem Solving	1	2	3	4	5
Partnering	1	2	3	4	5
Teamwork	1	2	3	4	5
Other, please specify	1	2	3	4	5
Other, please specify	1	2	3	4	5
Other, please specify	1	2	3	4	5

**9. What are the day-to-day challenges that your company faces in managing construction operations?**

	Not a Concern			Critical Concern	
Availability of Skilled Workers	1	2	3	4	5
Availability of Project/Construction Management Personnel	1	2	3	4	5
Worker Motivation/Productivity	1	2	3	4	5
Workmanship Improvement	1	2	3	4	5
Materials Quality Control	1	2	3	4	5
Materials Availability	1	2	3	4	5
Cost Control	1	2	3	4	5
Schedule Control and Update	1	2	3	4	5
Project Safety	1	2	3	4	5
Other, please specify	1	2	3	4	5
Other, please specify	1	2	3	4	5
Other, please specify	1	2	3	4	5
Other, please specify	1	2	3	4	5

**10. In which of the following areas of environmental awareness do your project management employees need additional information or training? Check all that apply for the work typical to your firm only.**

	No Need			Critical Need	
Waste and Hazardous Material Management	1	2	3	4	5
Wetland Issues	1	2	3	4	5
Recycling	1	2	3	4	5
Buried Chemical/Petroleum Tanks	1	2	3	4	5
Clean Air Act	1	2	3	4	5
Noise Pollution	1	2	3	4	5
Other, please specify	1	2	3	4	5
Other, please specify	1	2	3	4	5

**11. In which of the following areas of business knowledge do your project management employees need additional information or training? Check all that apply.**

	No			Critical	
Strategic Planning/Visioning	1	2	3	4	5
Budgeting/Cost Control	1	2	3	4	5
Total Quality Management	1	2	3	4	5
Technological Impacts on Business	1	2	3	4	5
Marketing	1	2	3	4	5
Leadership	1	2	3	4	5

Leadership	1	2	3	4	5
Partnering/Strategic Alliances	1	2	3	4	5
Dealing with Politicians	1	2	3	4	5
Alternative Financing of Projects	1	2	3	4	5
Economic Analysis (cost/benefit, value engineering, etc.)	1	2	3	4	5
Relationship Between Transportation and Economy	1	2	3	4	5
Impact of Fuel or Energy Prices Change on Business	1	2	3	4	5
Other, please specify	1	2	3	4	5
Other, please specify					

### III. NON-SUPERVISORY WORKERS EDUCATION AND TRAINING NEEDS

**Do you have a minimum education requirement for your non-supervisory trade workers (e.g., carpenters, welders, ironworkers, equipment operators, etc.)?**

Yes  No

If "yes," what is your minimum education requirement? Check all that apply.

High School Diploma  Vocational School  Technical School

Other, please specify \_\_\_\_\_

**2. Do you require a trade or union certification from your non-supervisory trade workers?**

Yes  No

If "yes," what is your certification requirement and in what trade(s)?

Please specify \_\_\_\_\_

**3. How much do you budget per non-supervisory trade worker for training?**

None  Less than \$50  \$50-\$ 100  
 \$100-\$300  \$300-\$500  More than \$500

**4. What kind of training program does your company currently use for non-supervisory trade workers?**

**Check all that apply.**

Formal in-house skills and task-oriented training program, please describe:

\_\_\_\_\_

Informal in-house on-the-job training (OJT), please describe:

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\_\_\_ External non-union craft apprenticeship or other training programs, please describe:

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- \_\_\_ Union apprenticeship or other training programs
- \_\_\_ Reimbursement/pay raise incentives for taking technical/vocational trade classes
- \_\_\_ Hire only already trained and certified trade workers and provide no training
- \_\_\_ Other methods, please describe:
- 
- 

**5. Do you use the Internet to train your non-supervisory trade workers?**

- \_\_\_ Not at all
- \_\_\_ Only to help with project orientation to trade workers
- \_\_\_ Only to provide the trade workers access to project specifications and plans
- \_\_\_ To provide short training sessions(s) on the trade to the workers
- \_\_\_ To provide a comprehensive training program on the trade and construction methods to the workers
- \_\_\_ Other, please specify: \_\_\_\_\_
- 

**6. Based on a 1 to 5 scale, in relation to your construction operations, which of the following skill areas are affected with the market shortage in skilled trade workers? Check all that apply for the work typical to your firm only.**

	No Need			Critical Need	
Earthmoving Equipment Operation	1	2	3	4	5
Pavement Equipment Operation	1	2	3	4	5
Crane Operation	1	2	3	4	5
Rigging Operation	1	2	3	4	5
Milling Operation	1	2	3	4	5
Batch Plant Operation	1	2	3	4	5
Concrete Paving	1	2	3	4	5
Carpentry and Formwork	1	2	3	4	5
Asphalt Paving	1	2	3	4	5
Compaction Operations	1	2	3	4	5
Soils and Materials Testing (Quality Control)	1	2	3	4	5
Structural Steel	1	2	3	4	5



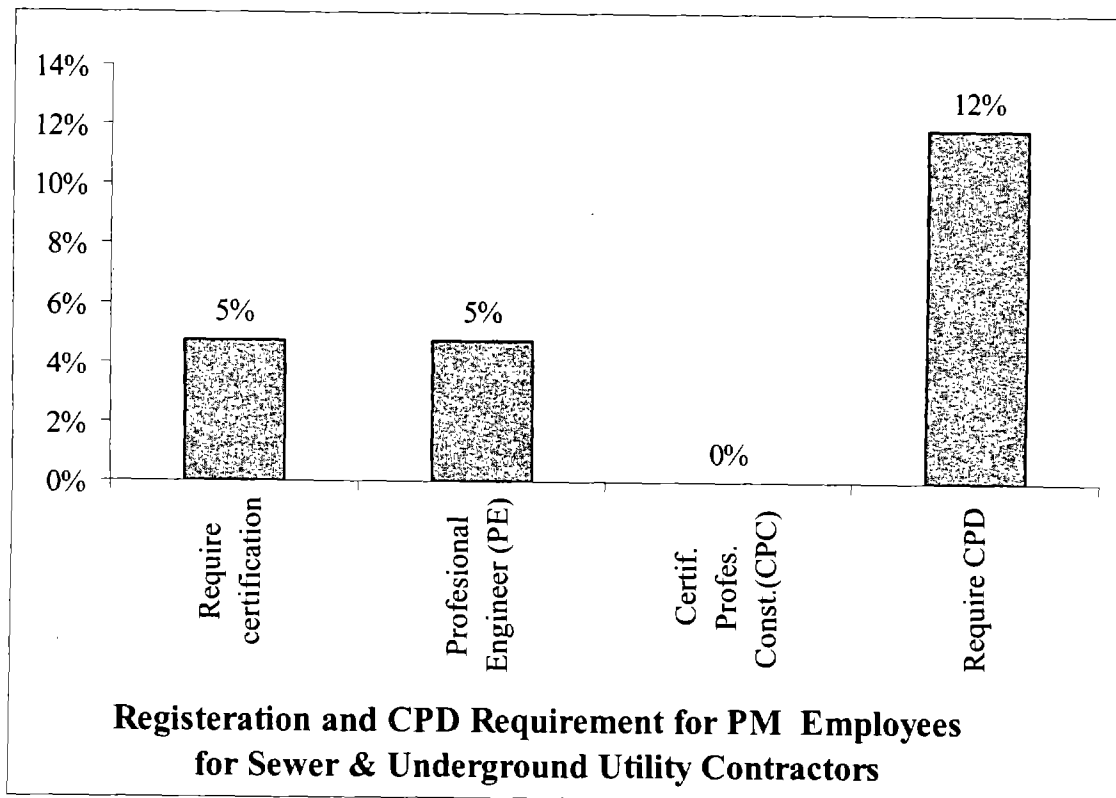
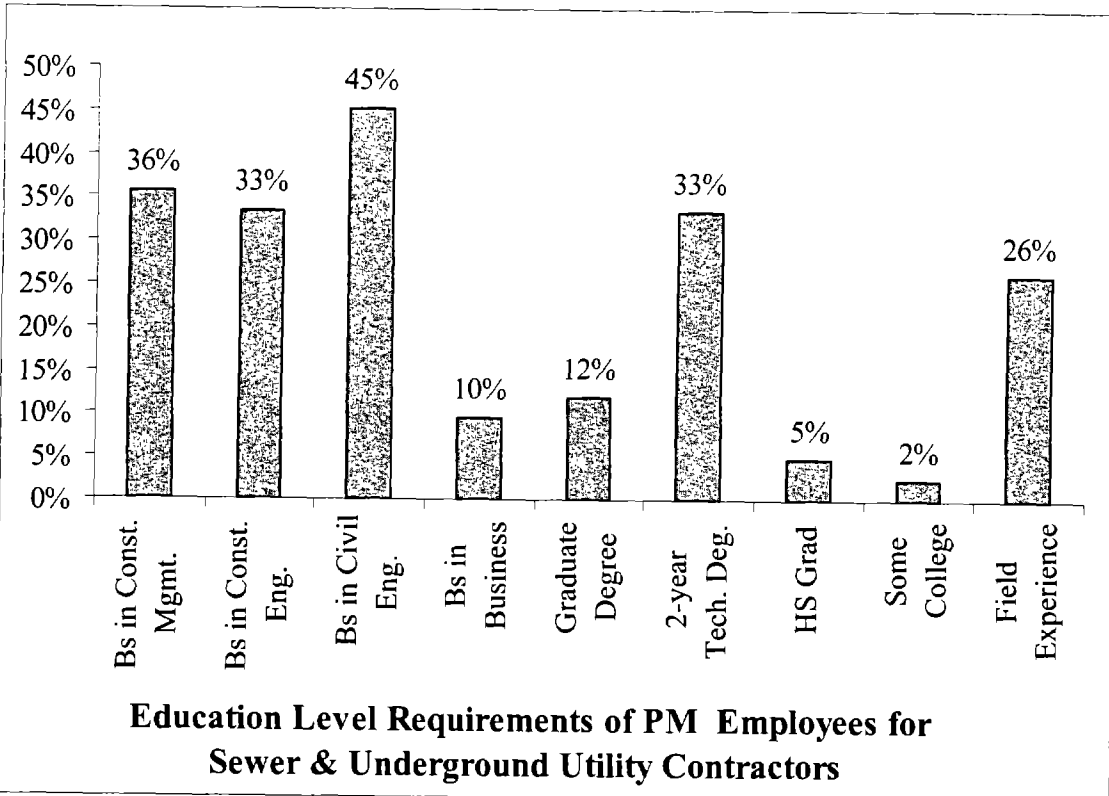


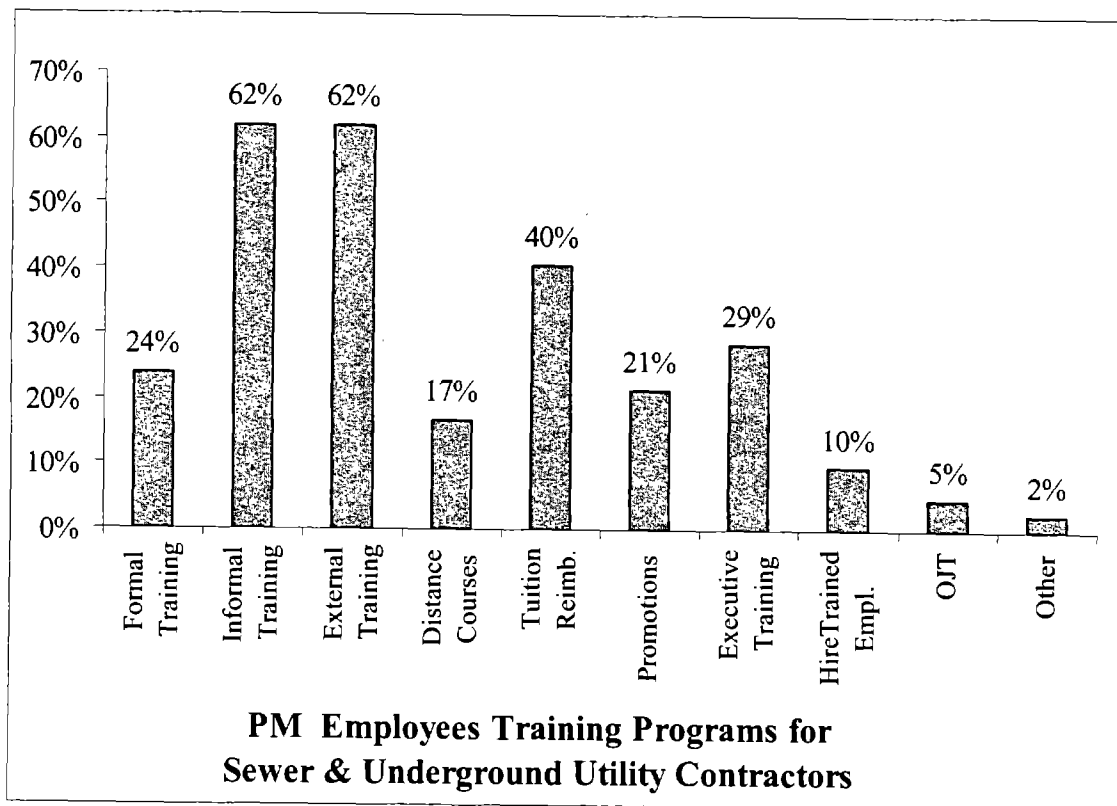
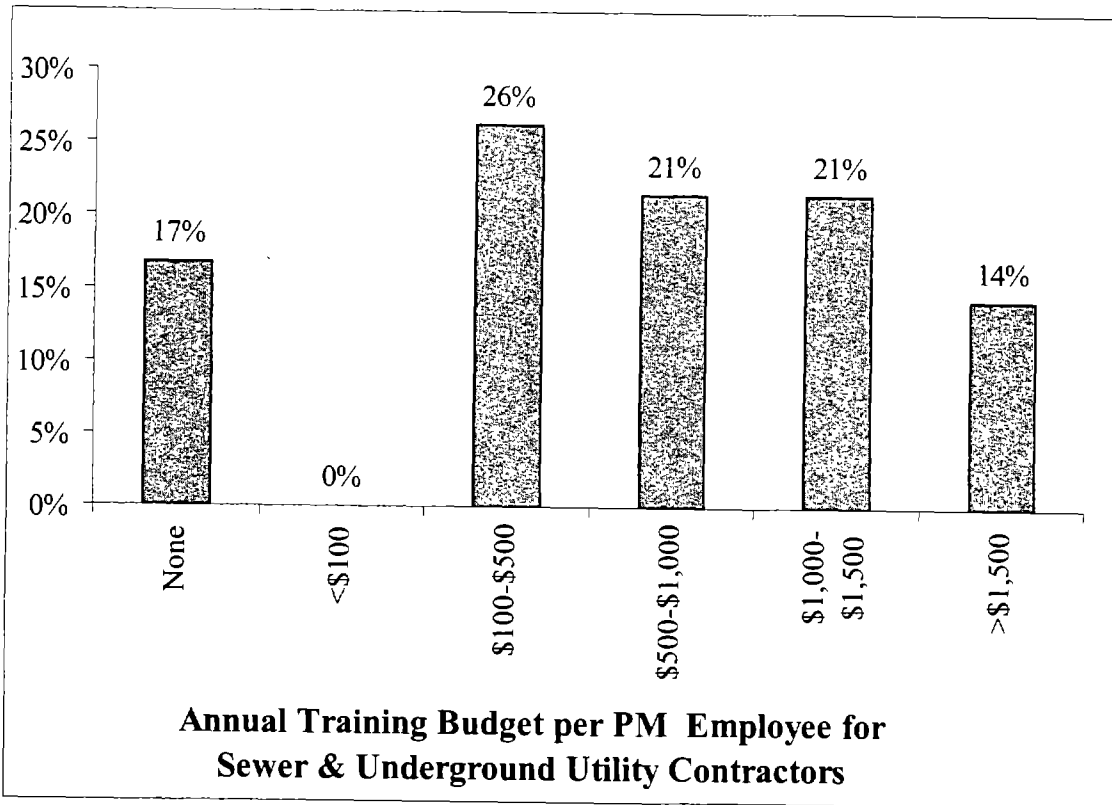


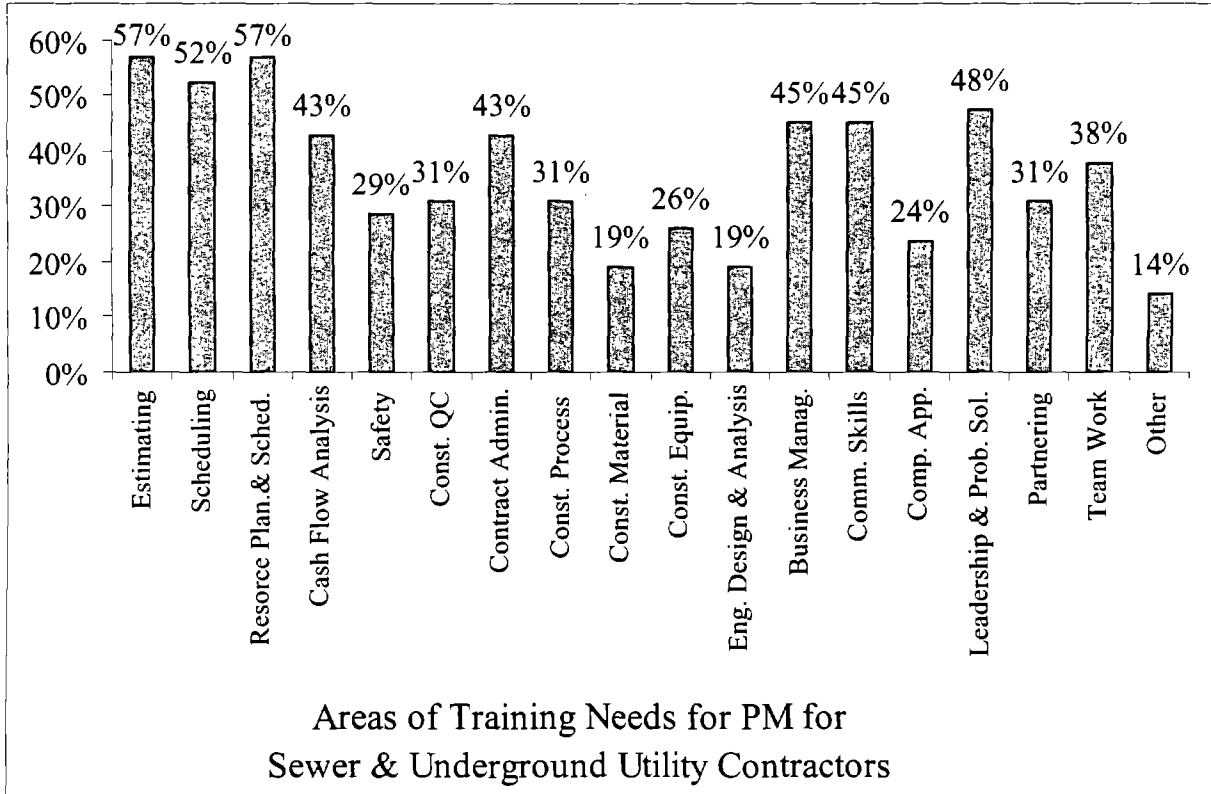
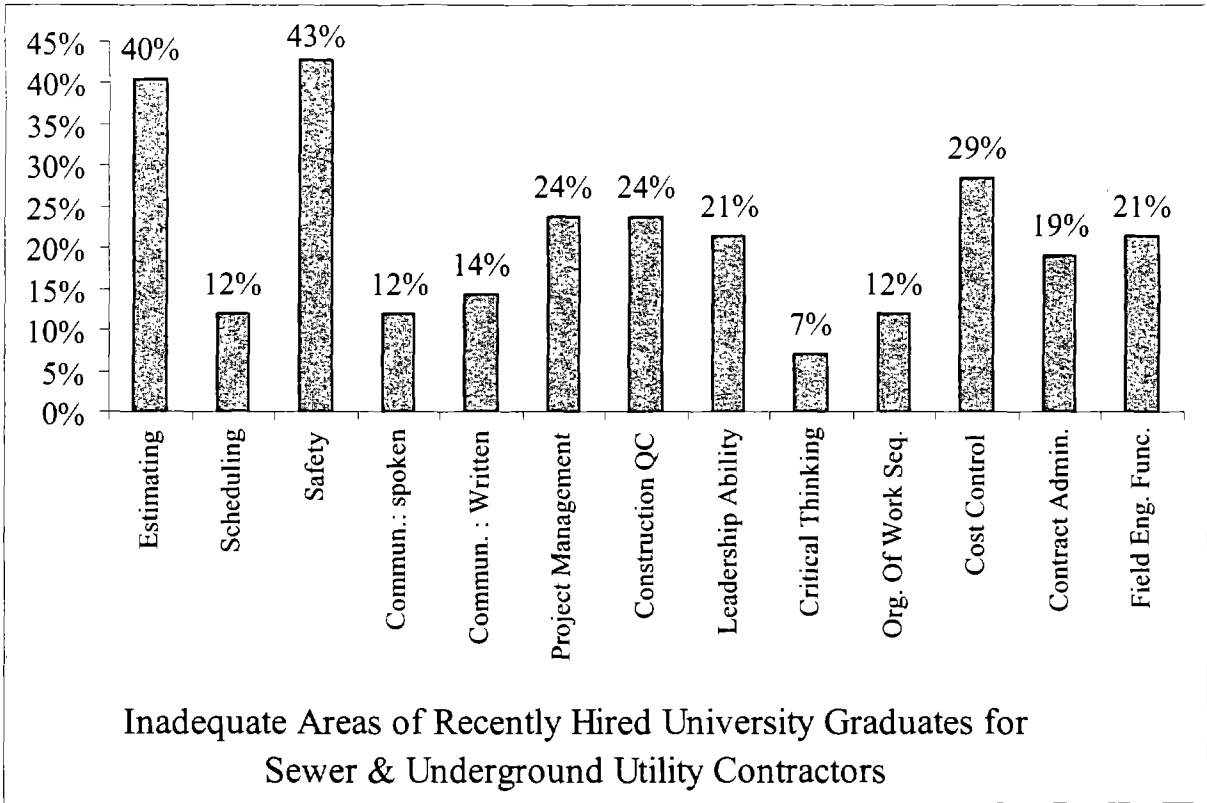
## **Appendix B**

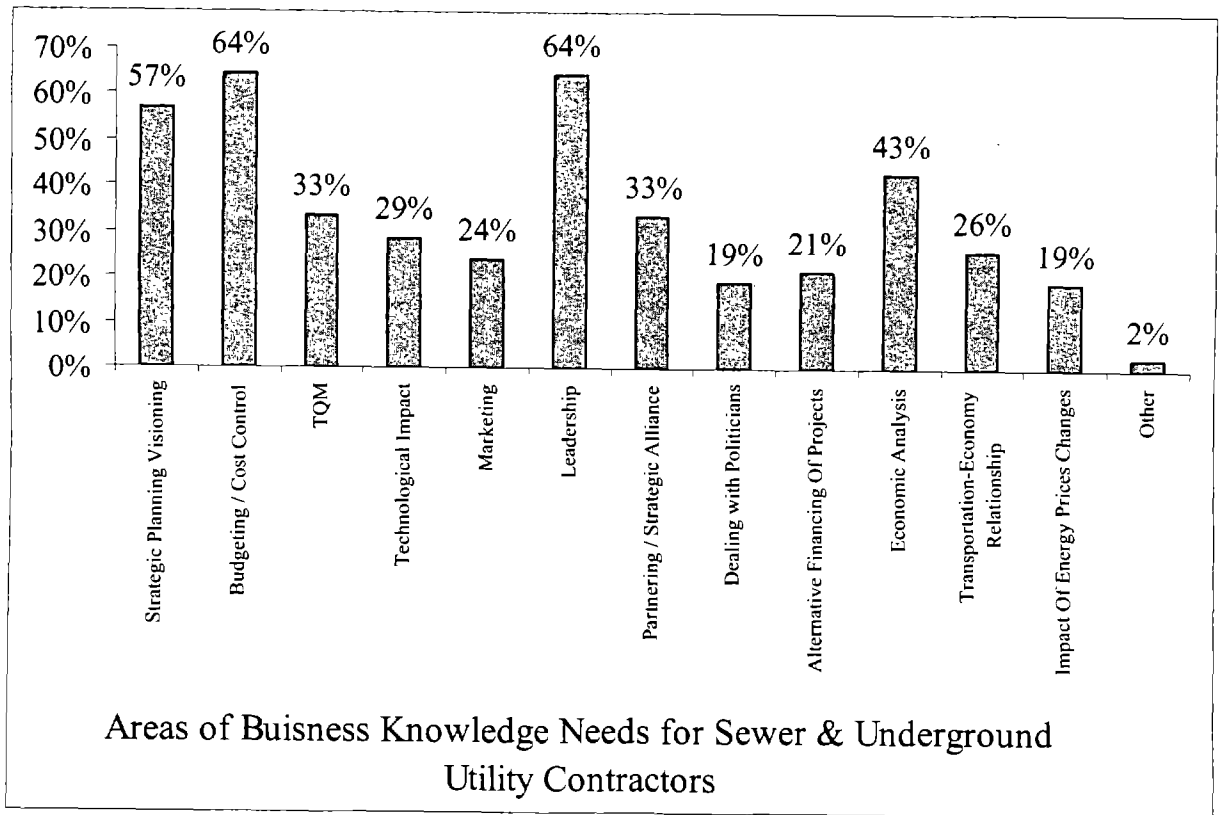
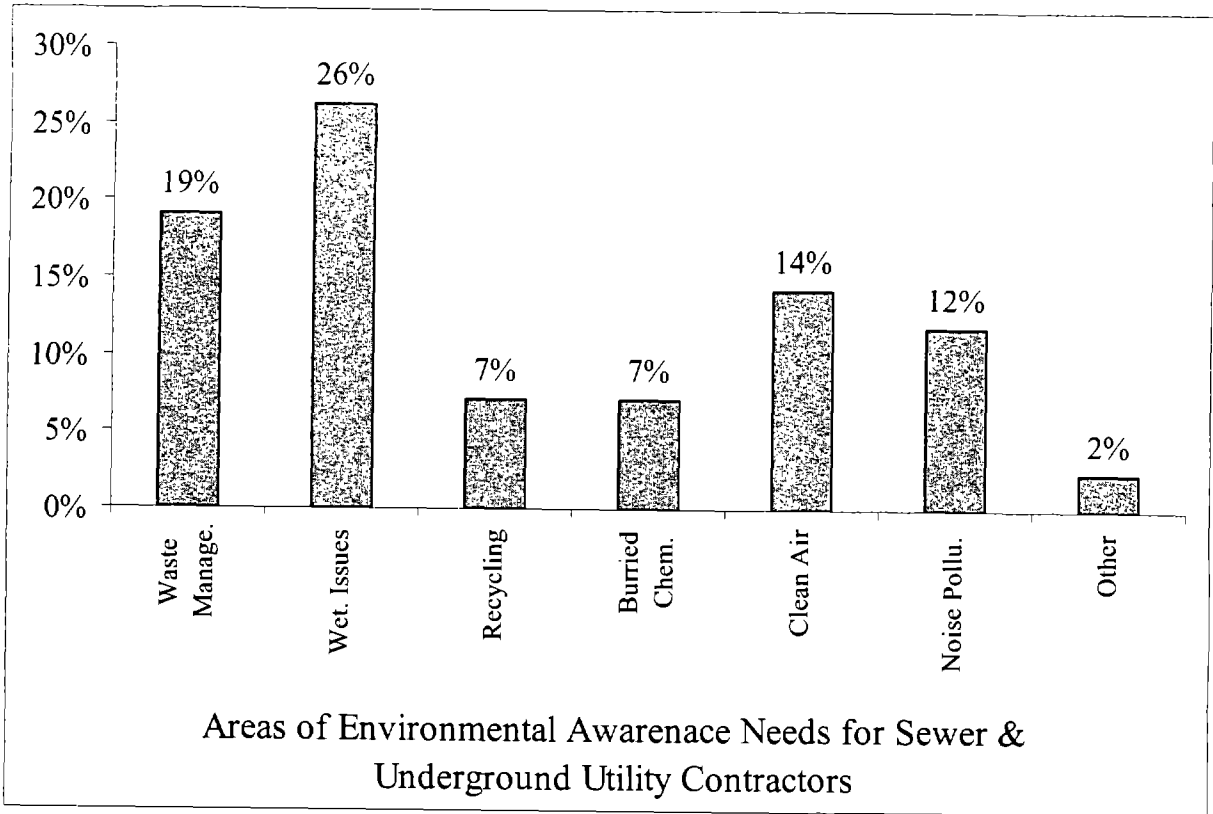
### **Analysis of PM Data by Construction Specialty**

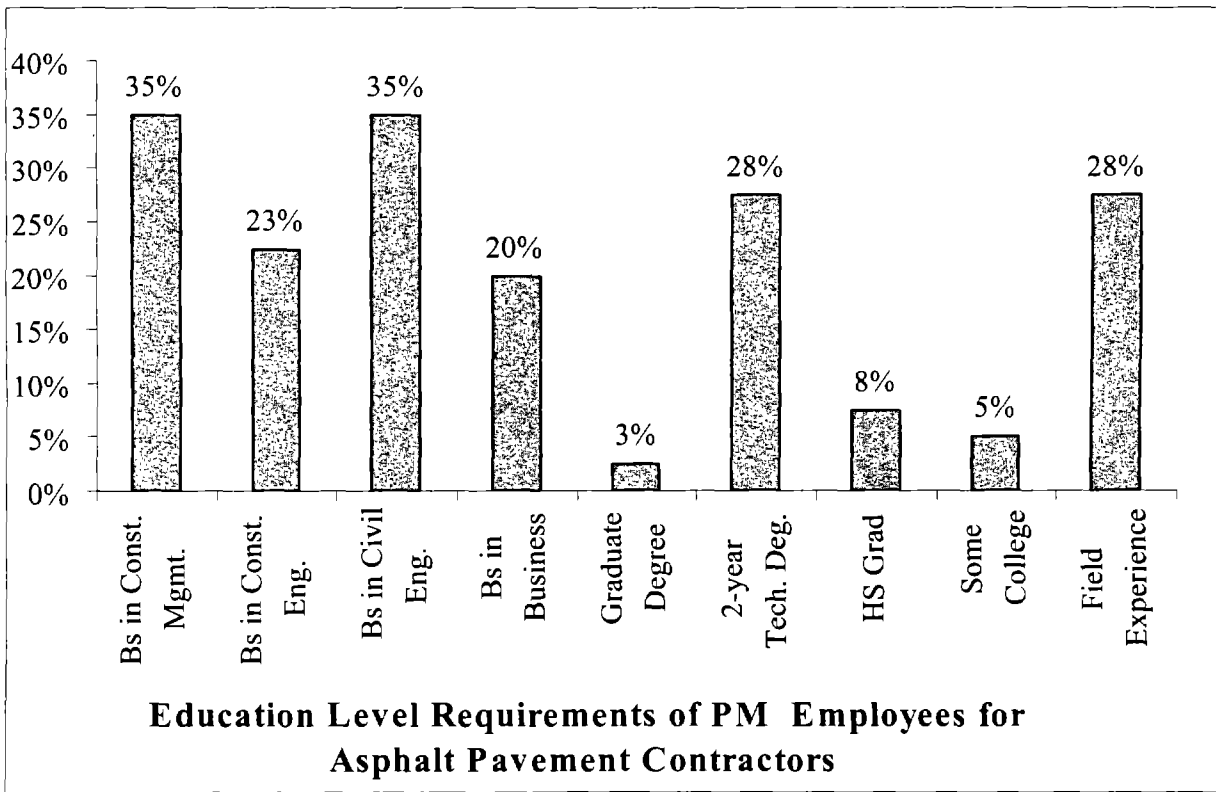
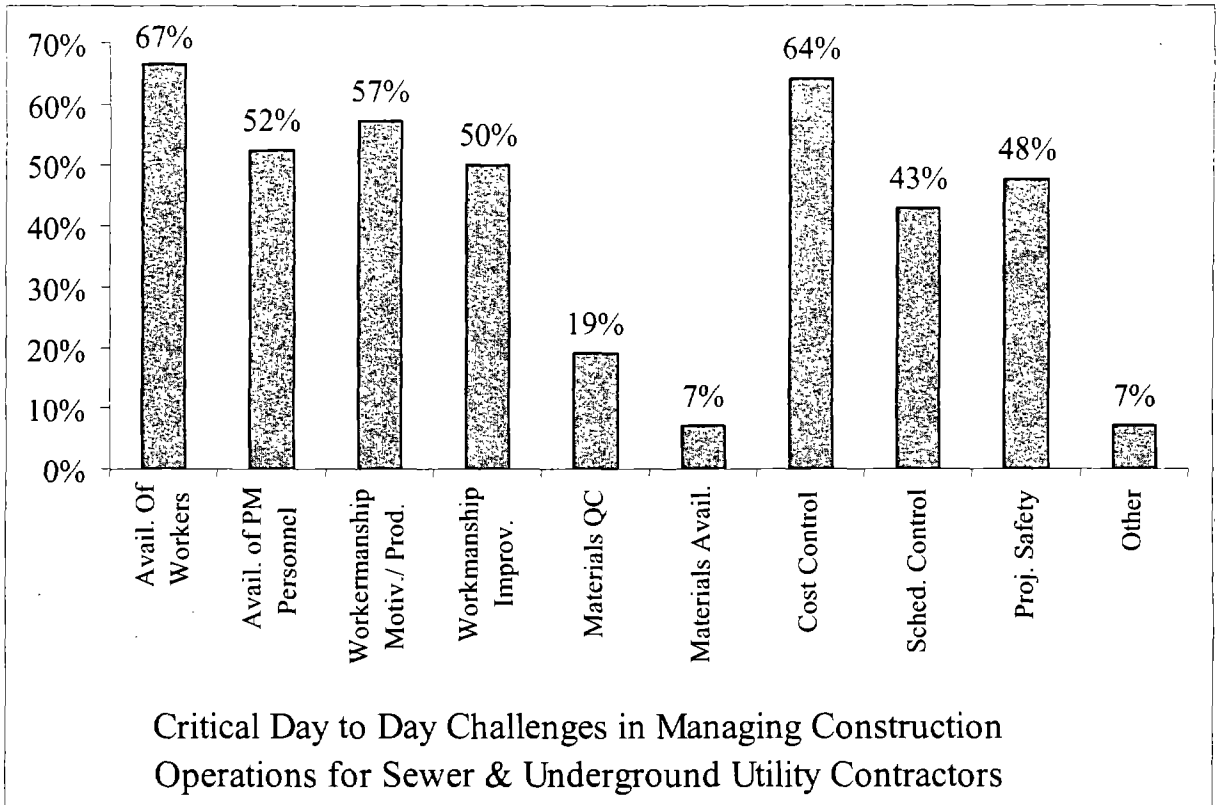


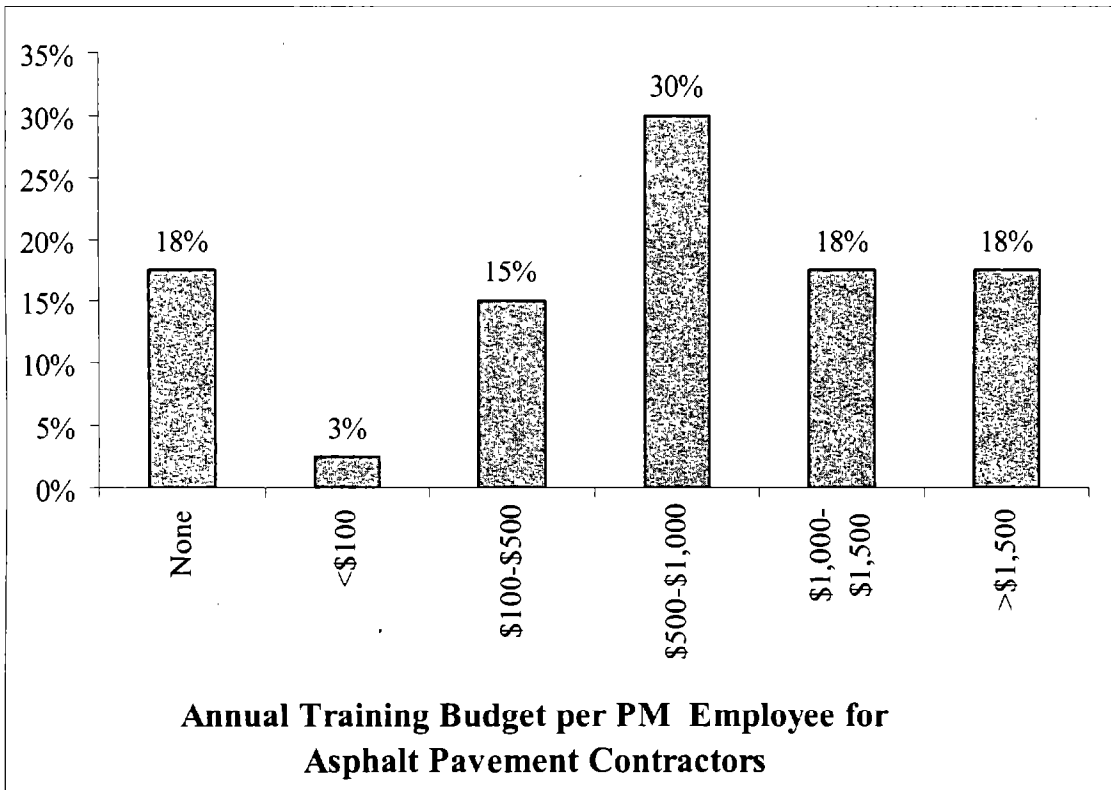
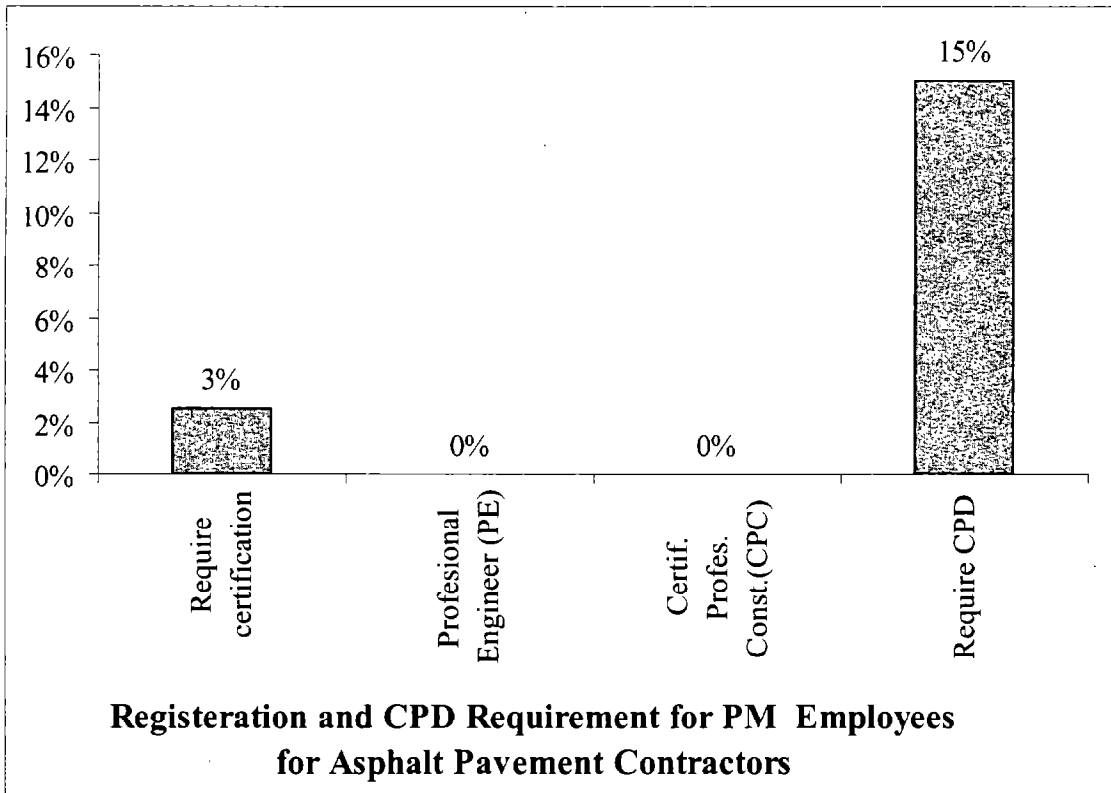




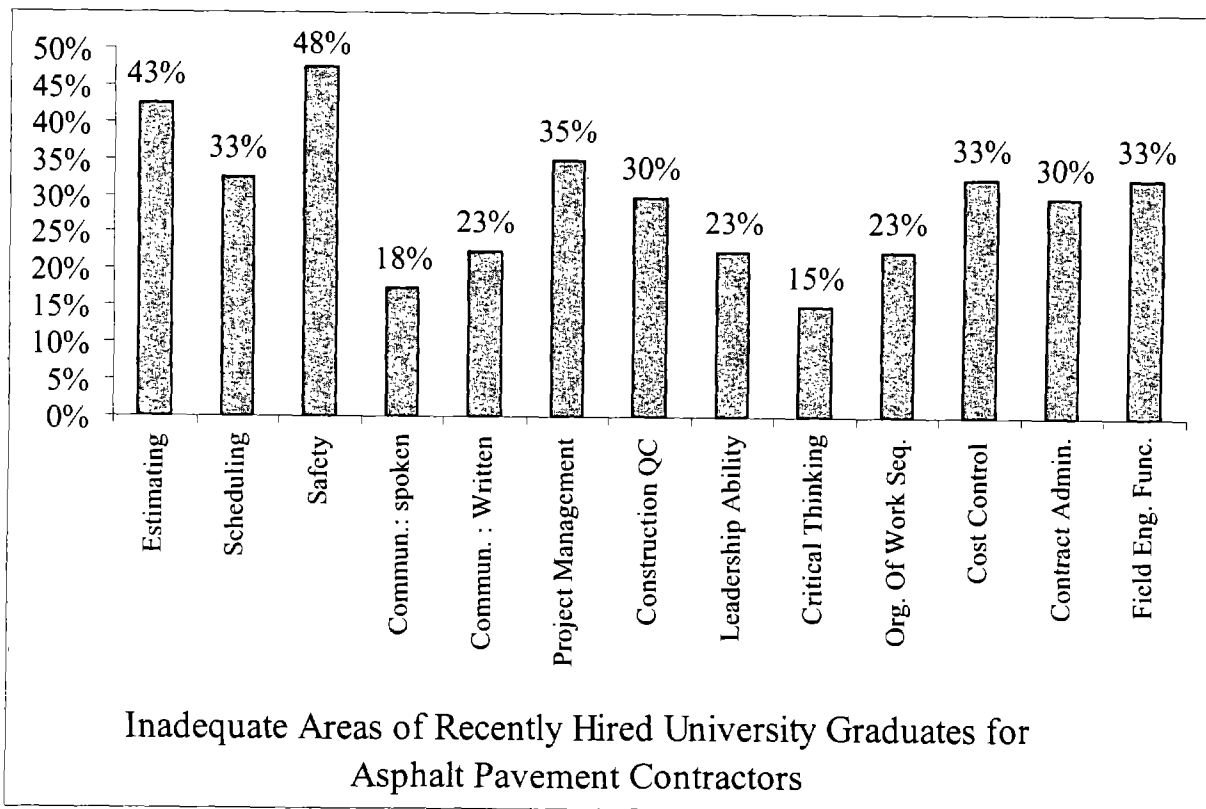
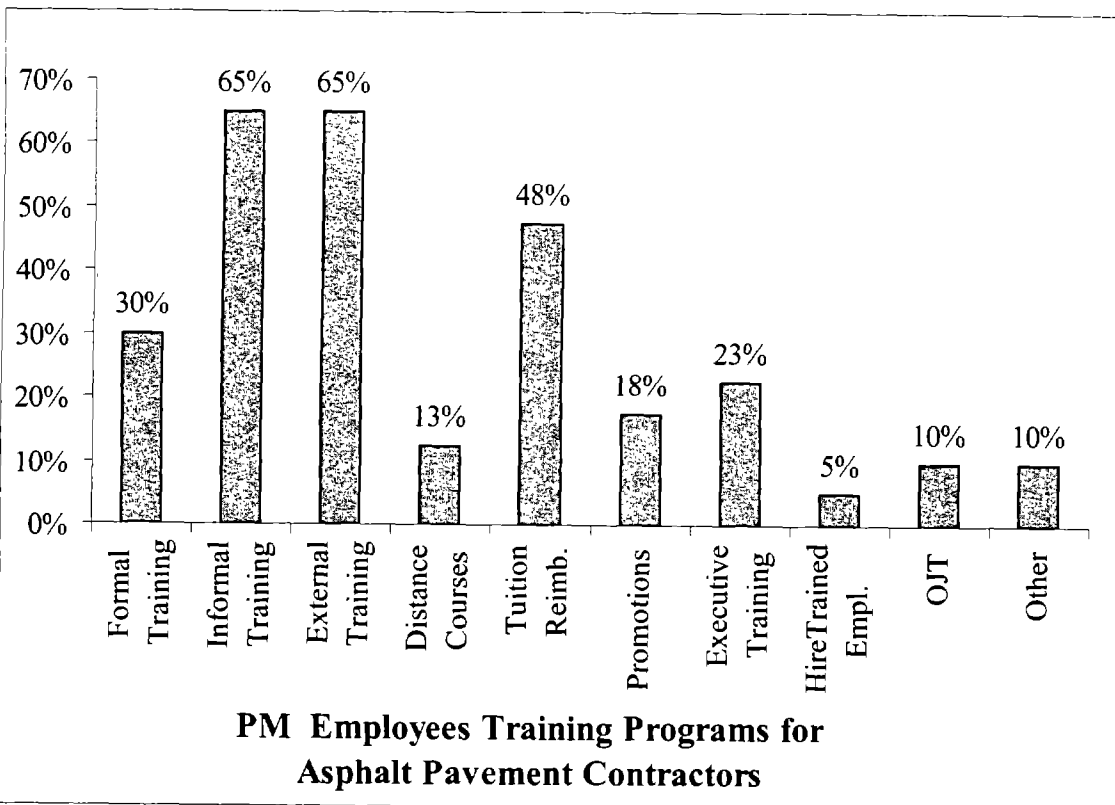


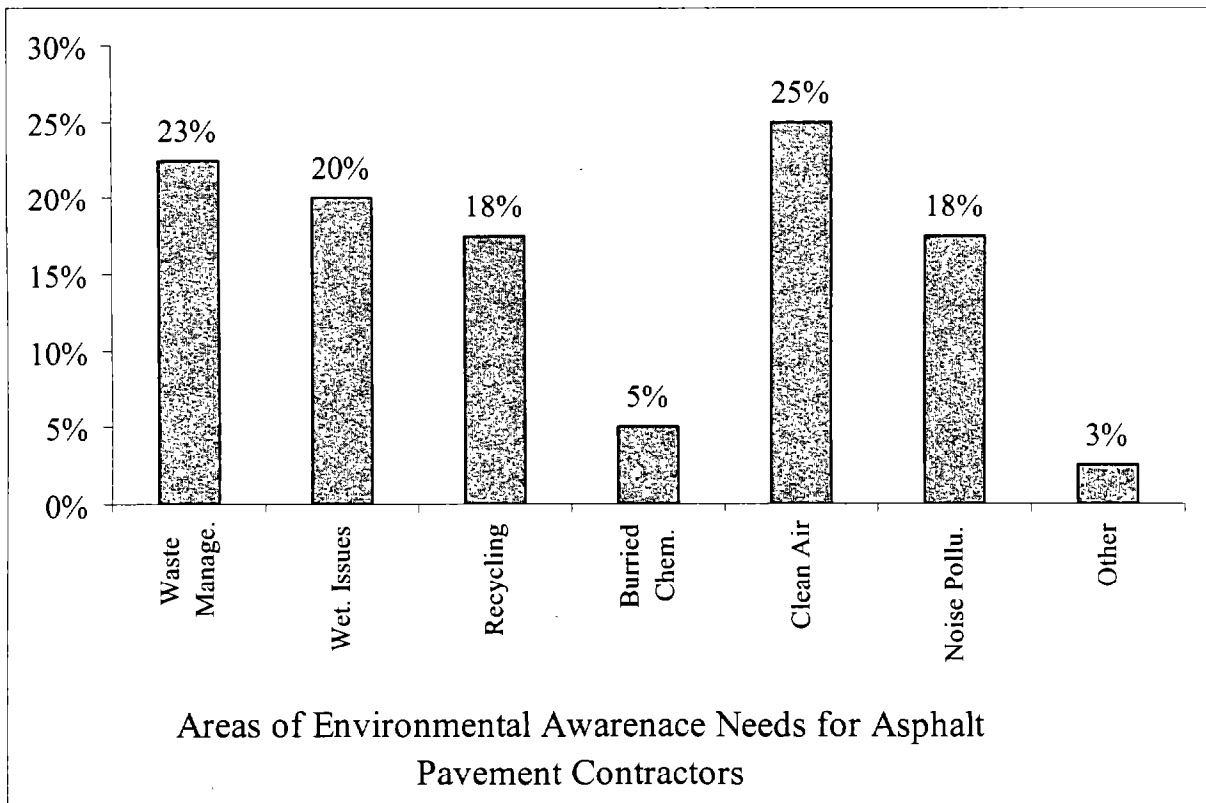
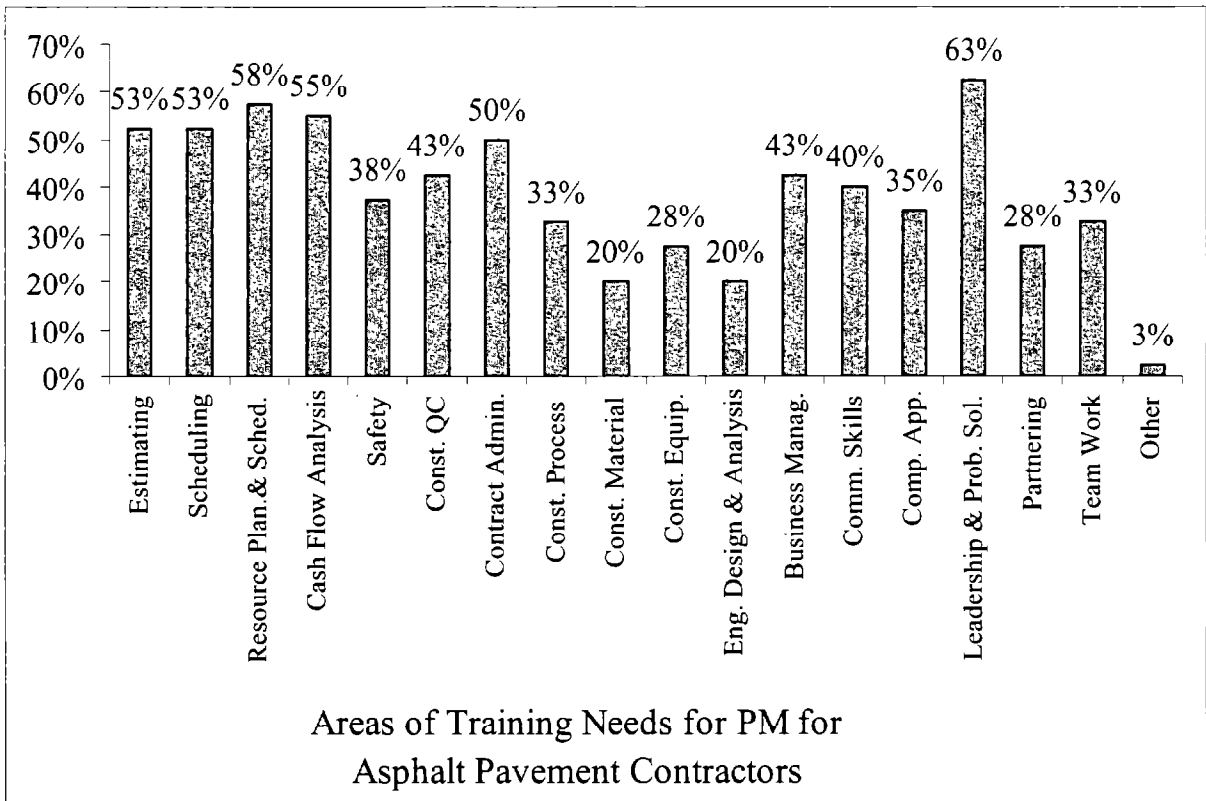


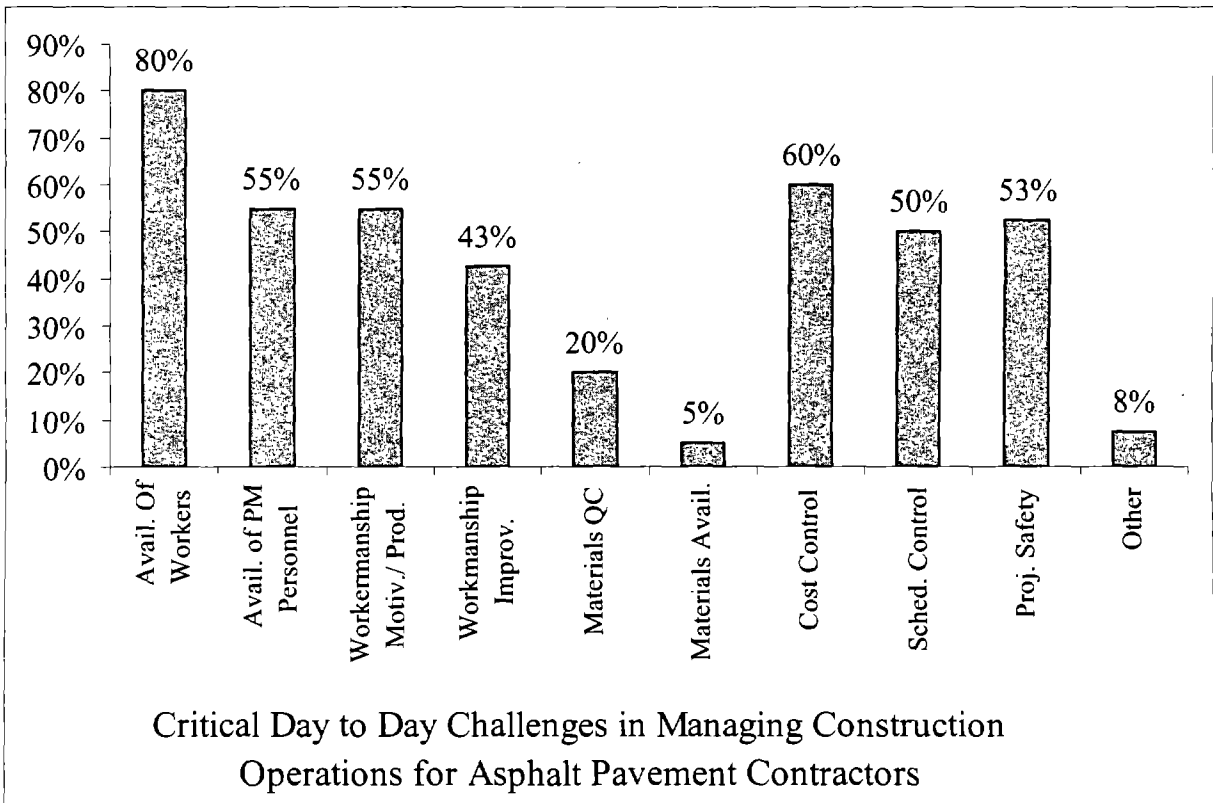
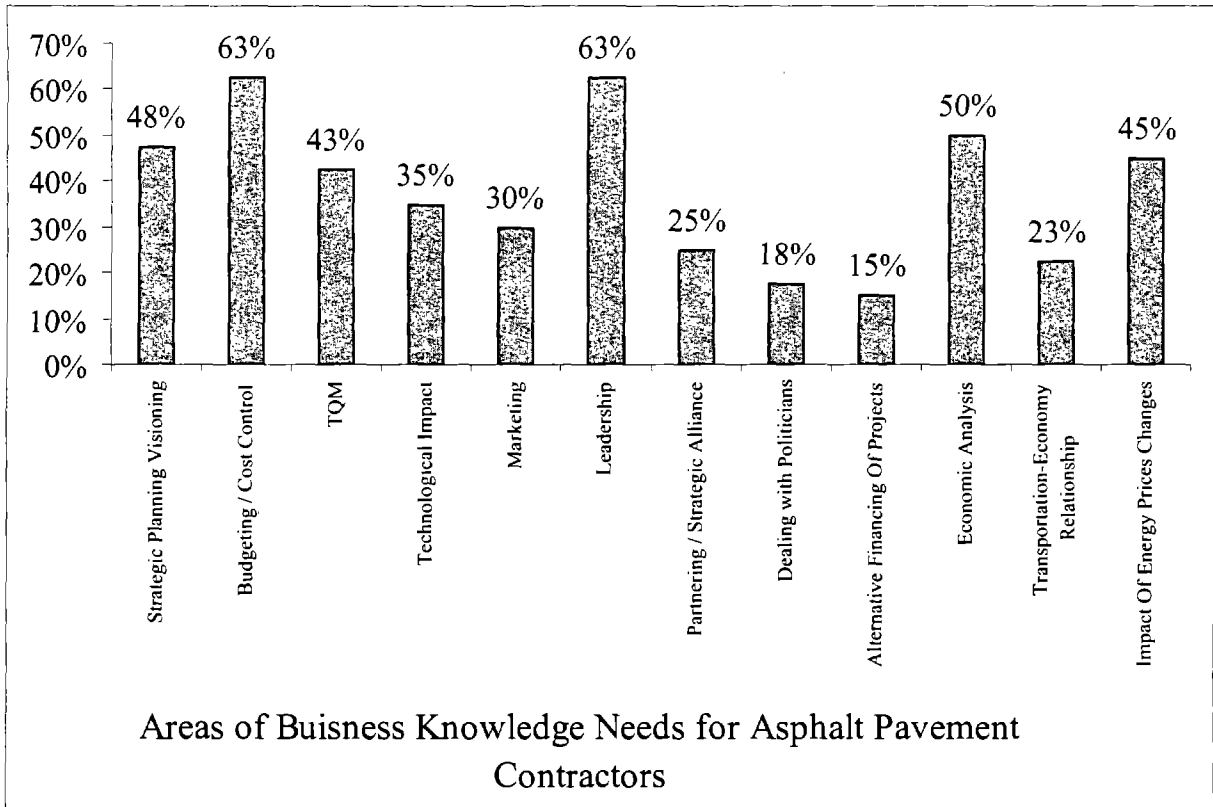


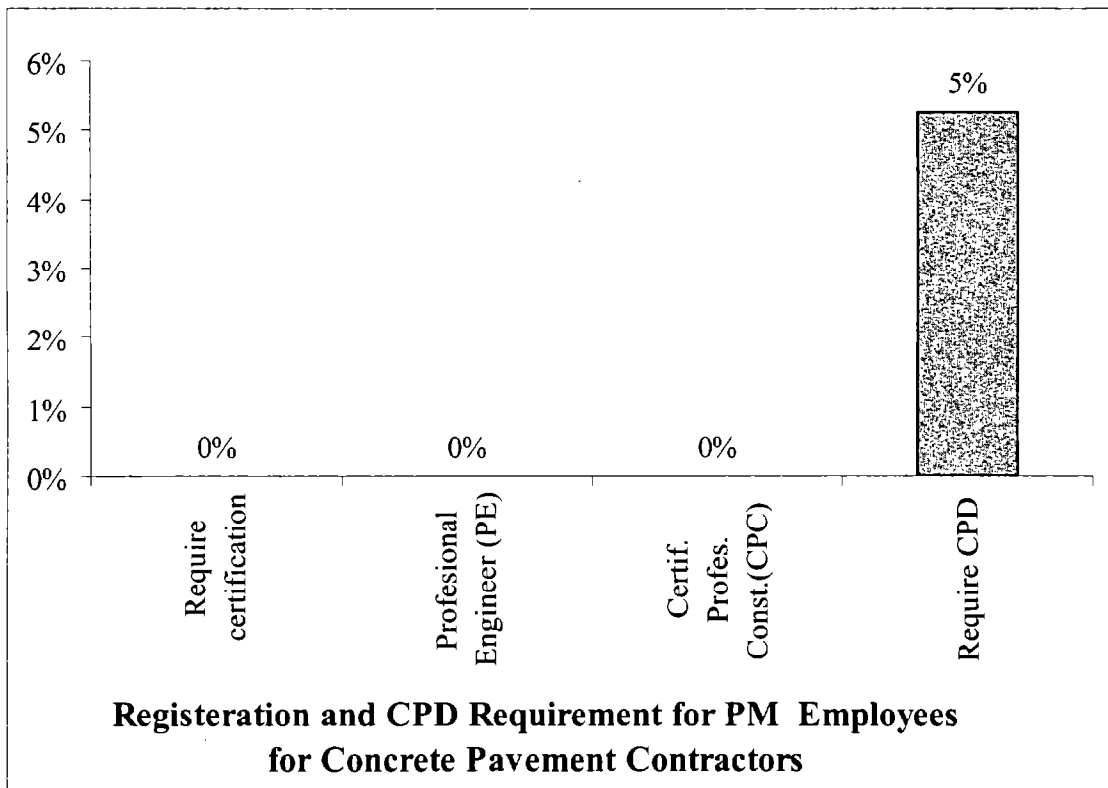
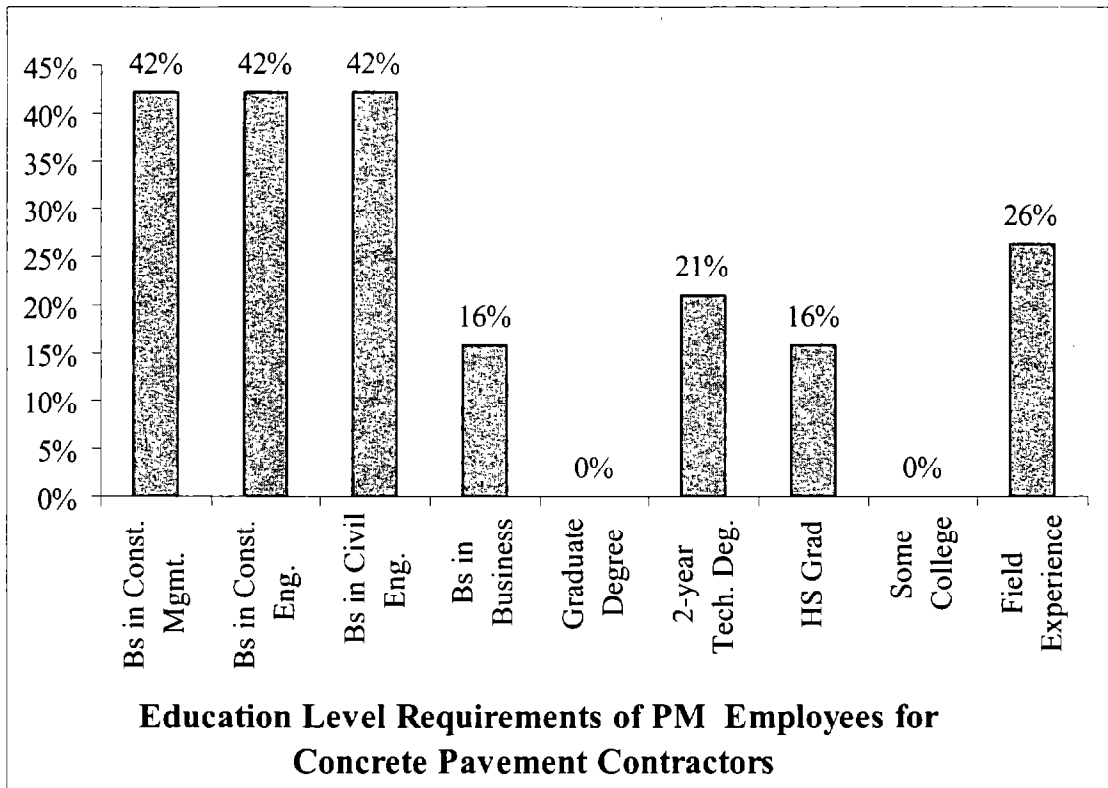


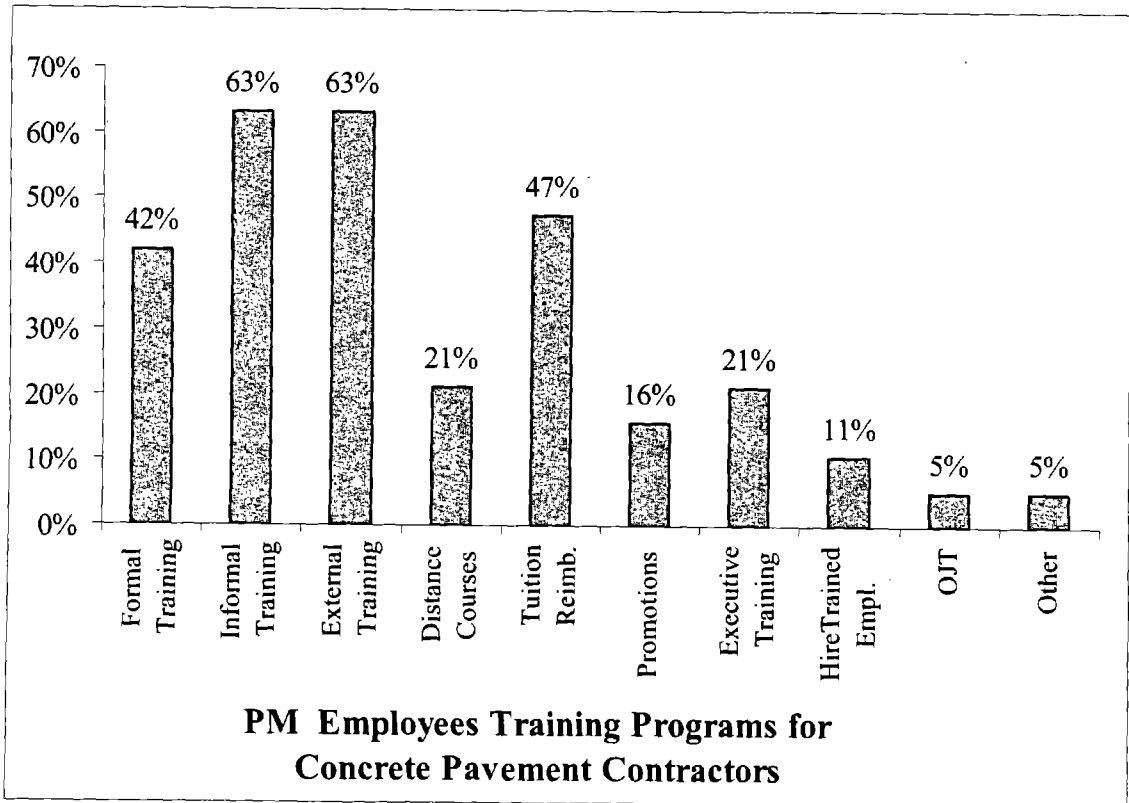
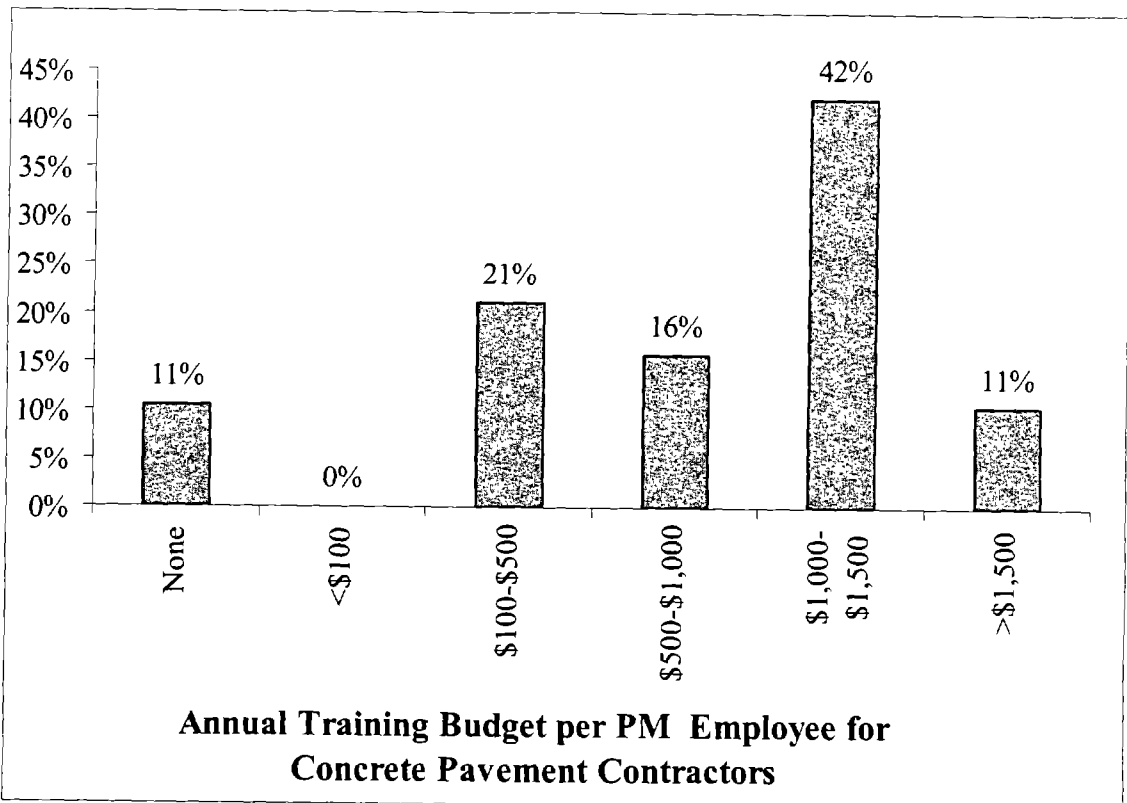


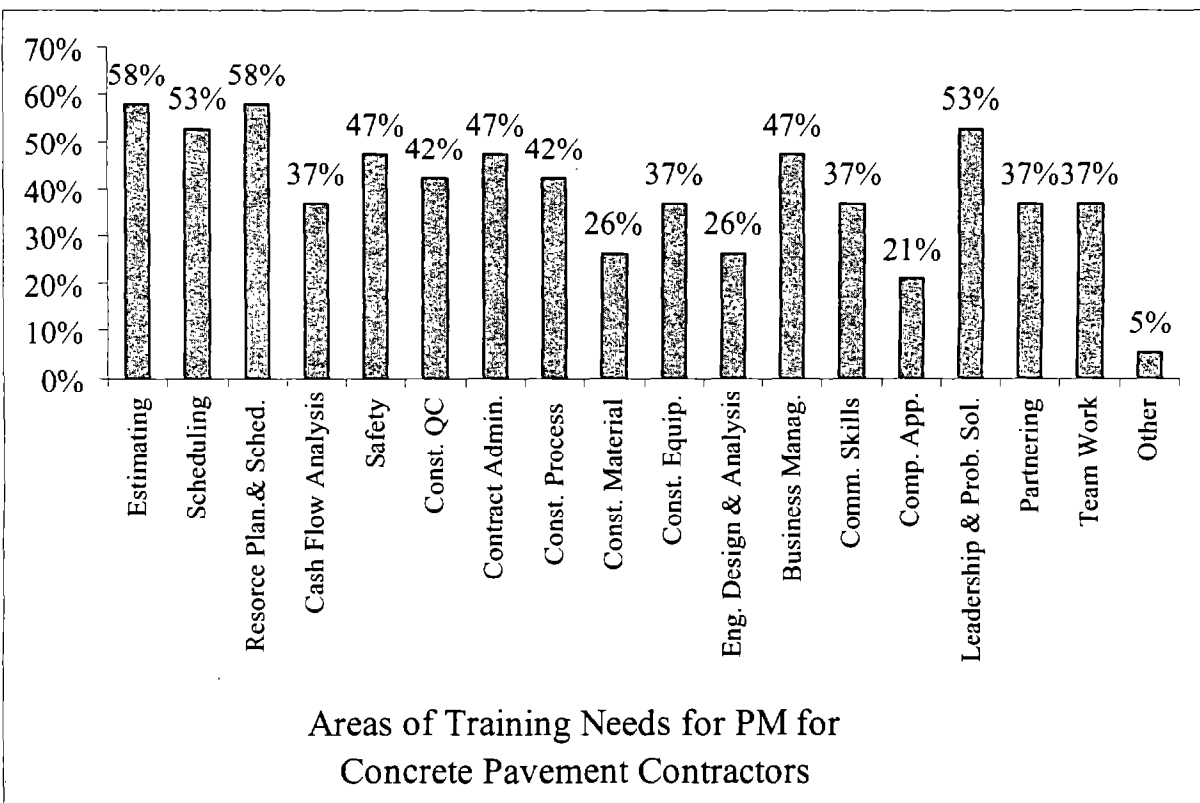
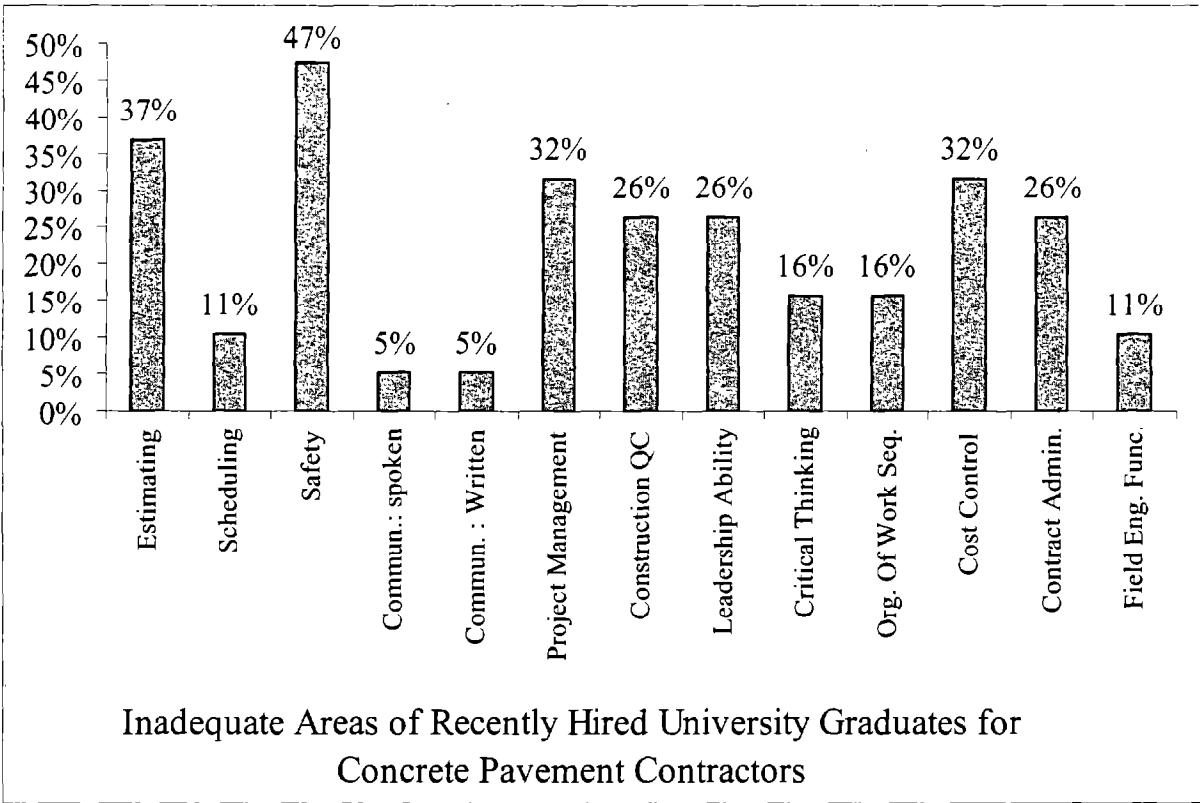


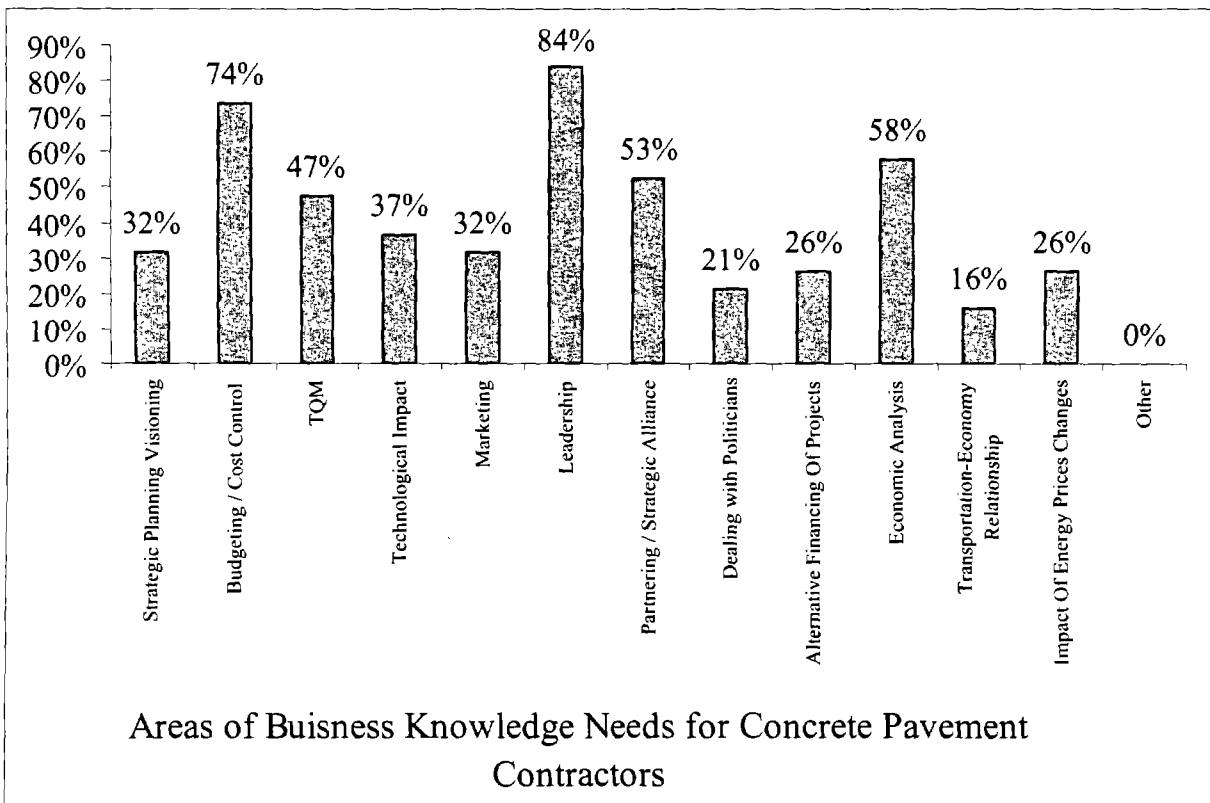
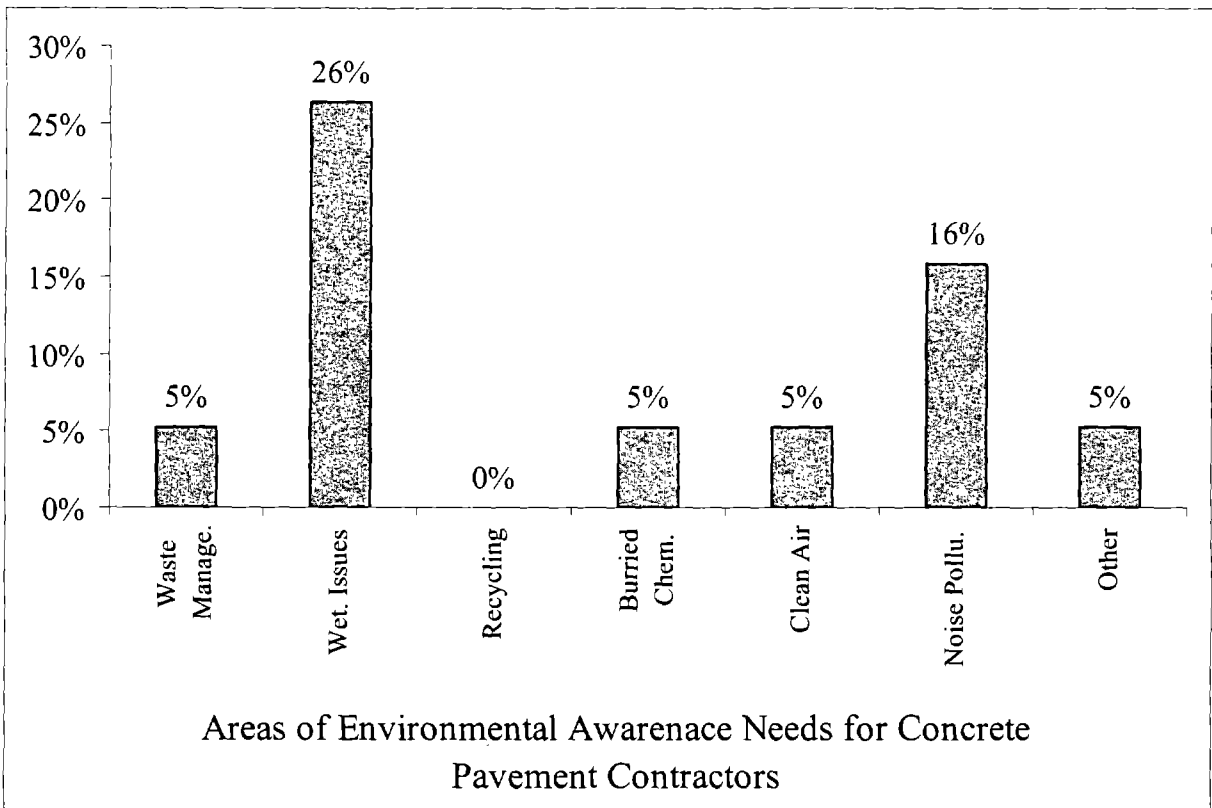


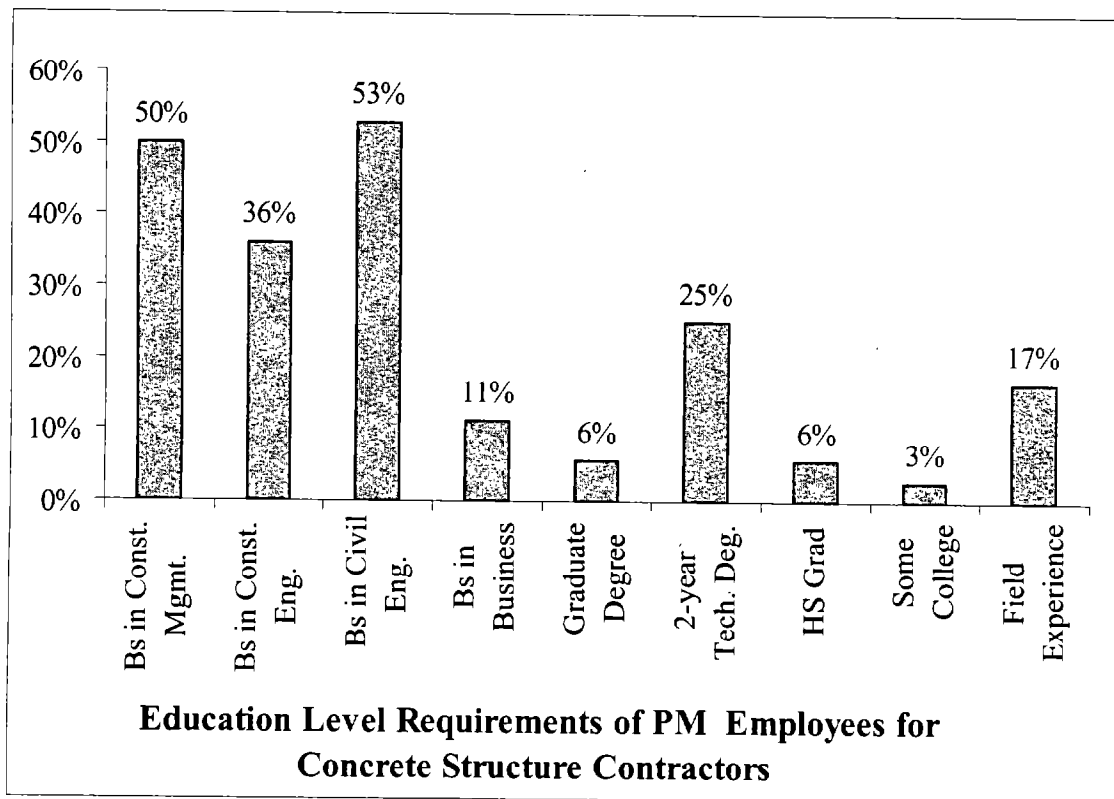
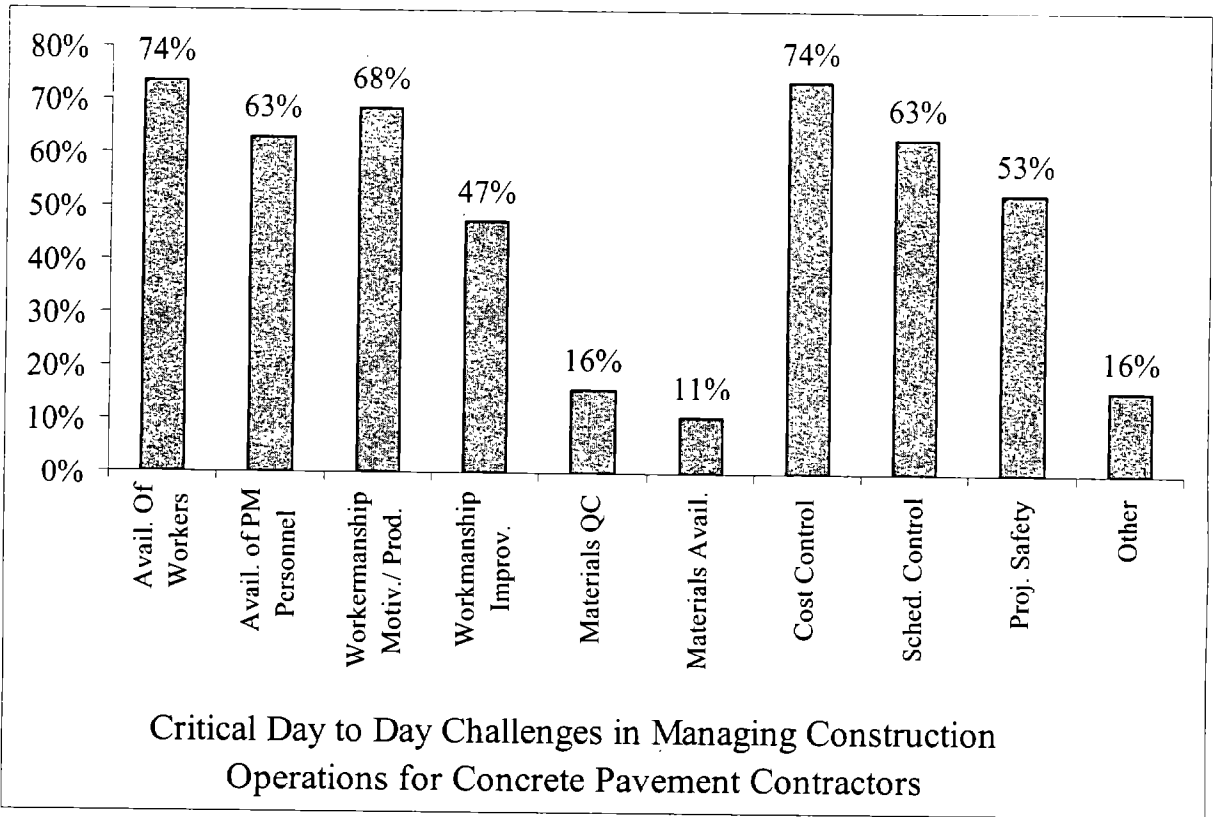




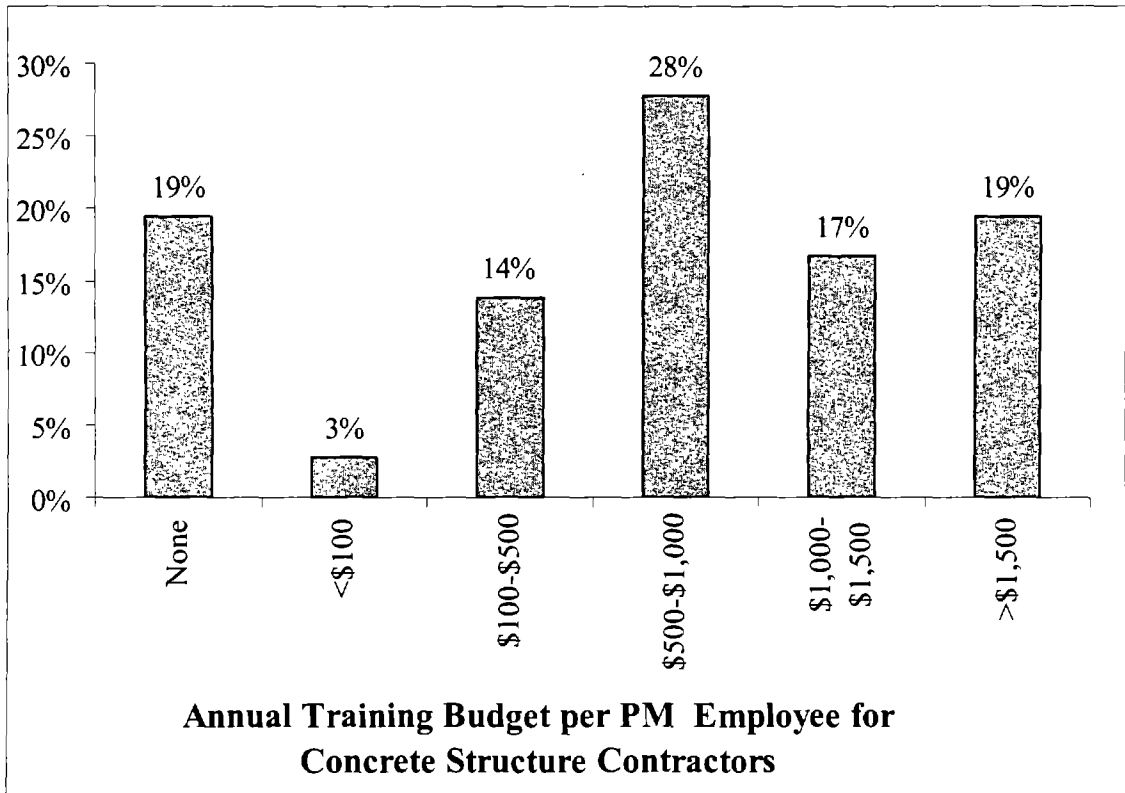
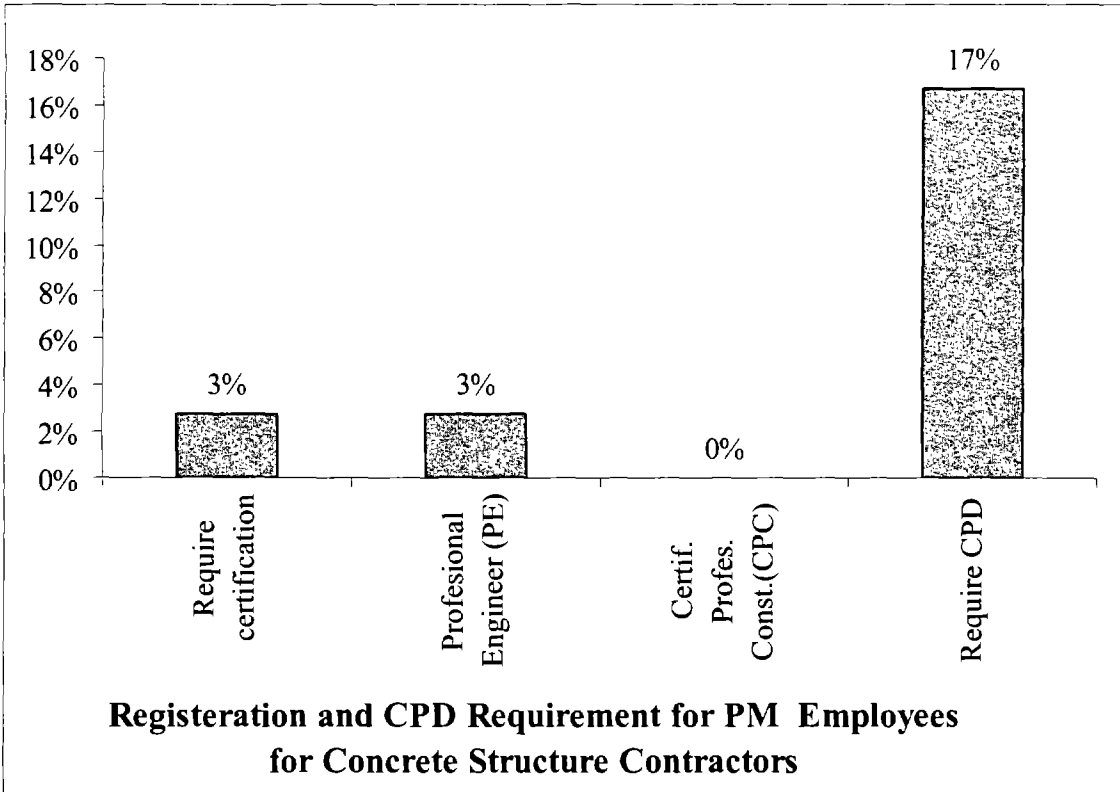


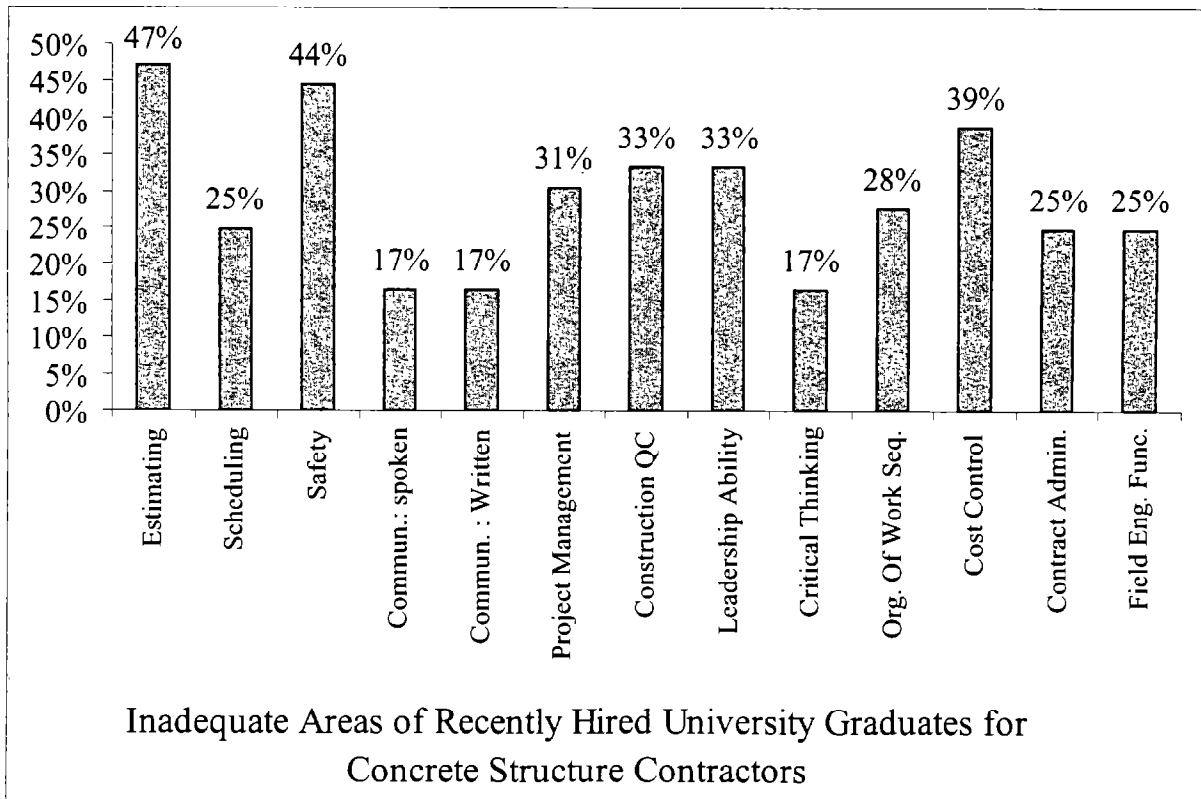
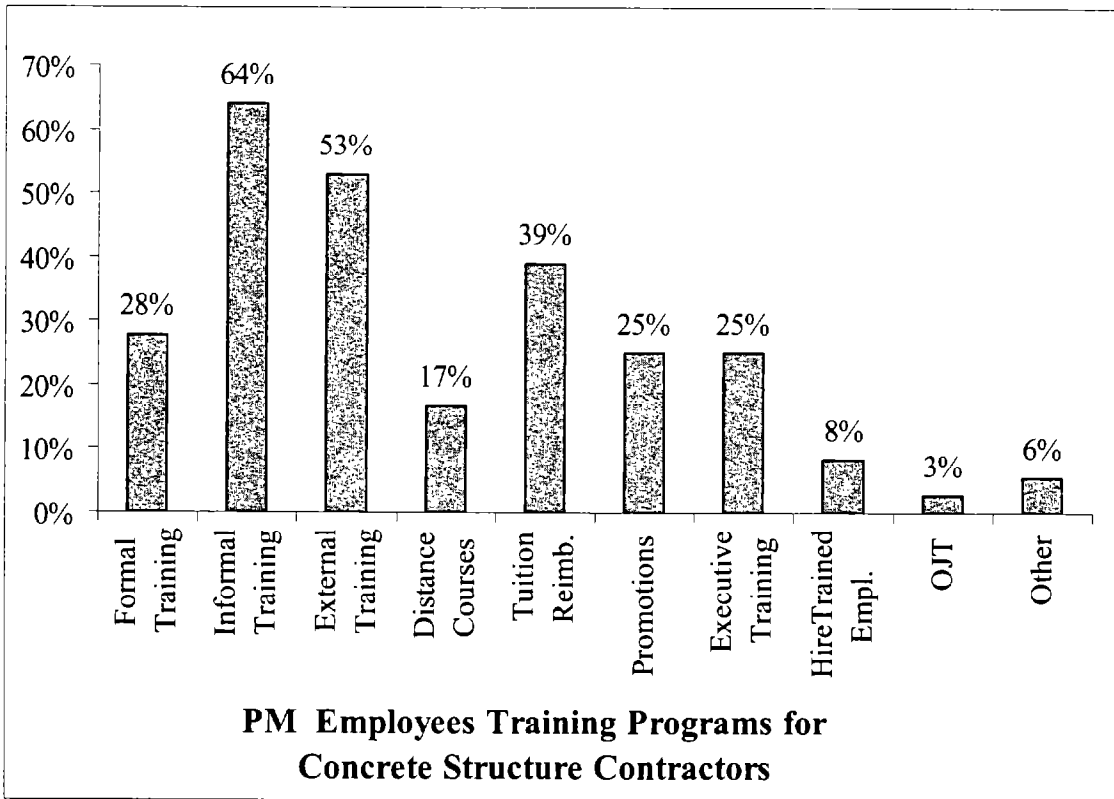


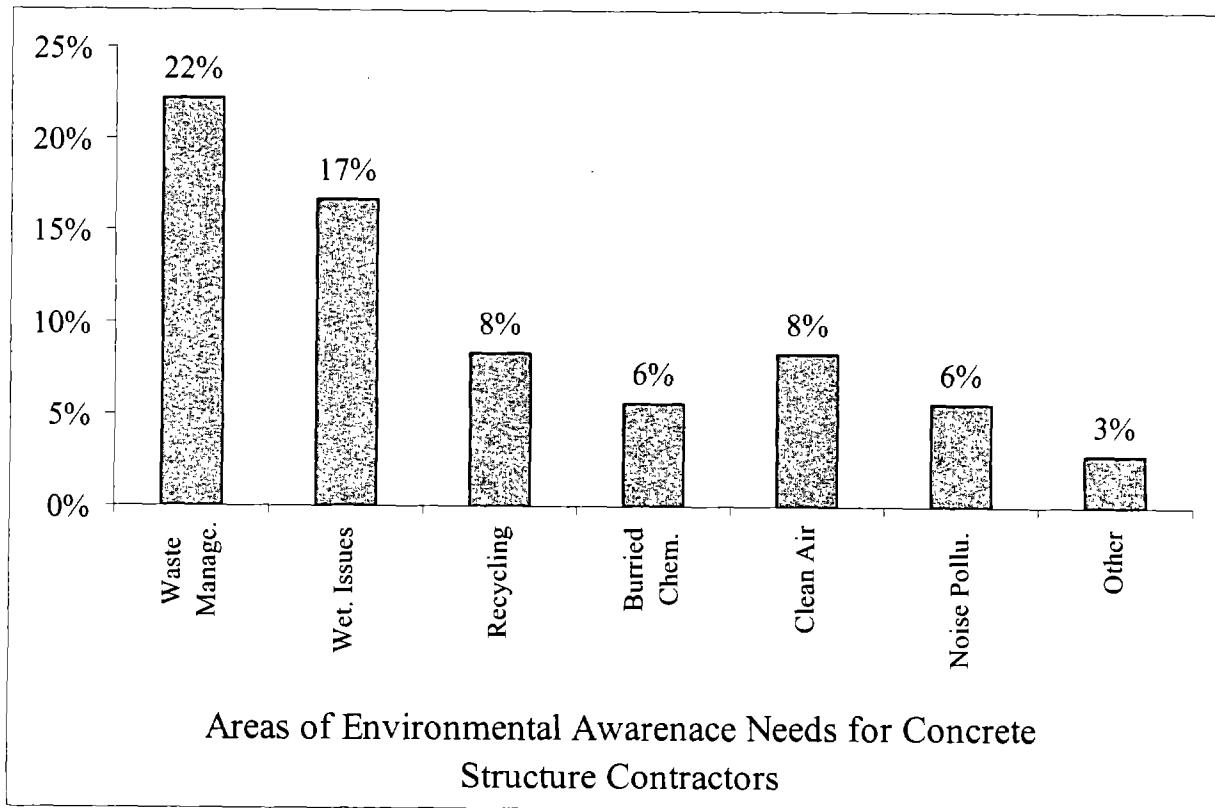
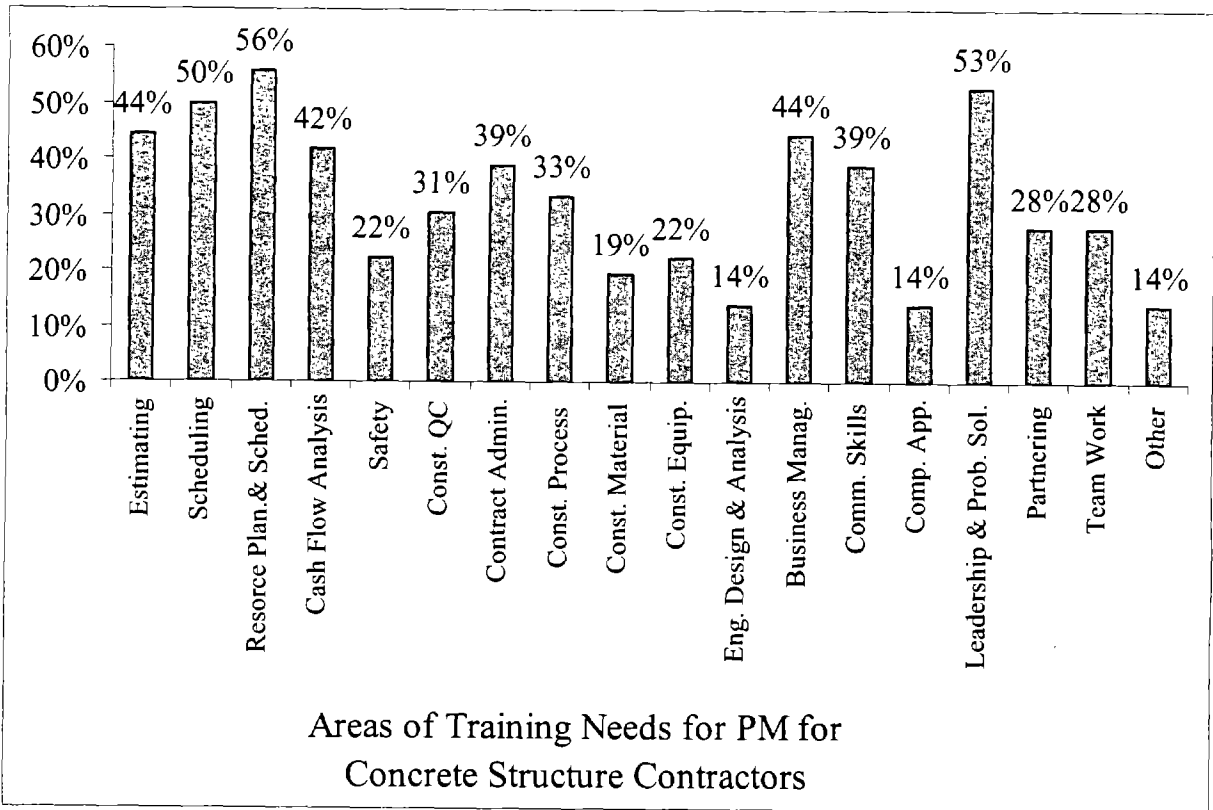


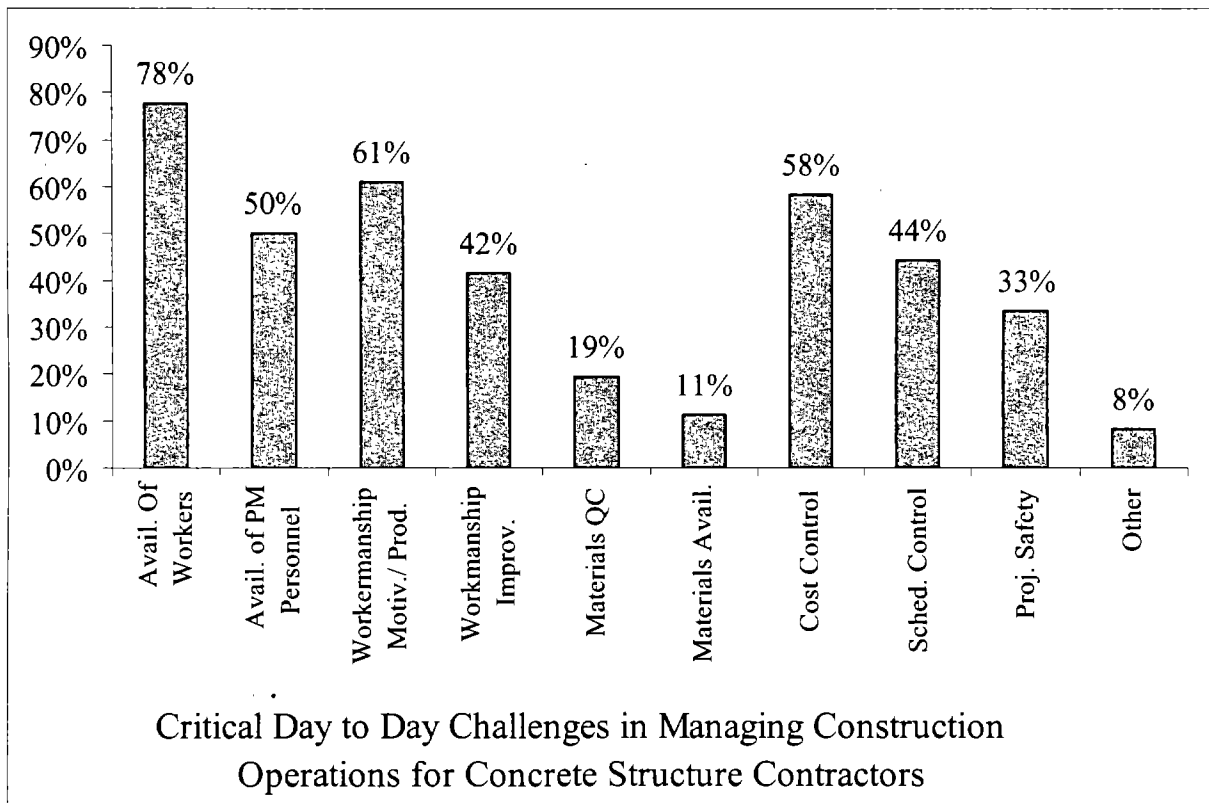
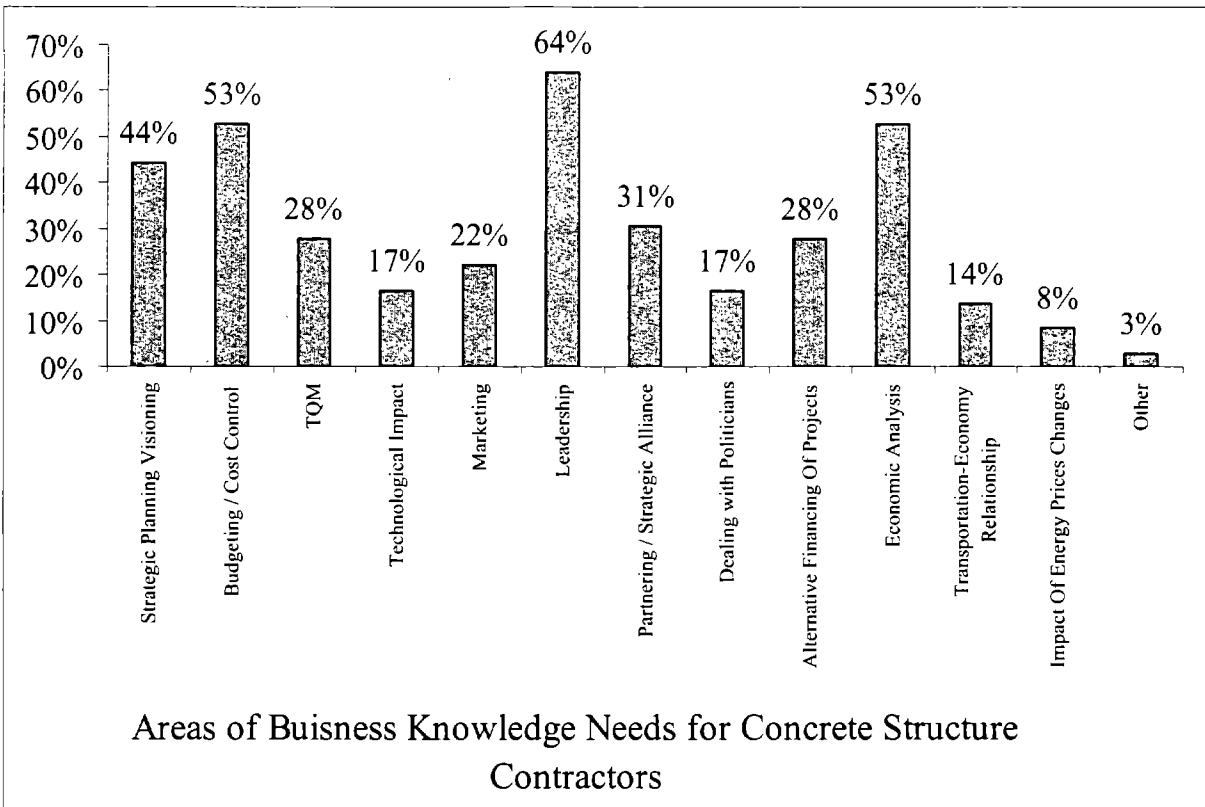


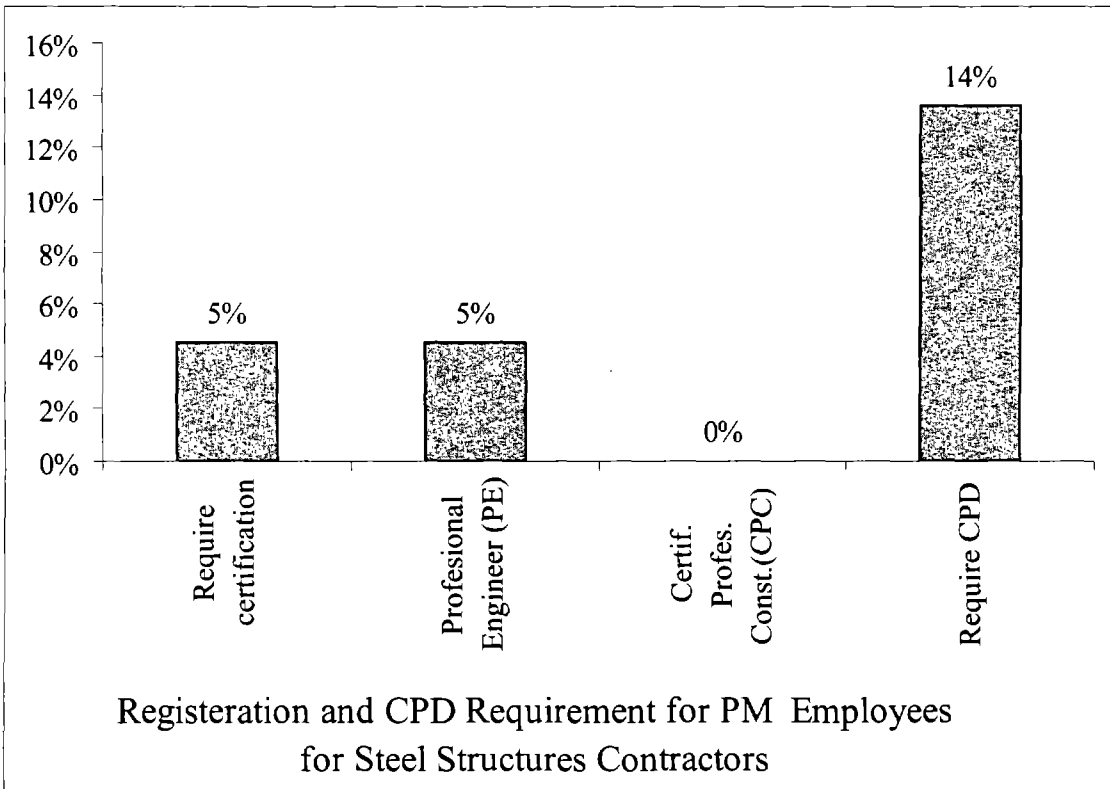
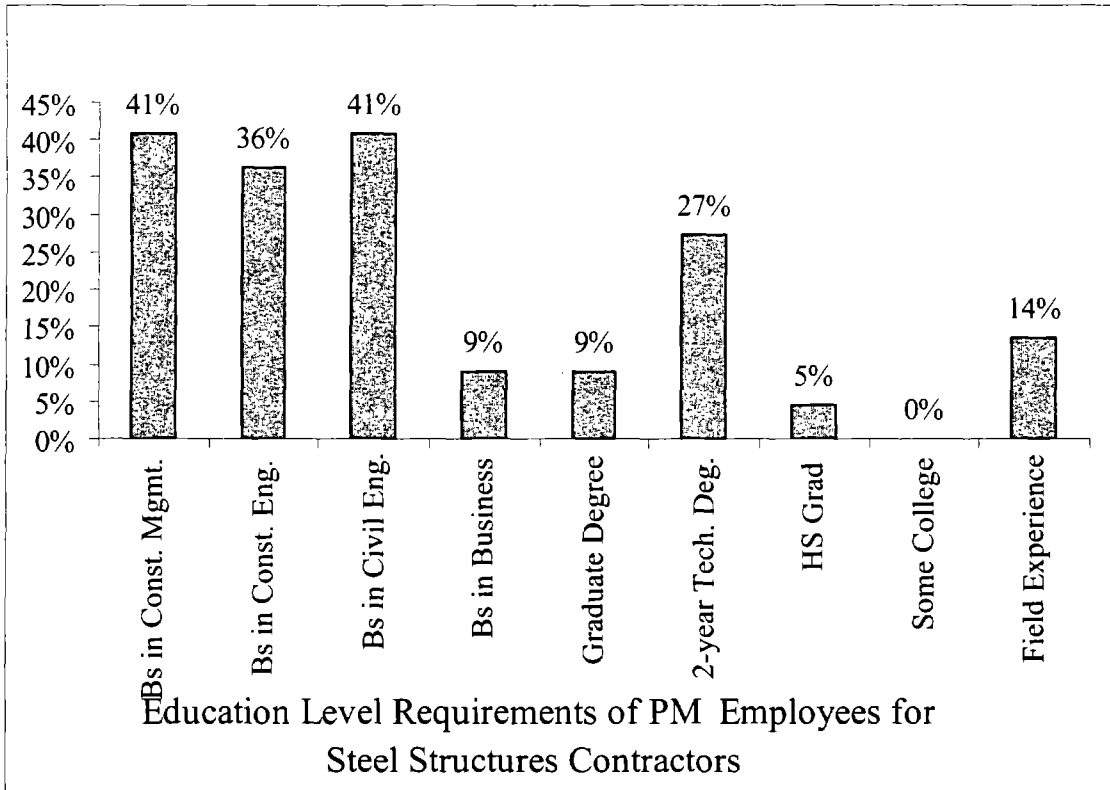


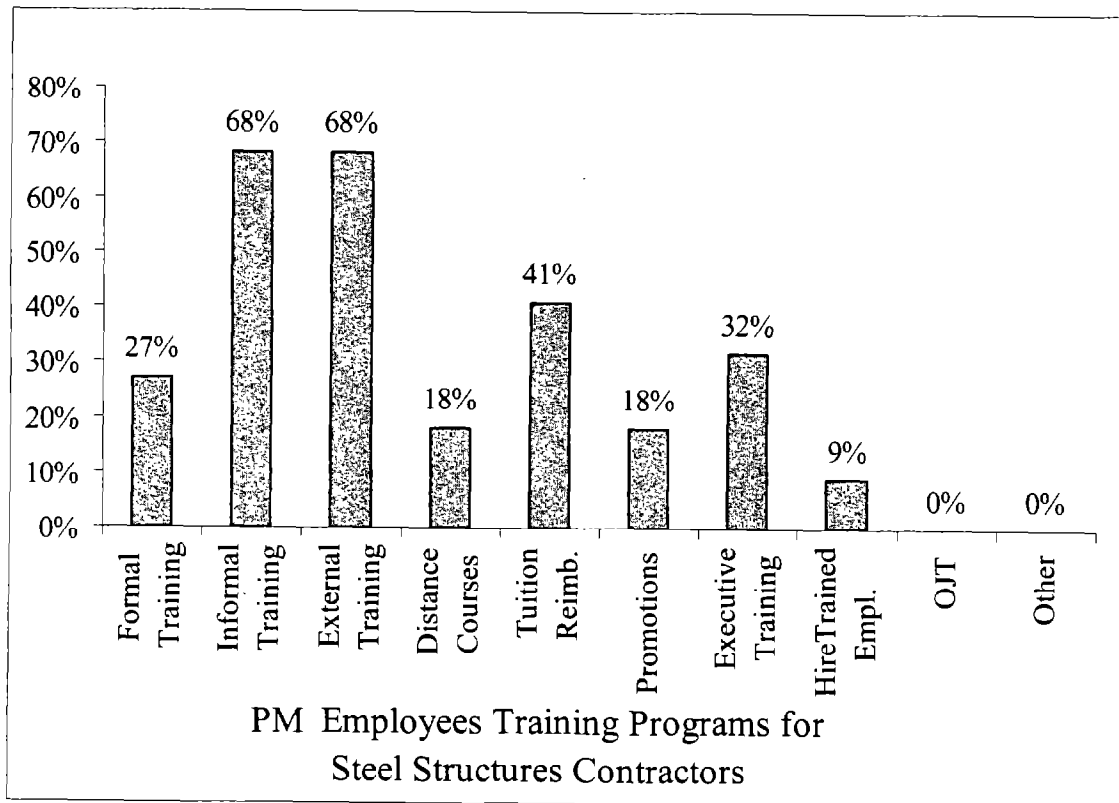
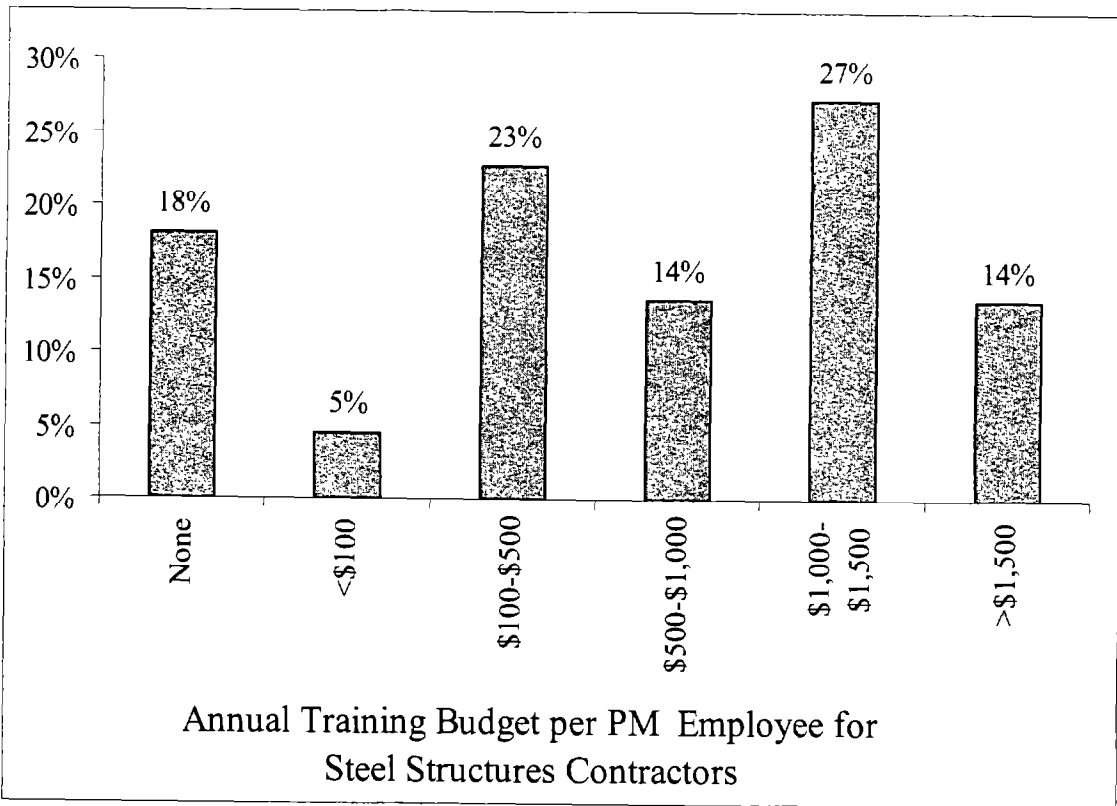


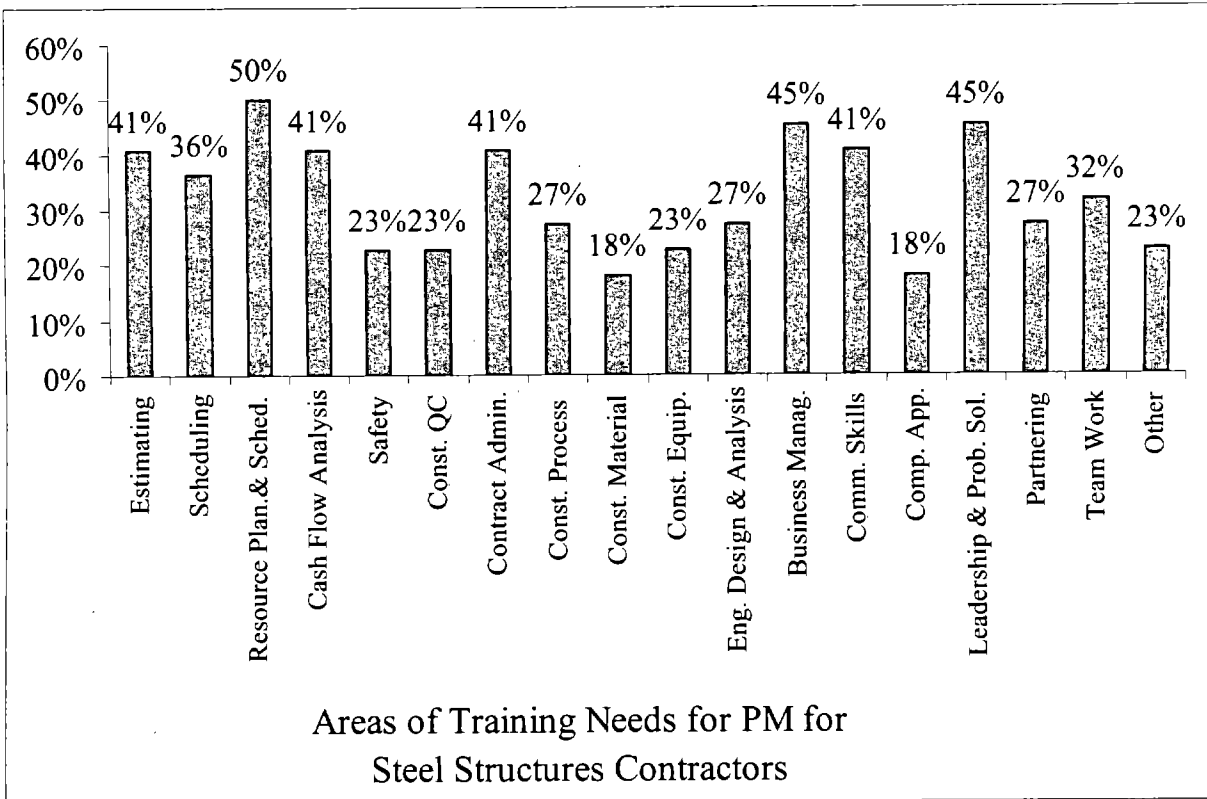
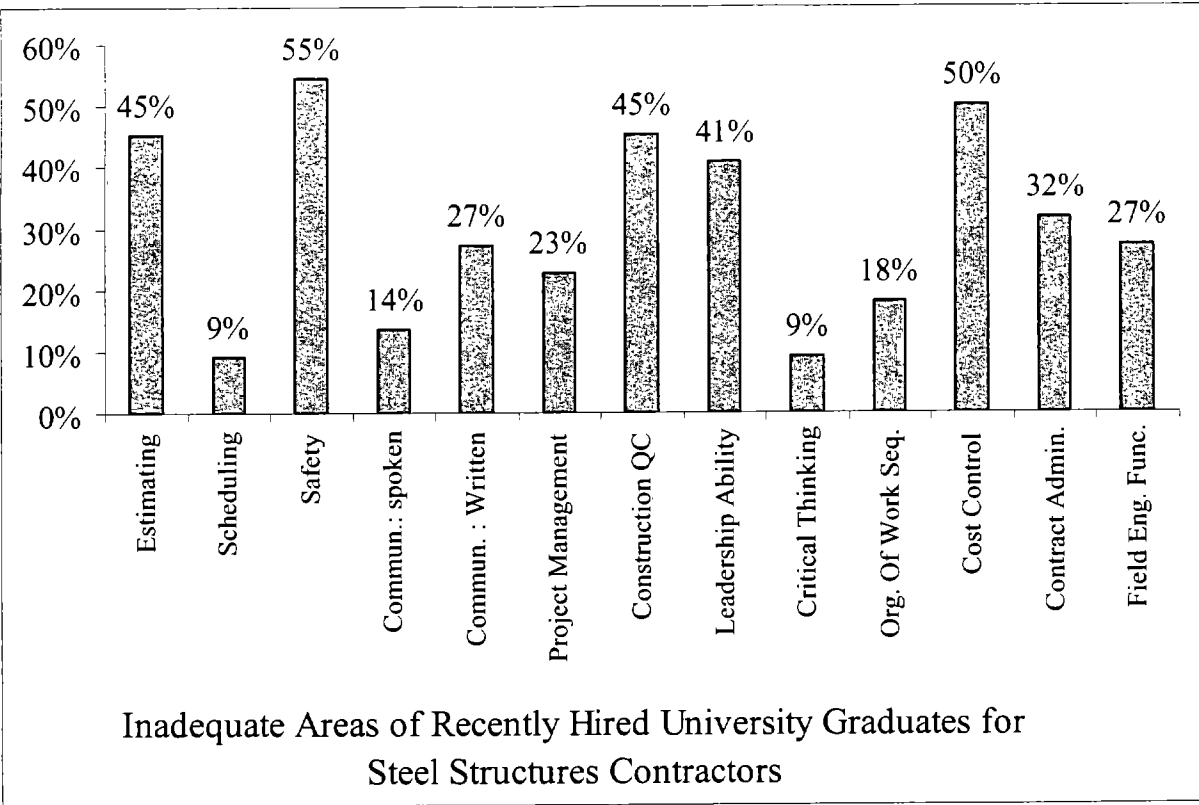


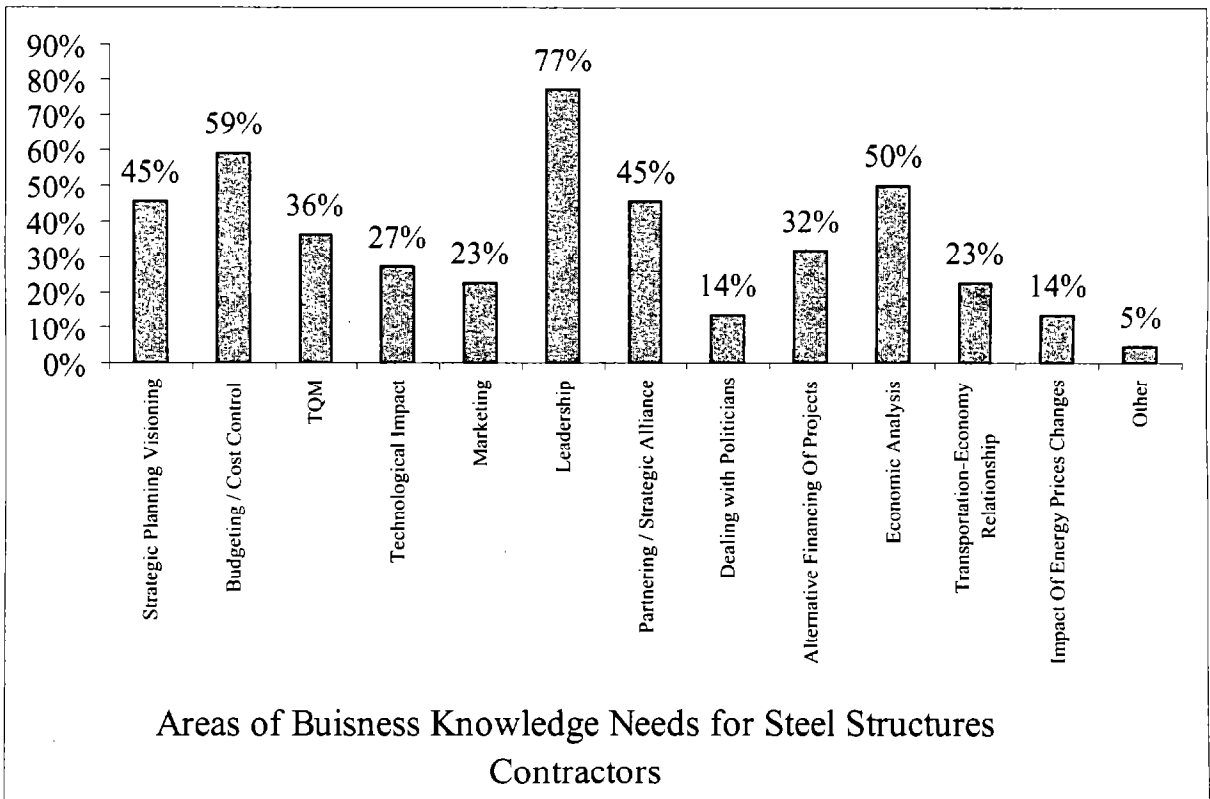
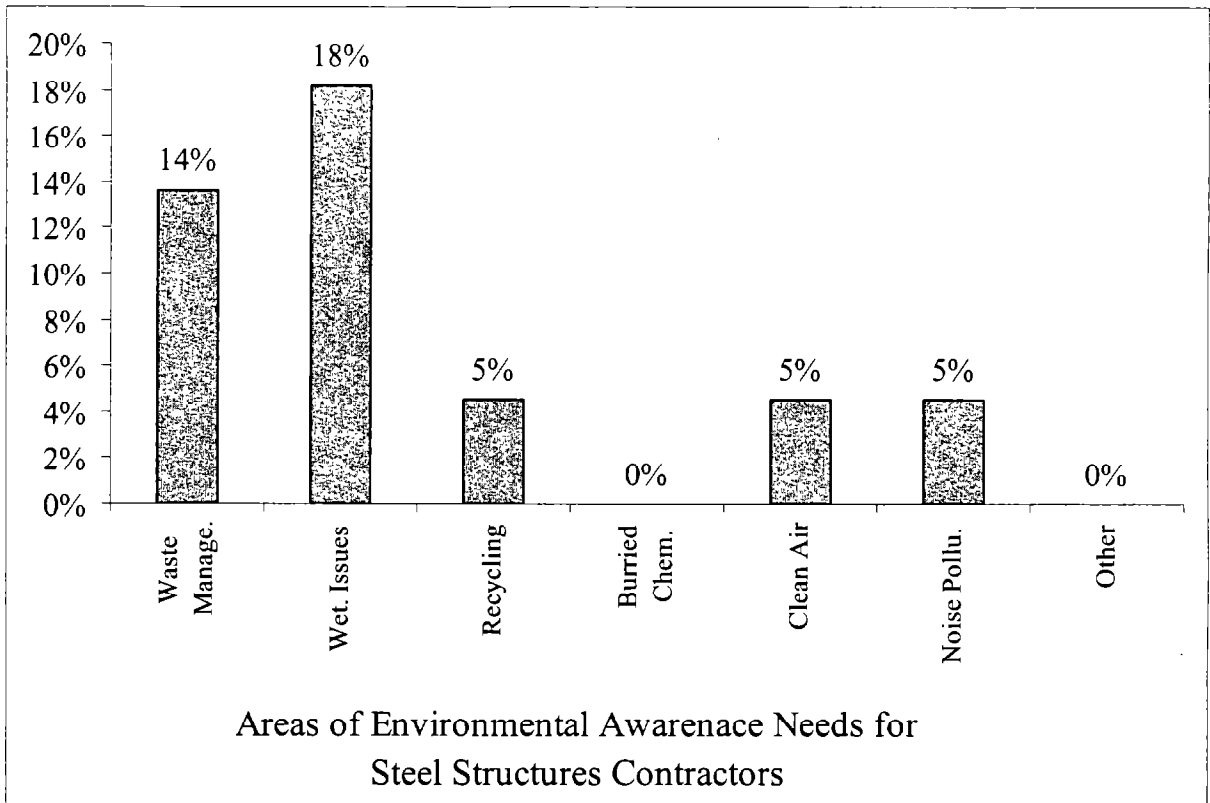




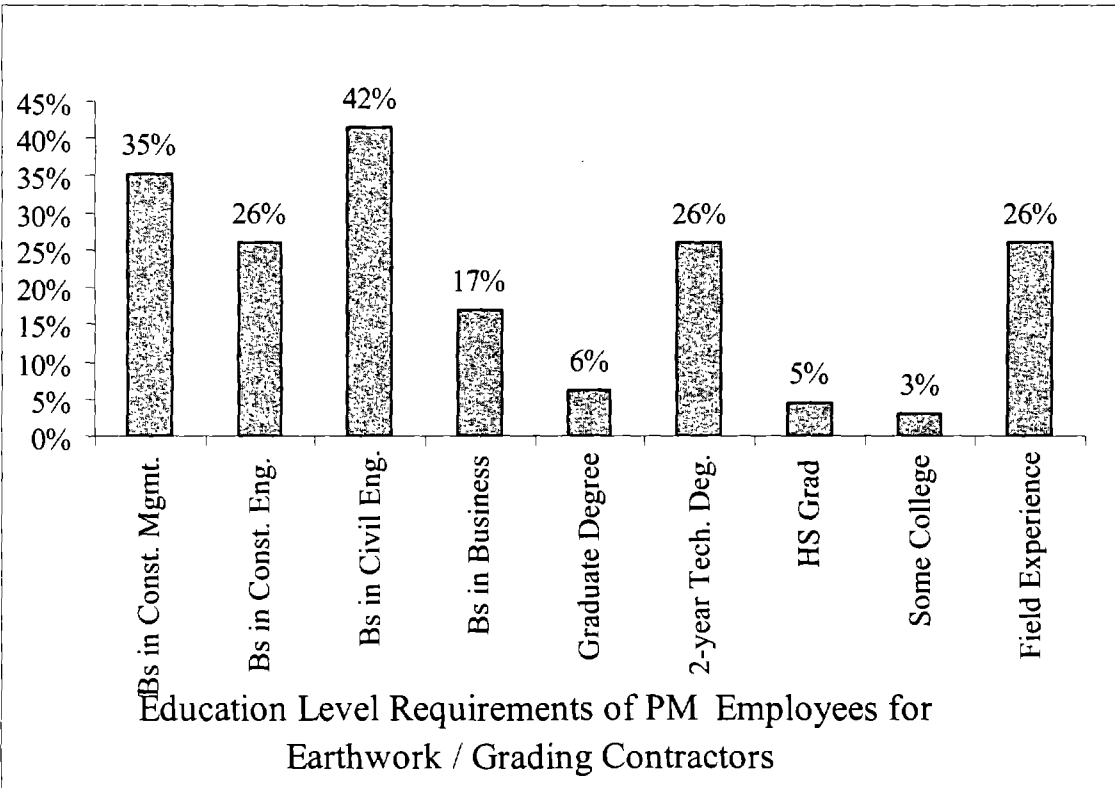
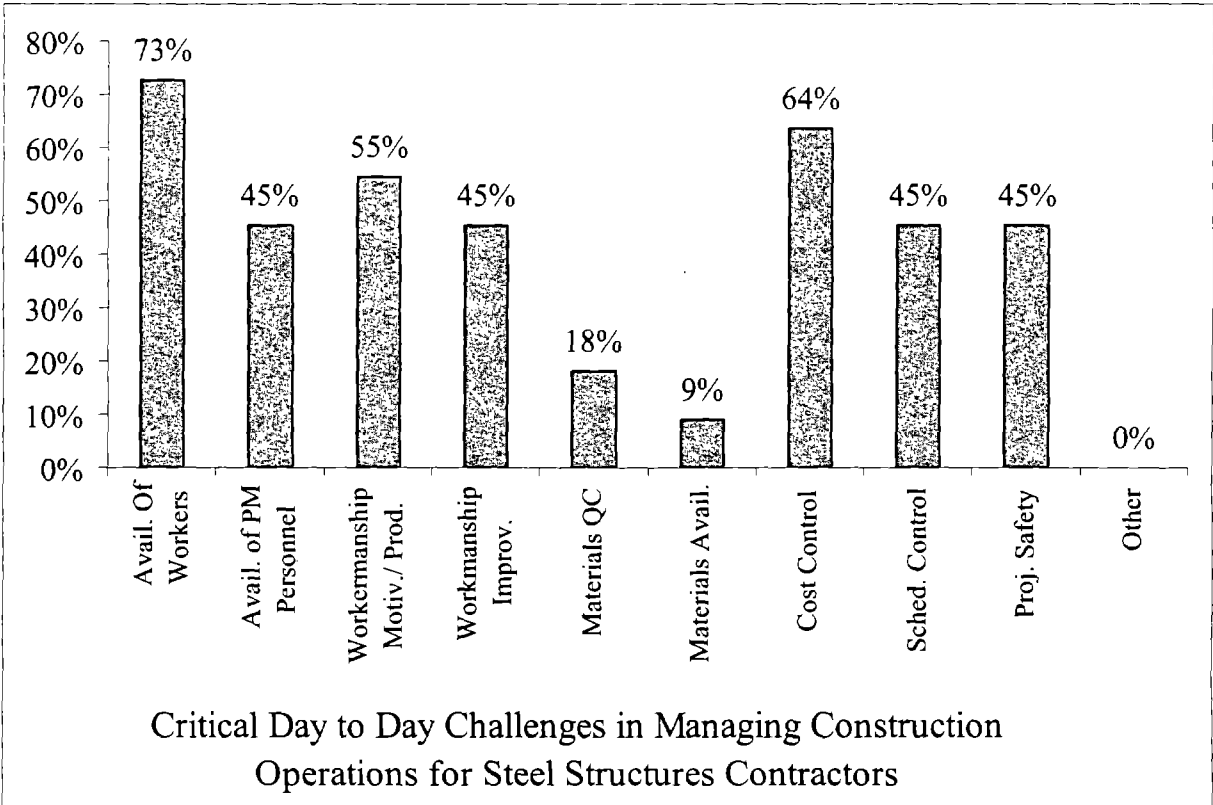


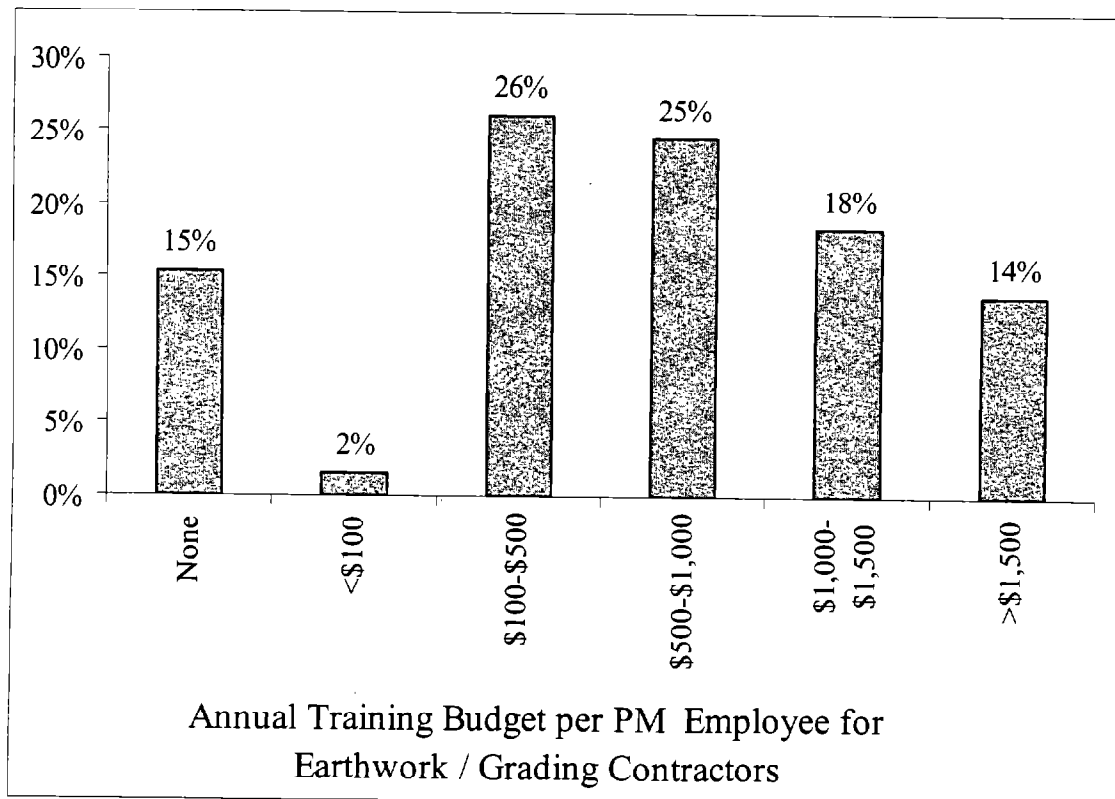
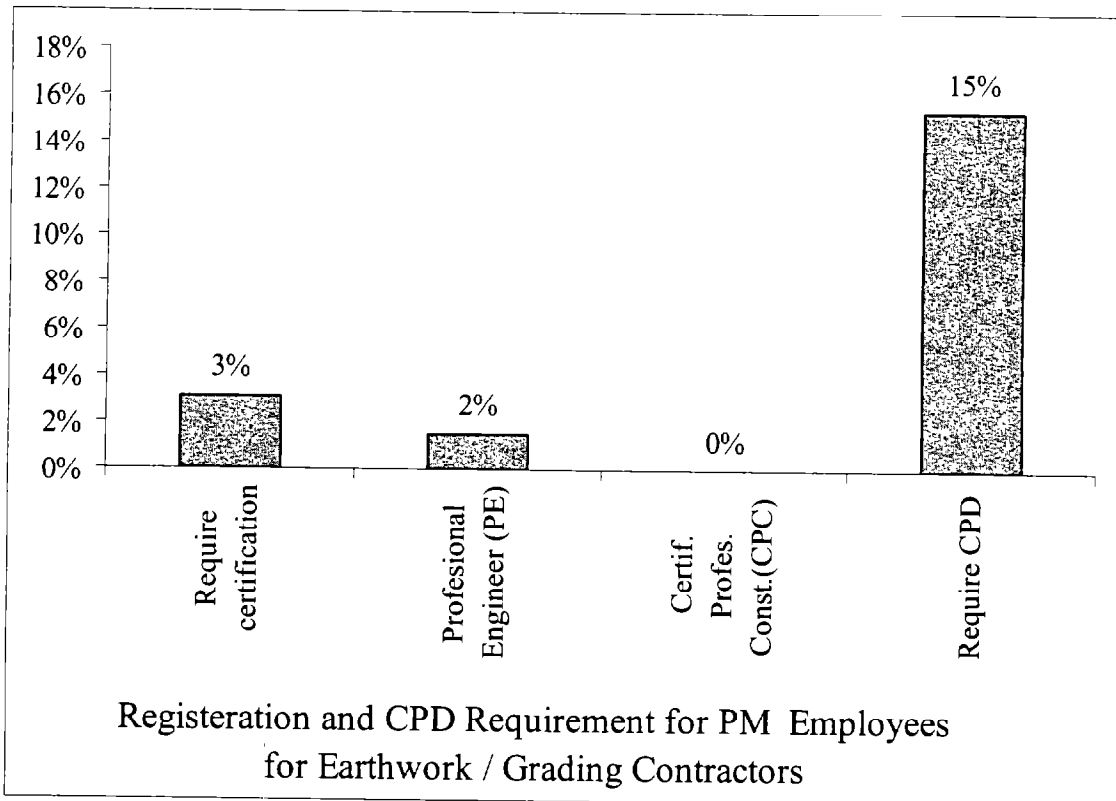


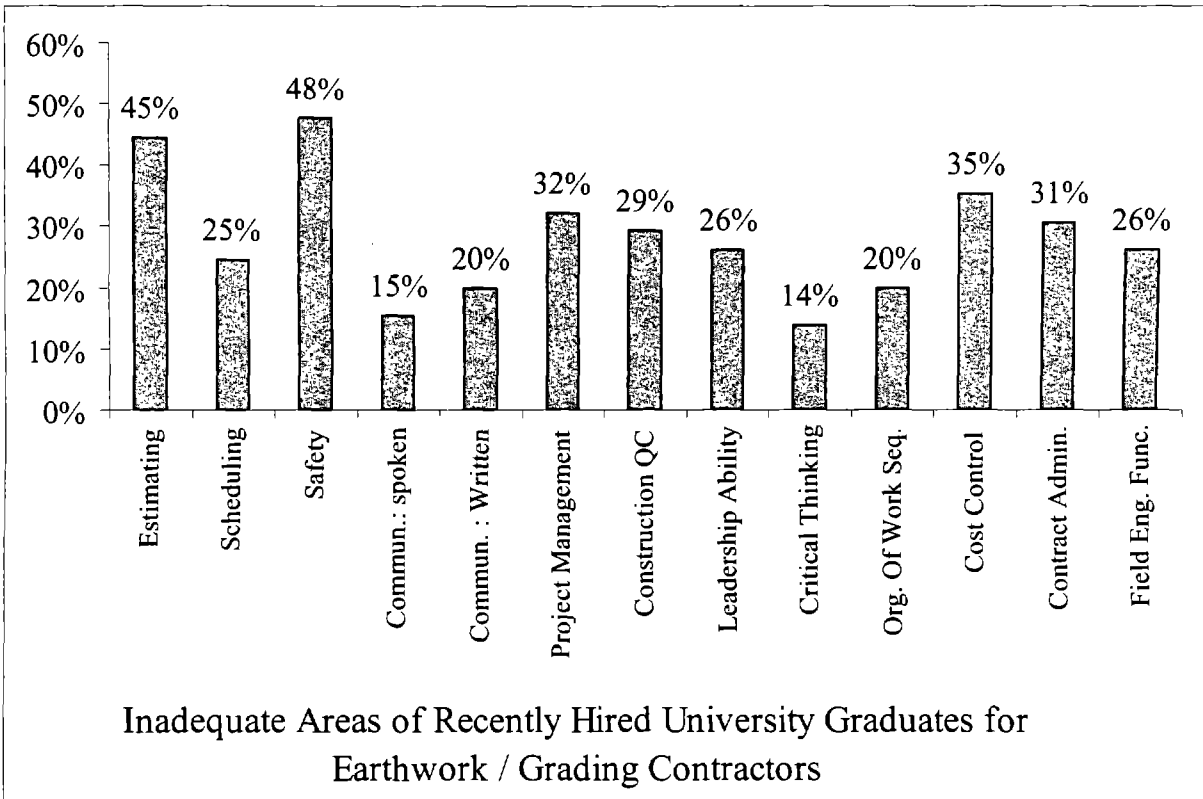
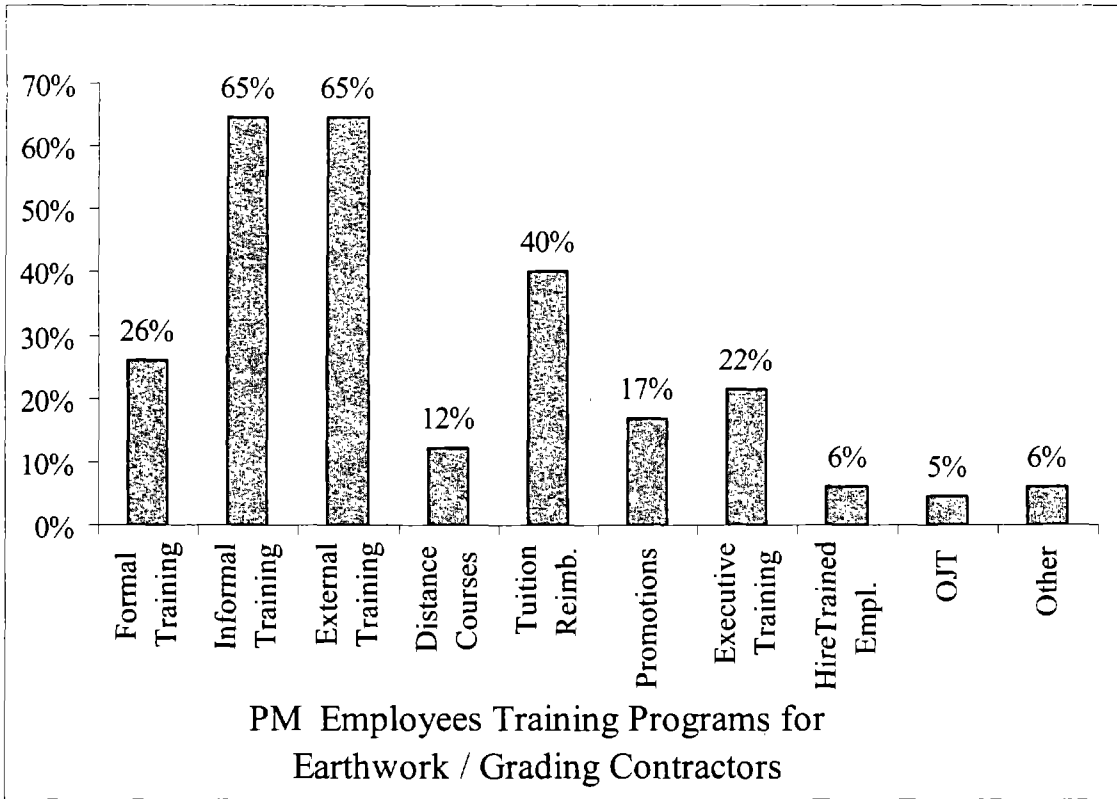


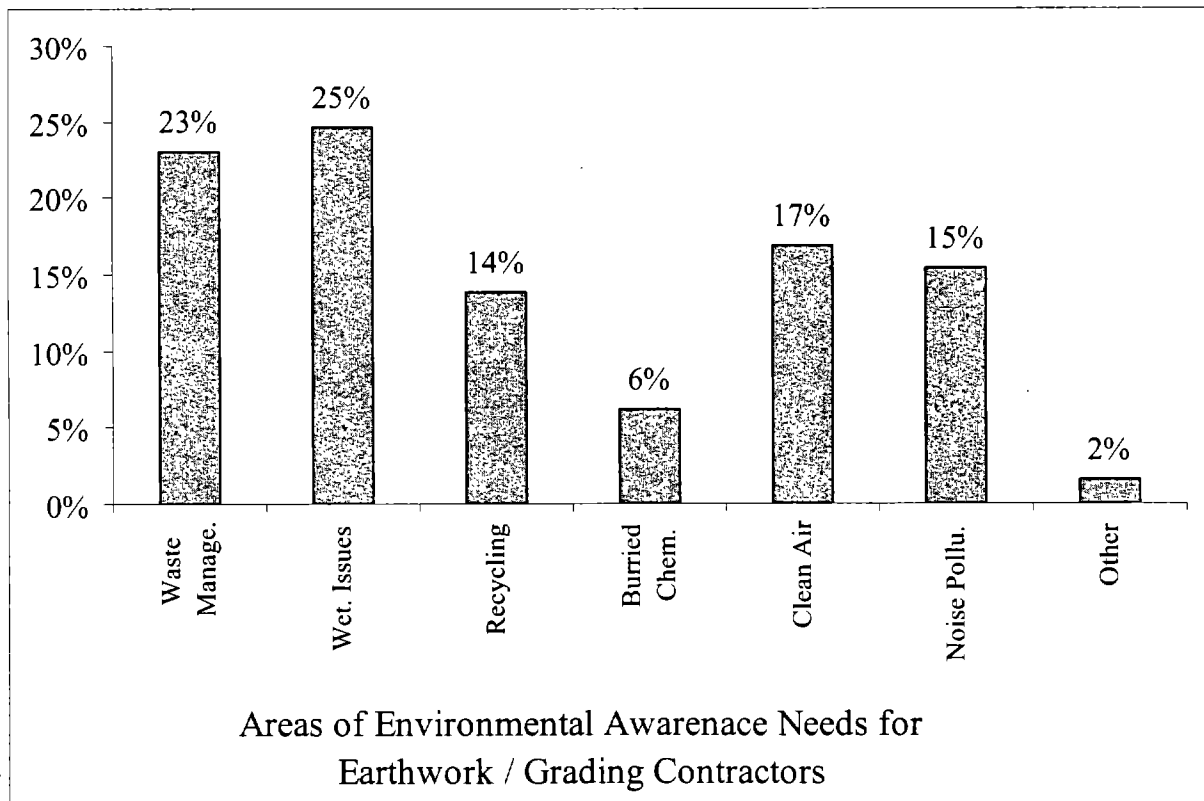
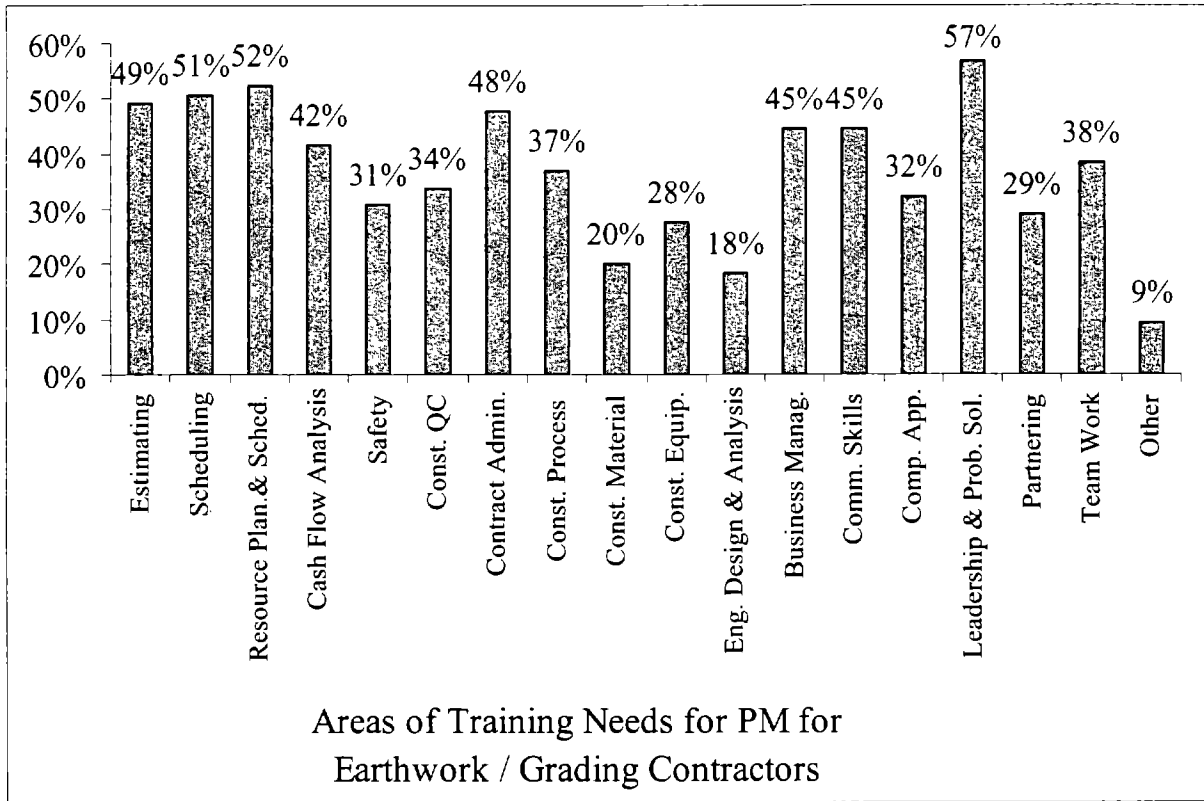


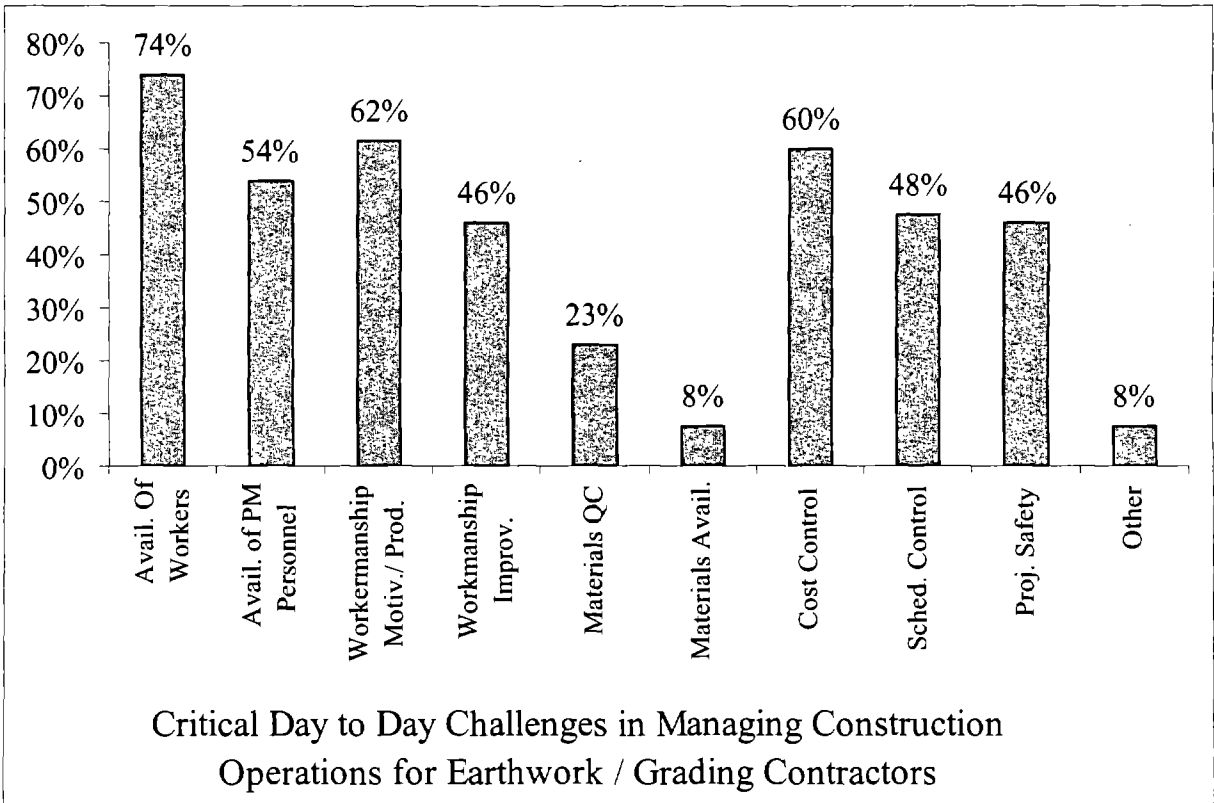
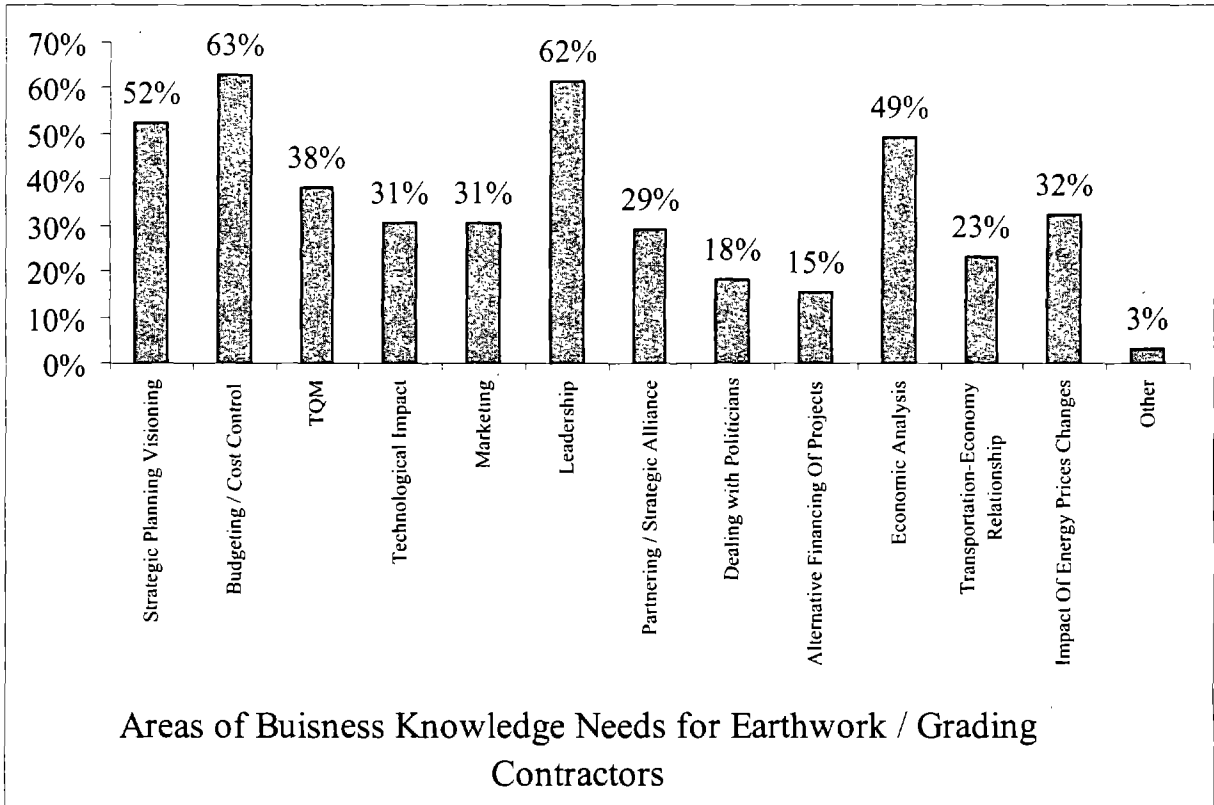












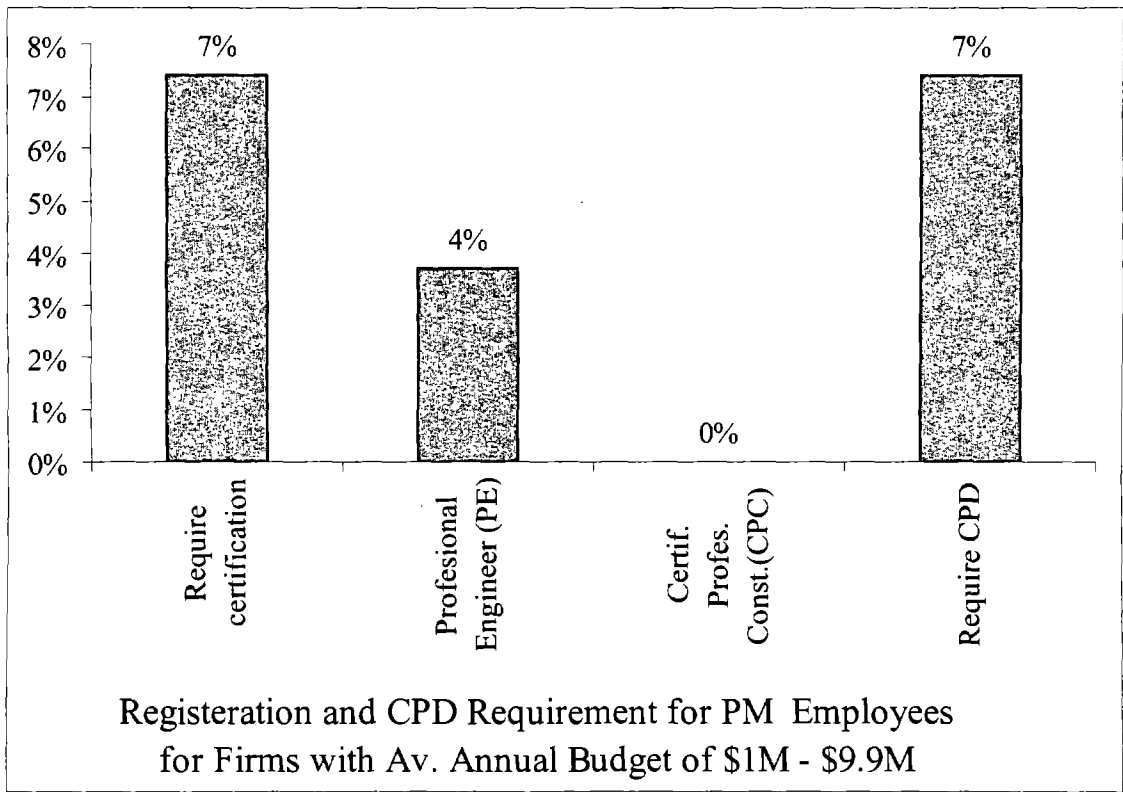
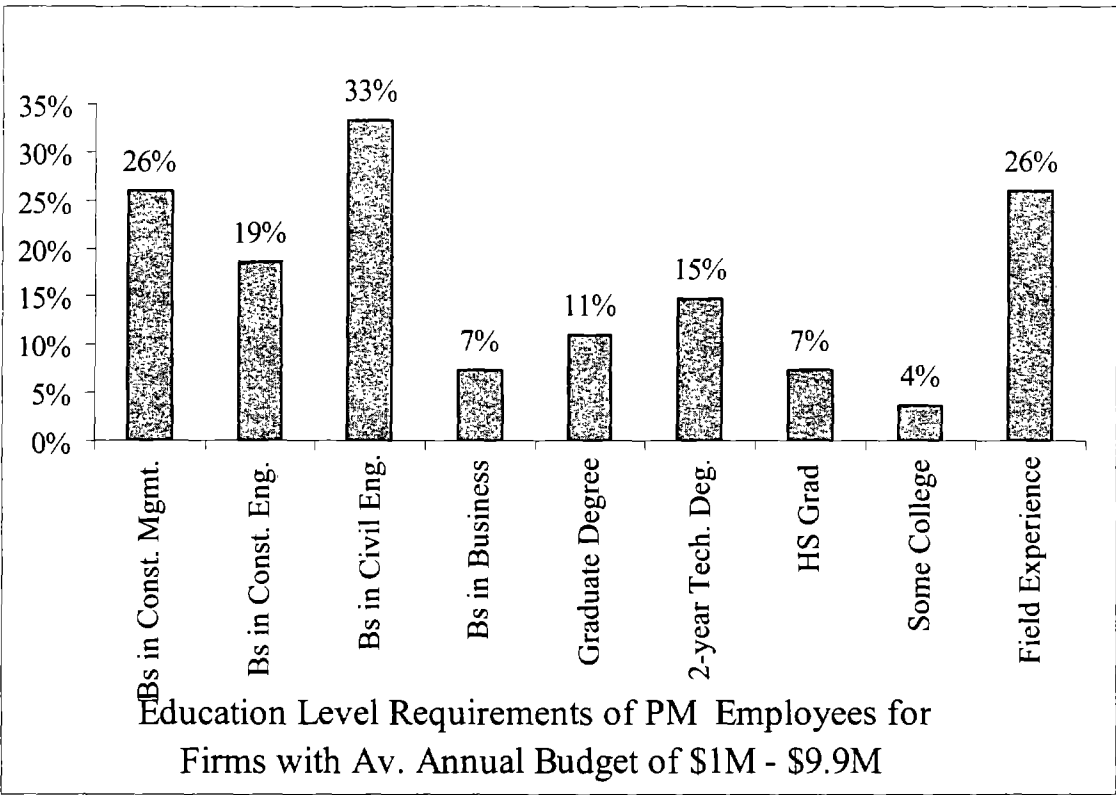


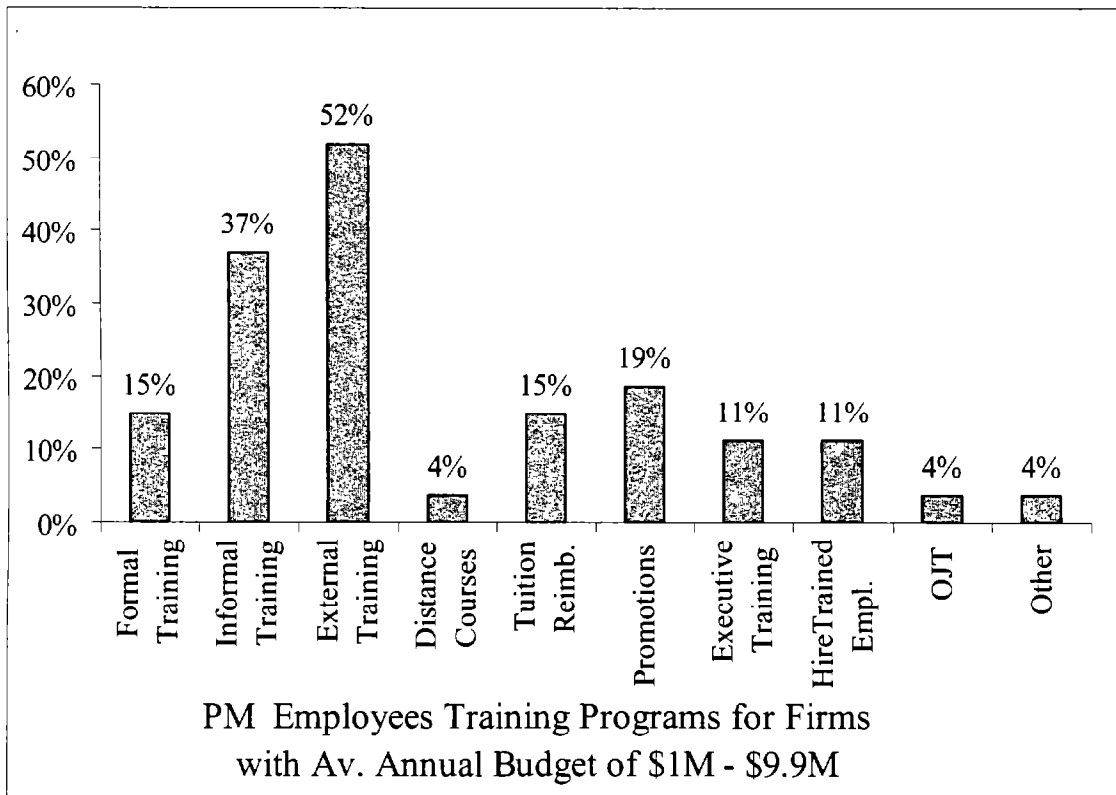
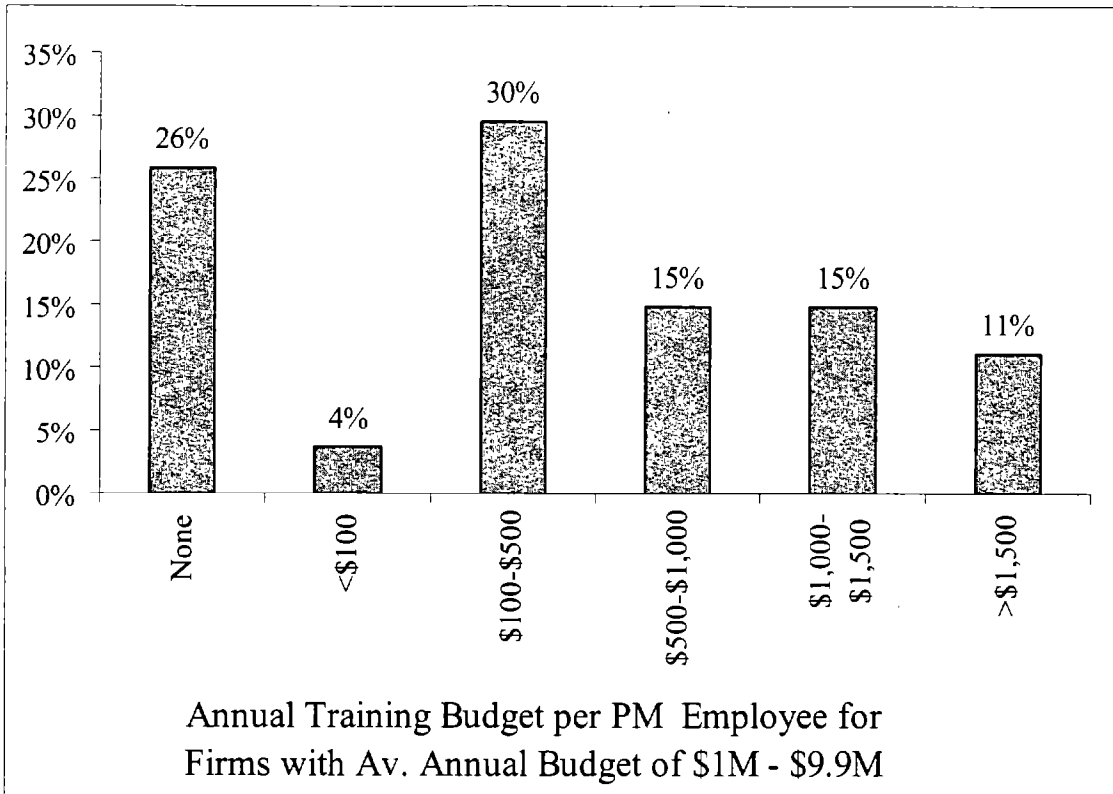
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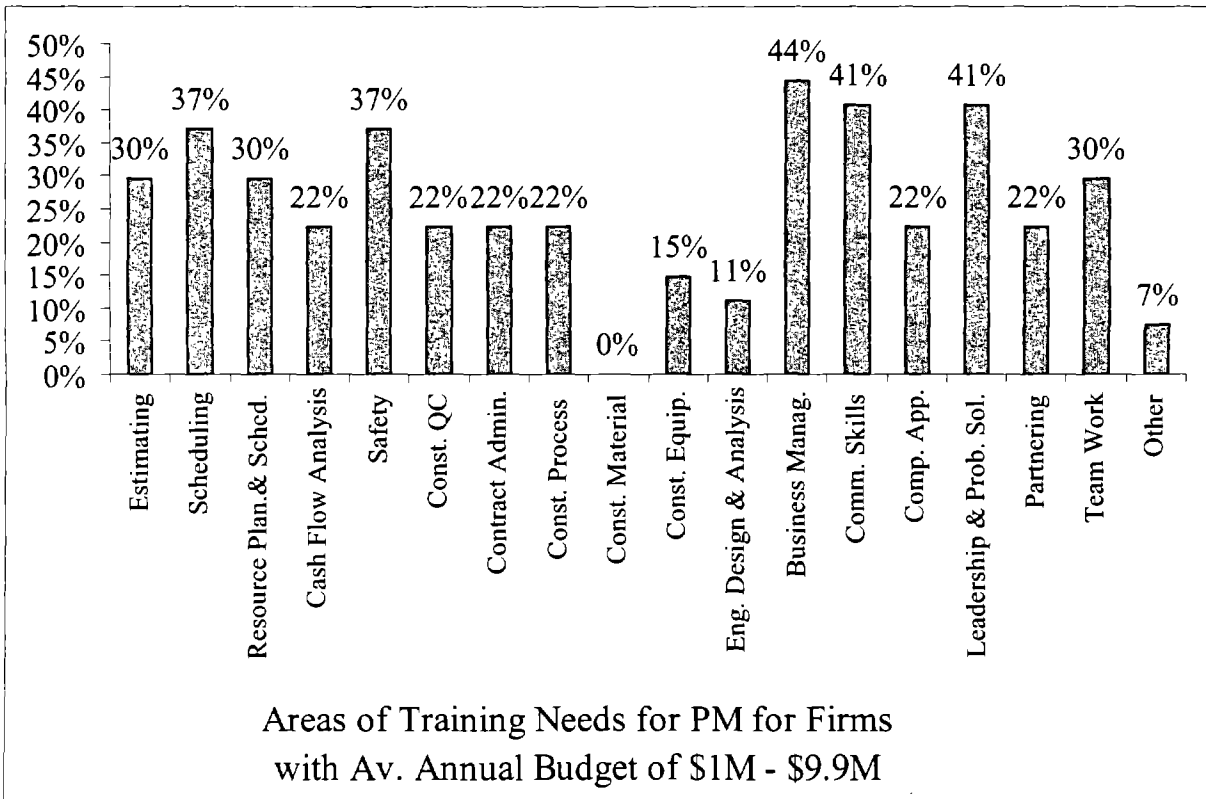
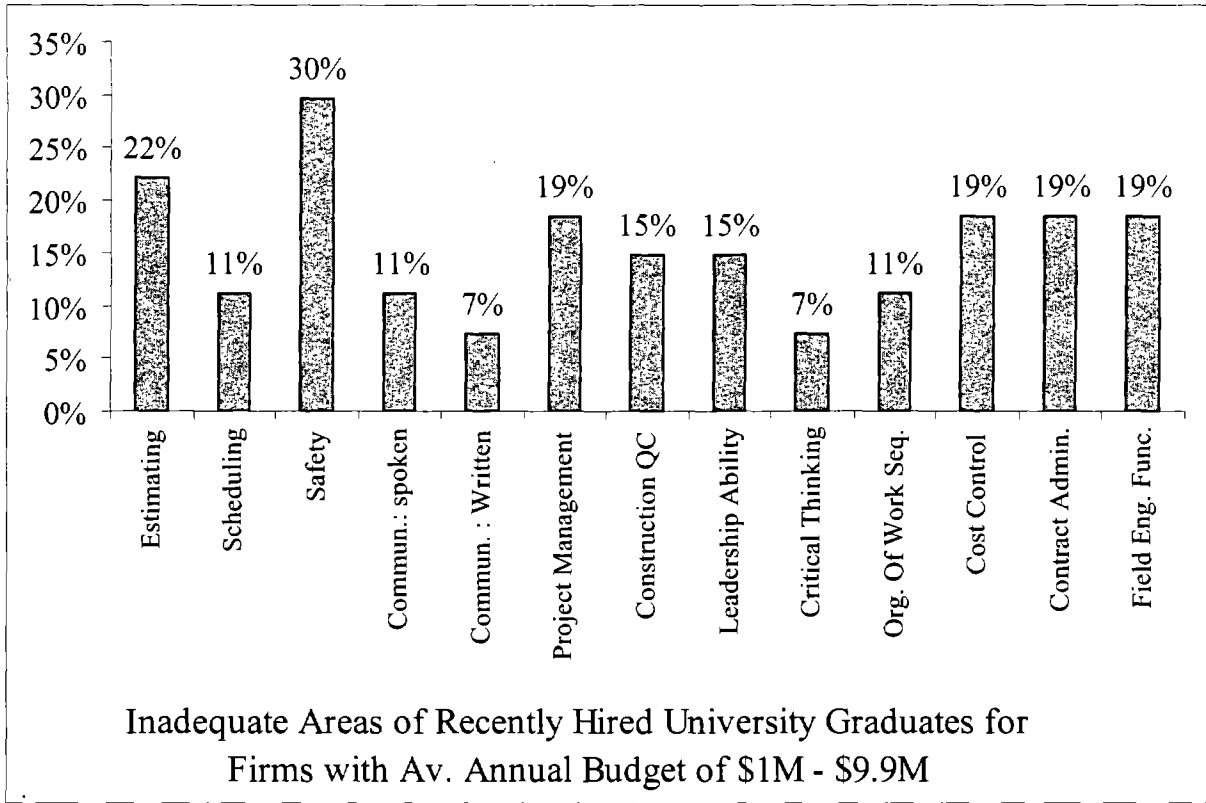
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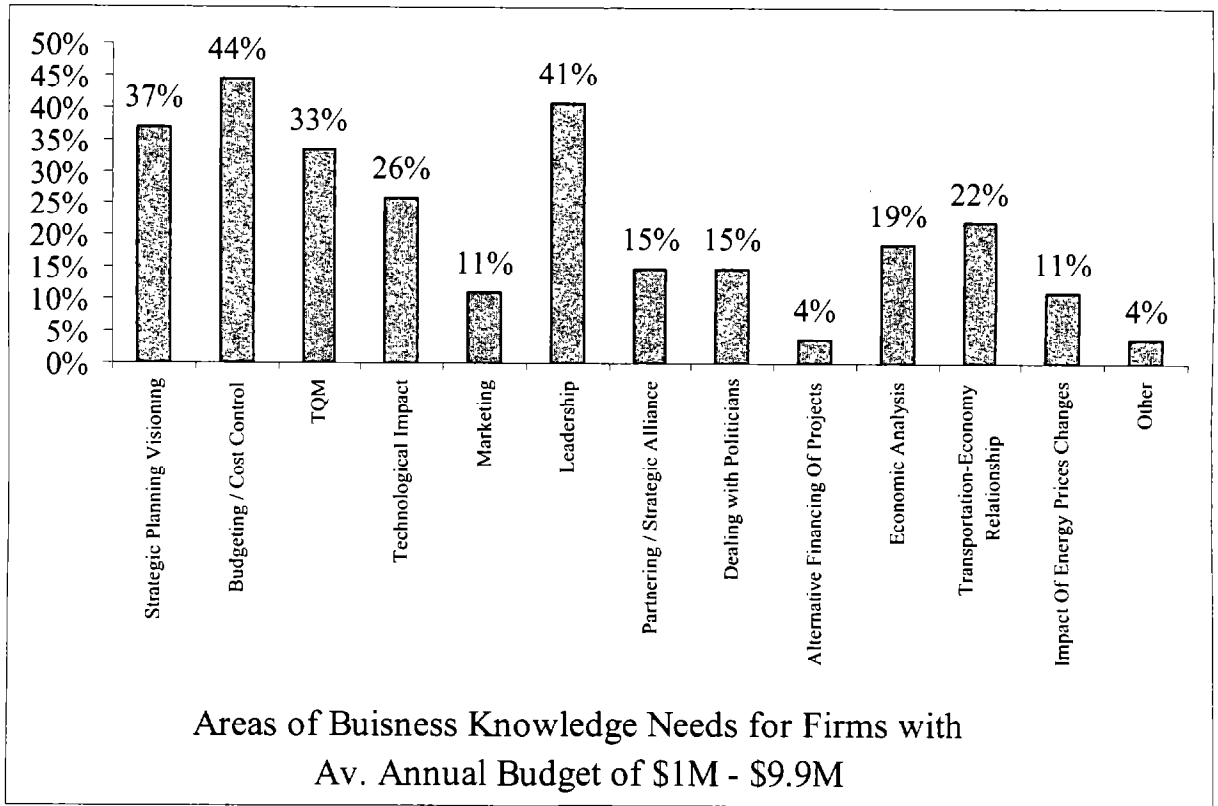
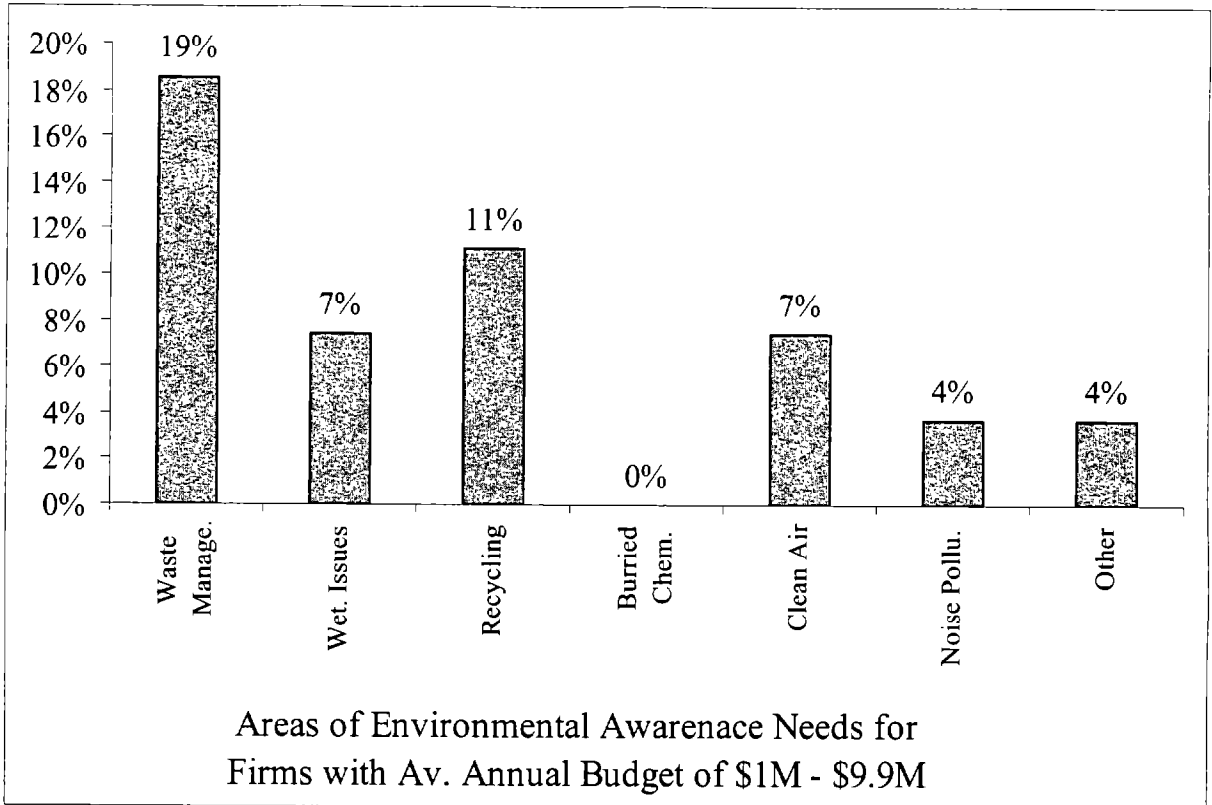


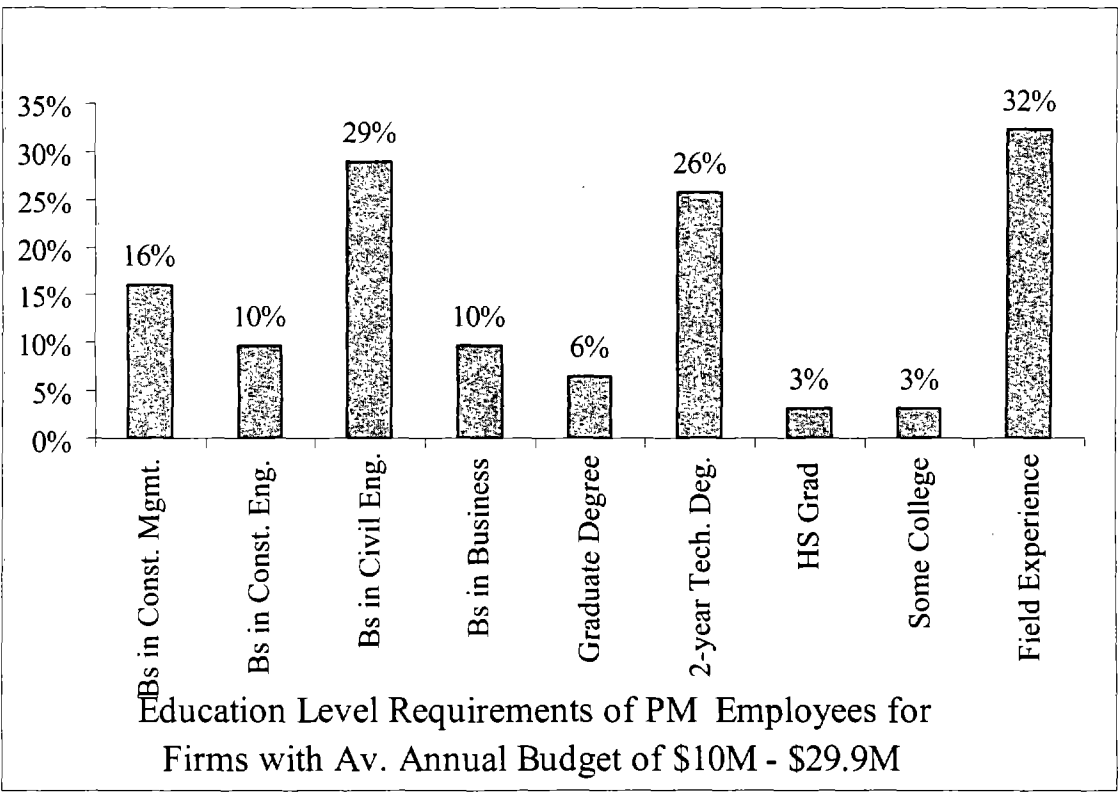
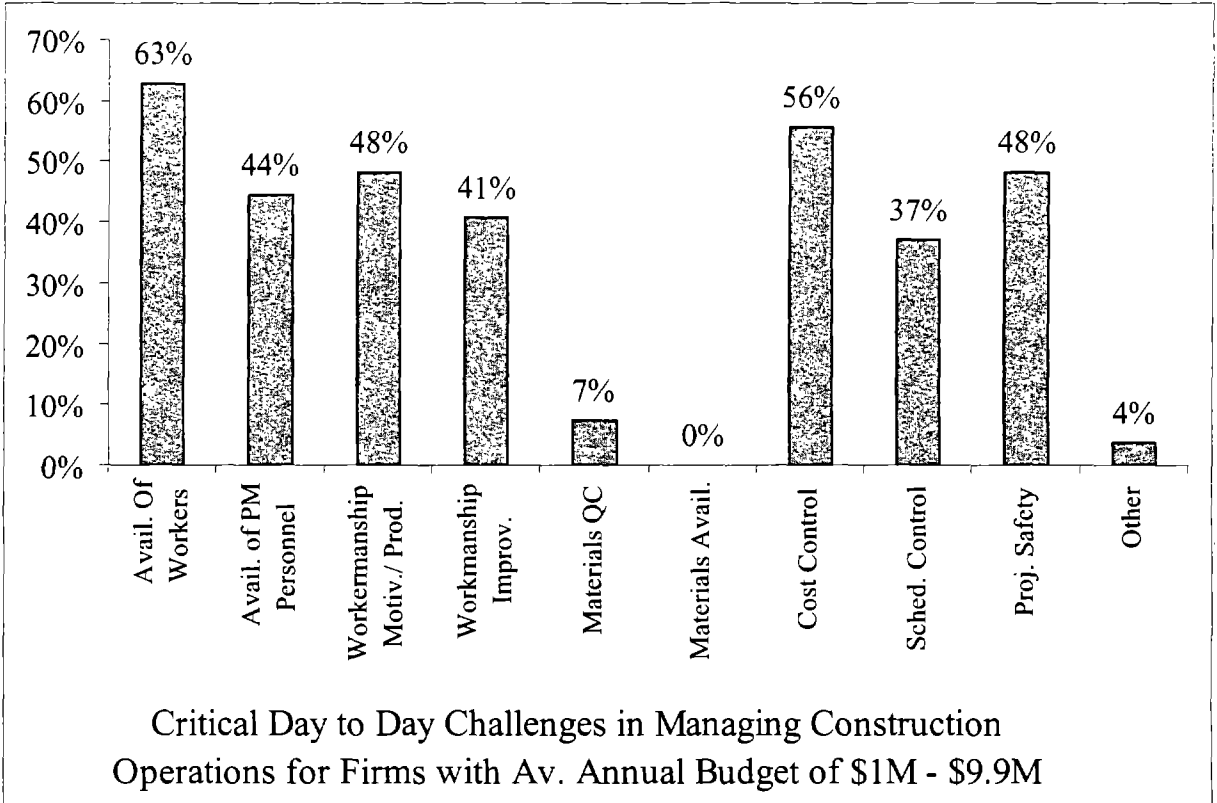


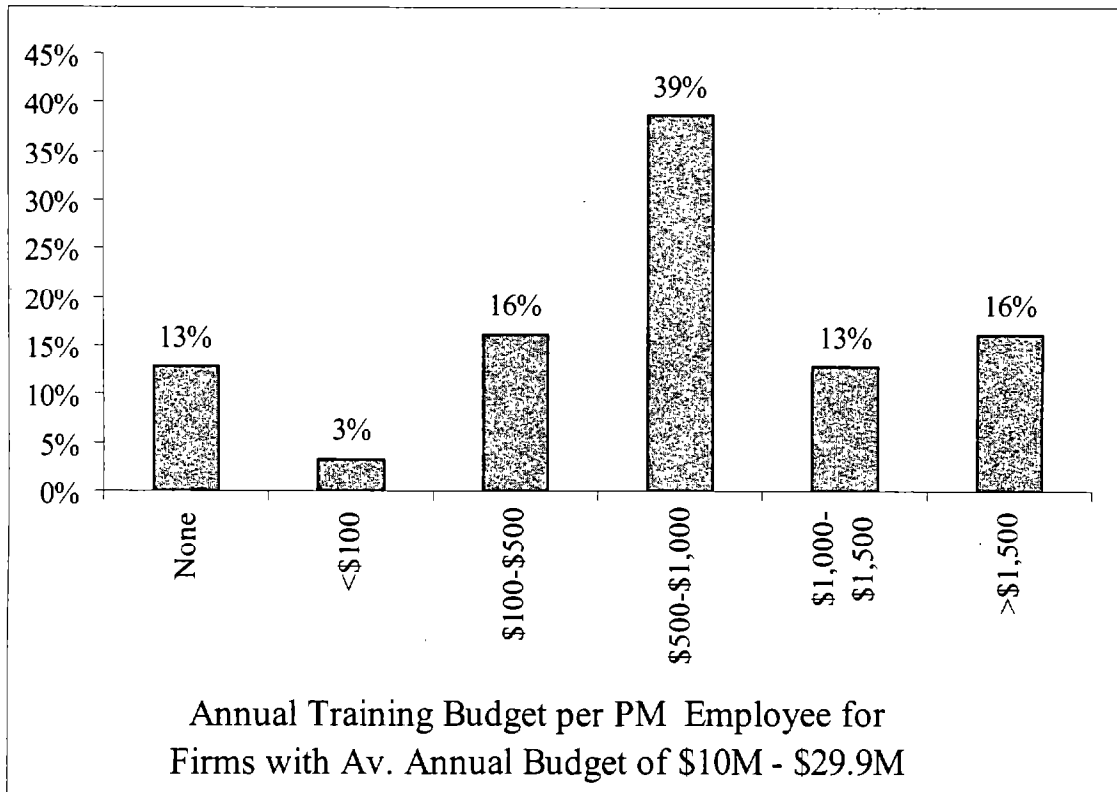
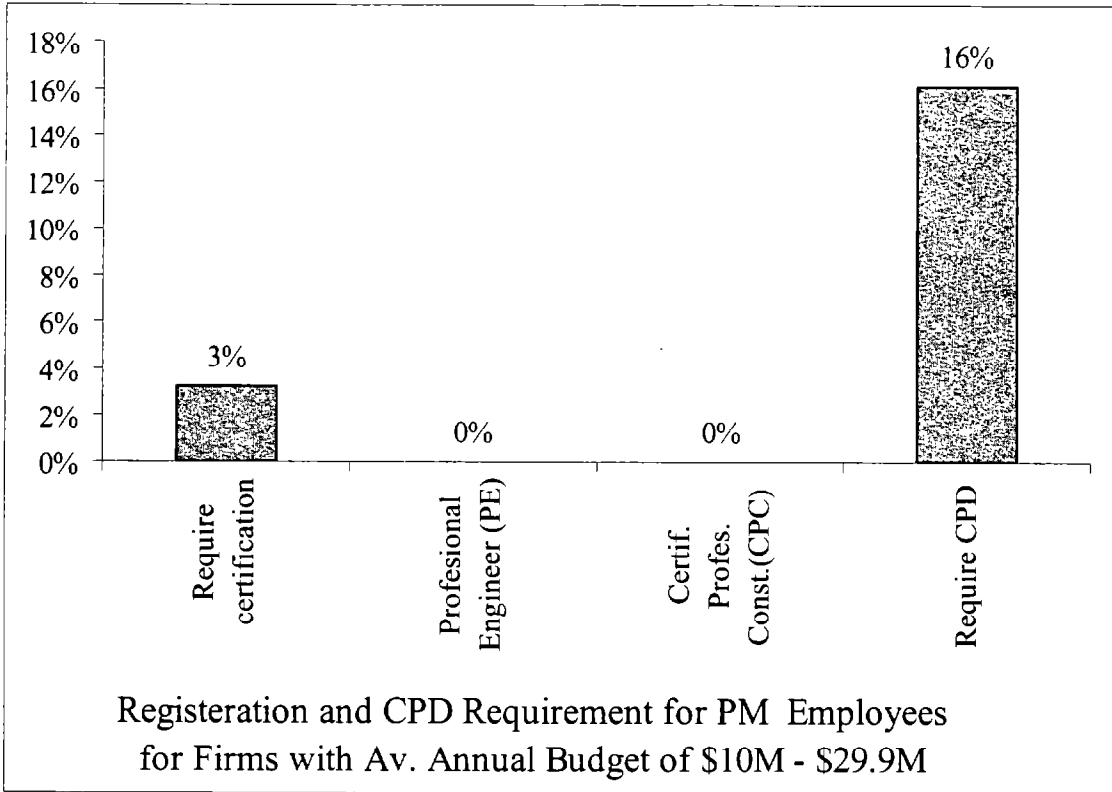


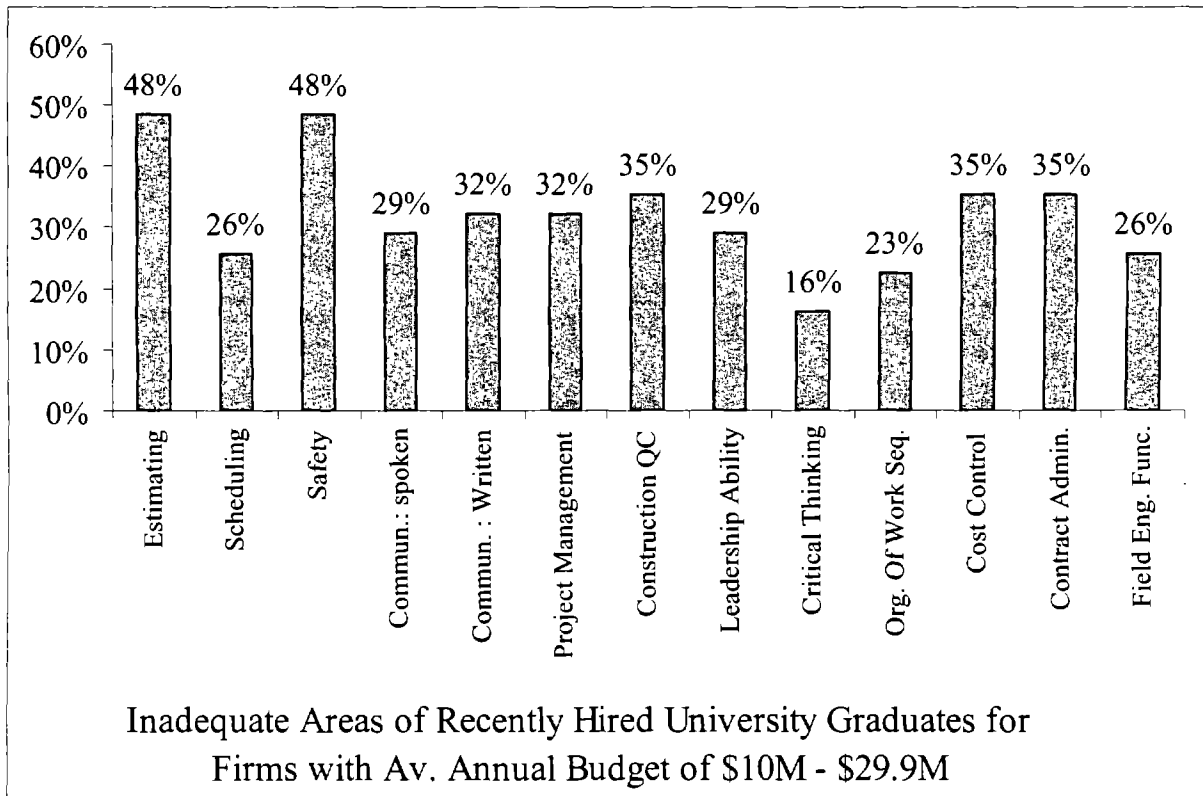
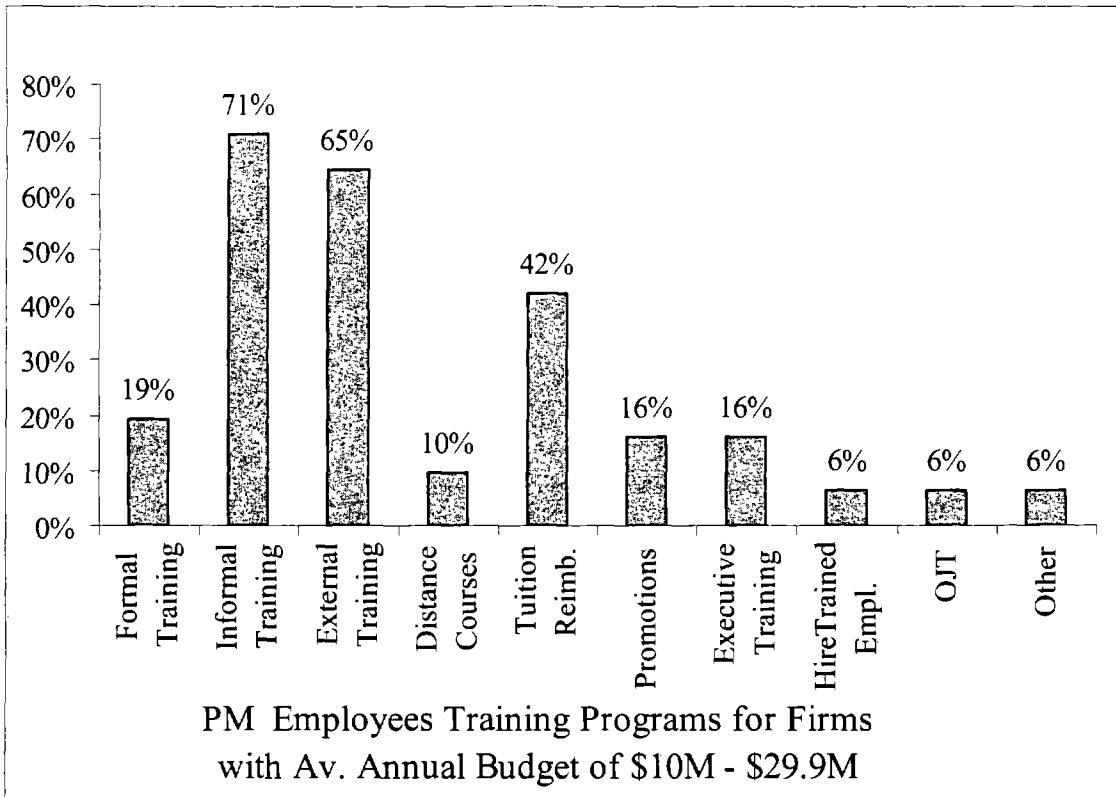


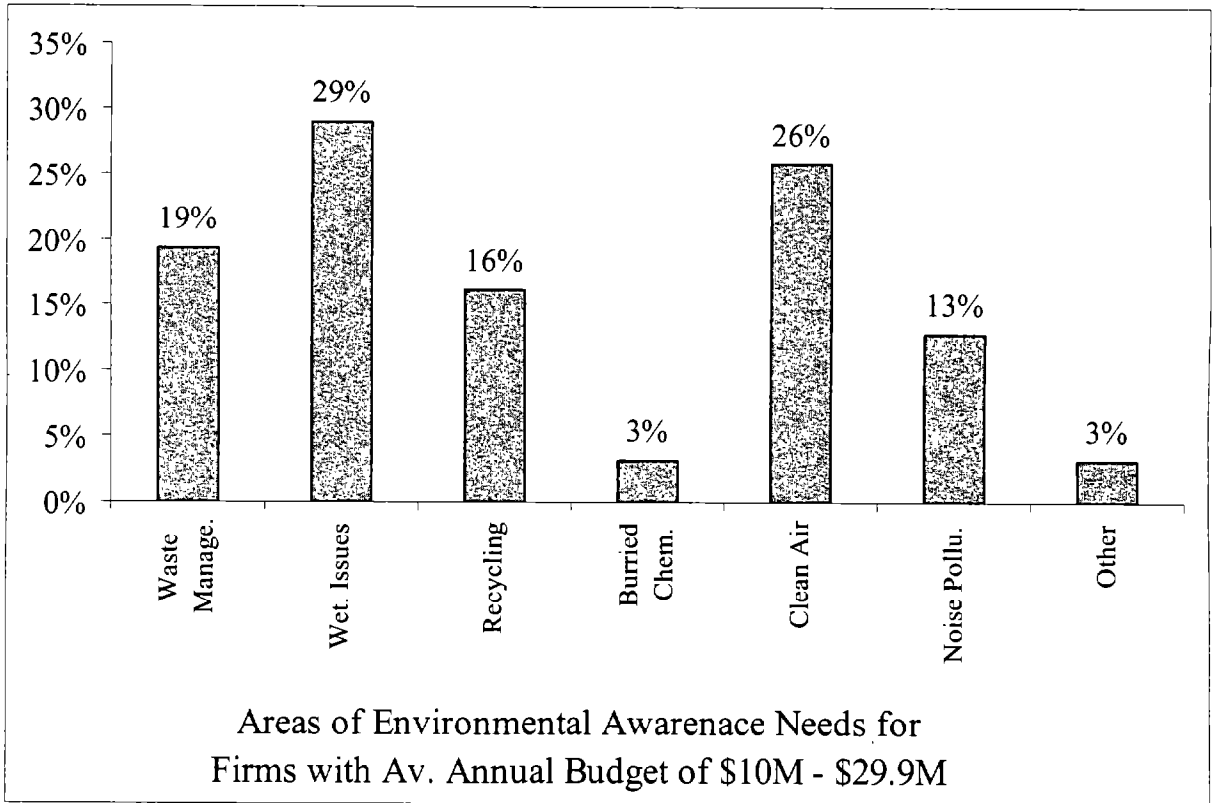
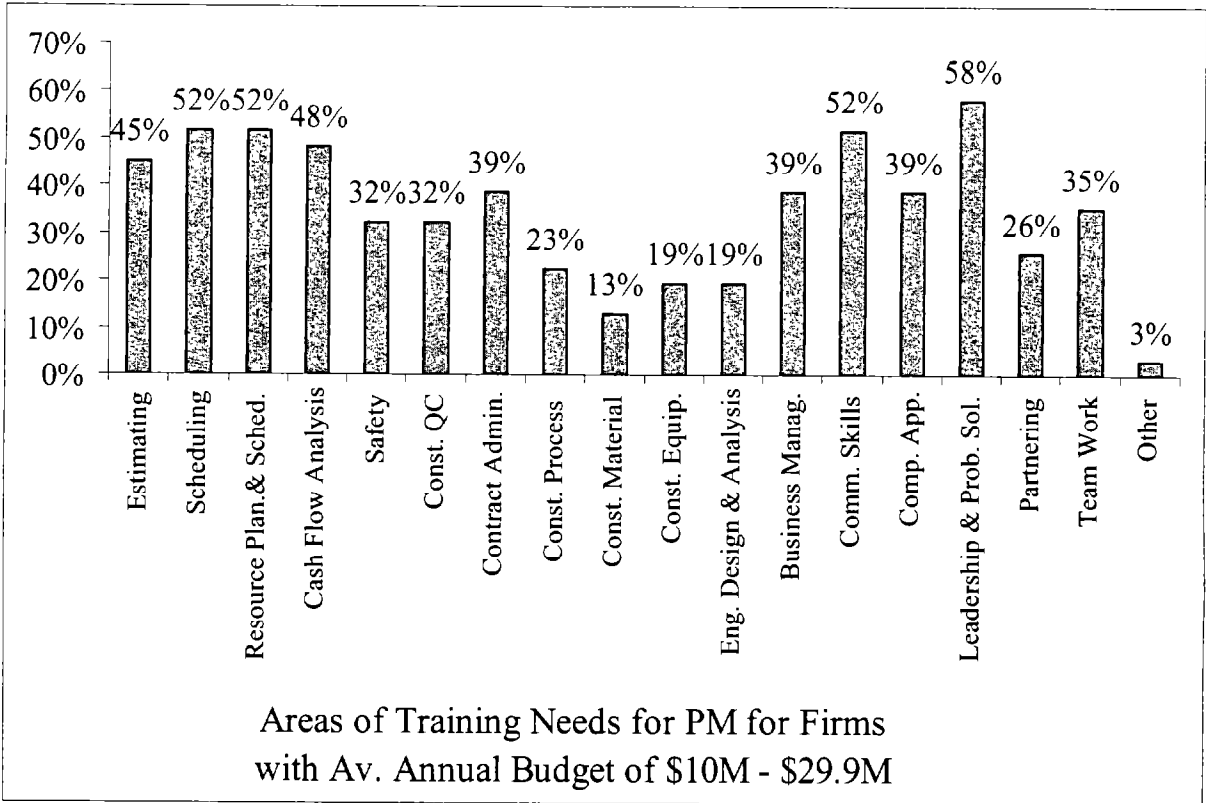




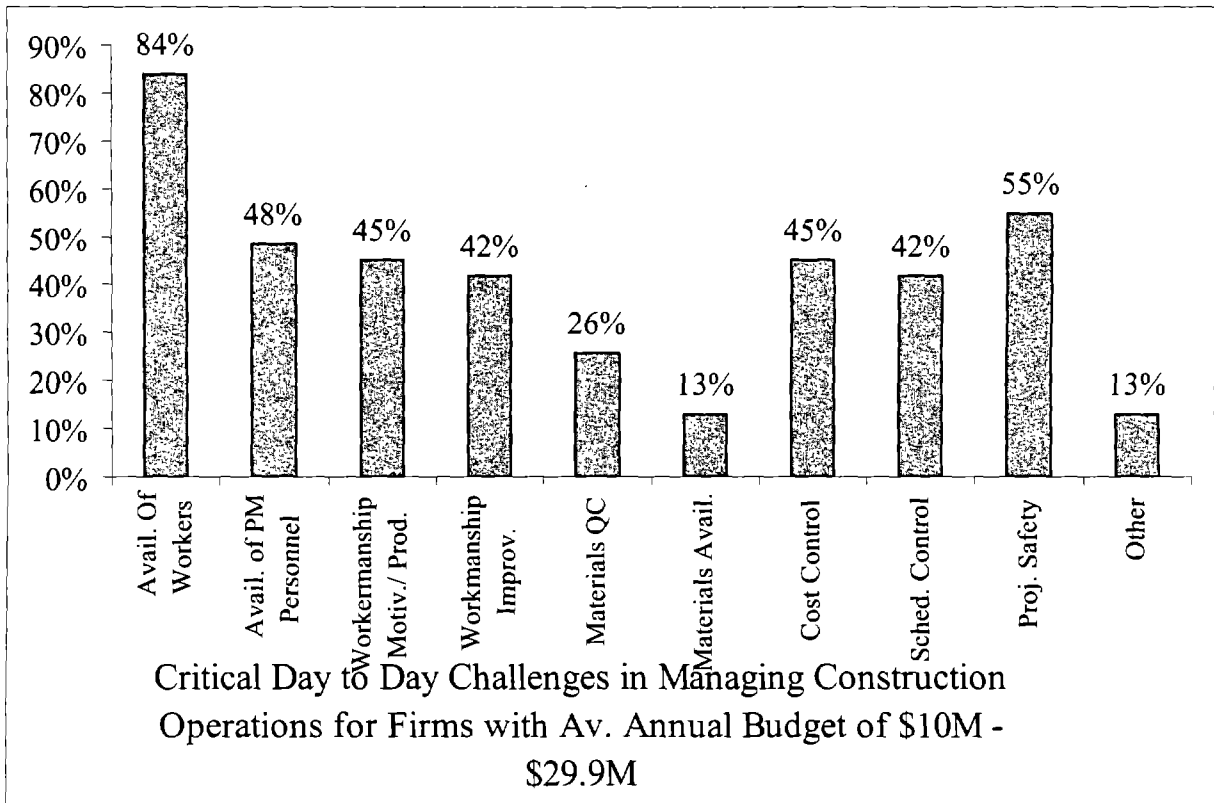
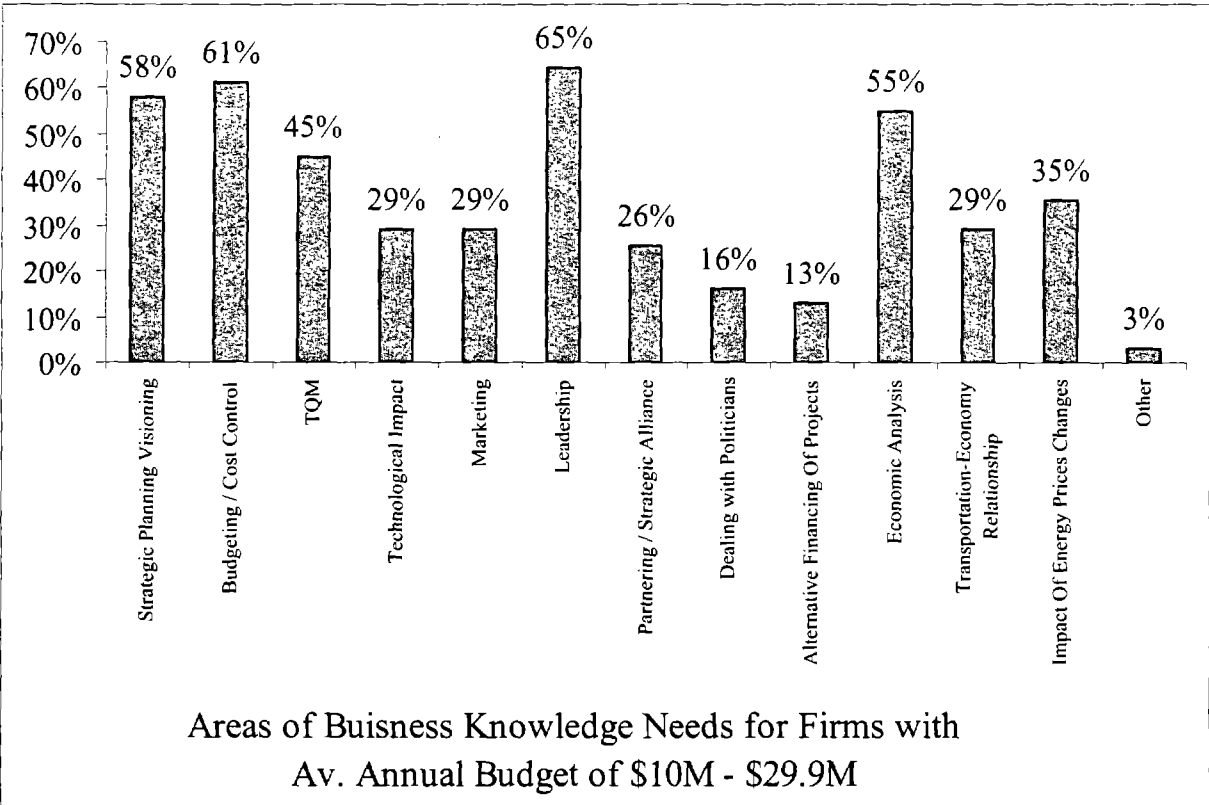


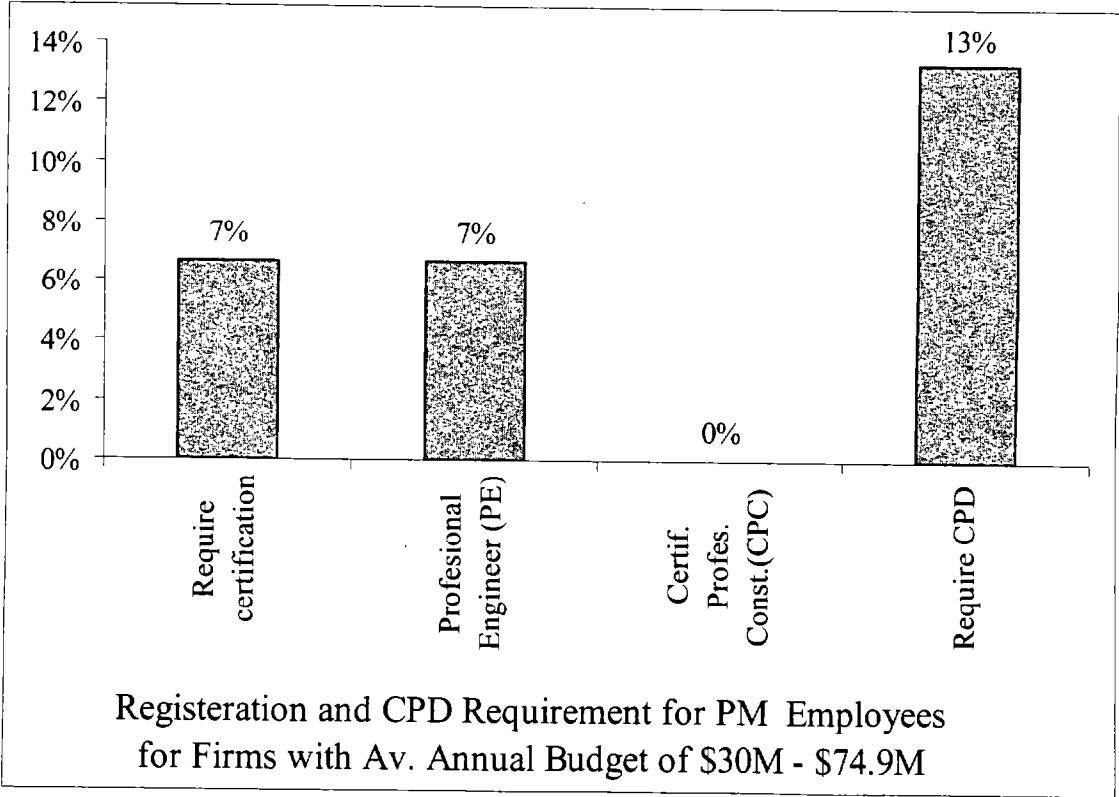
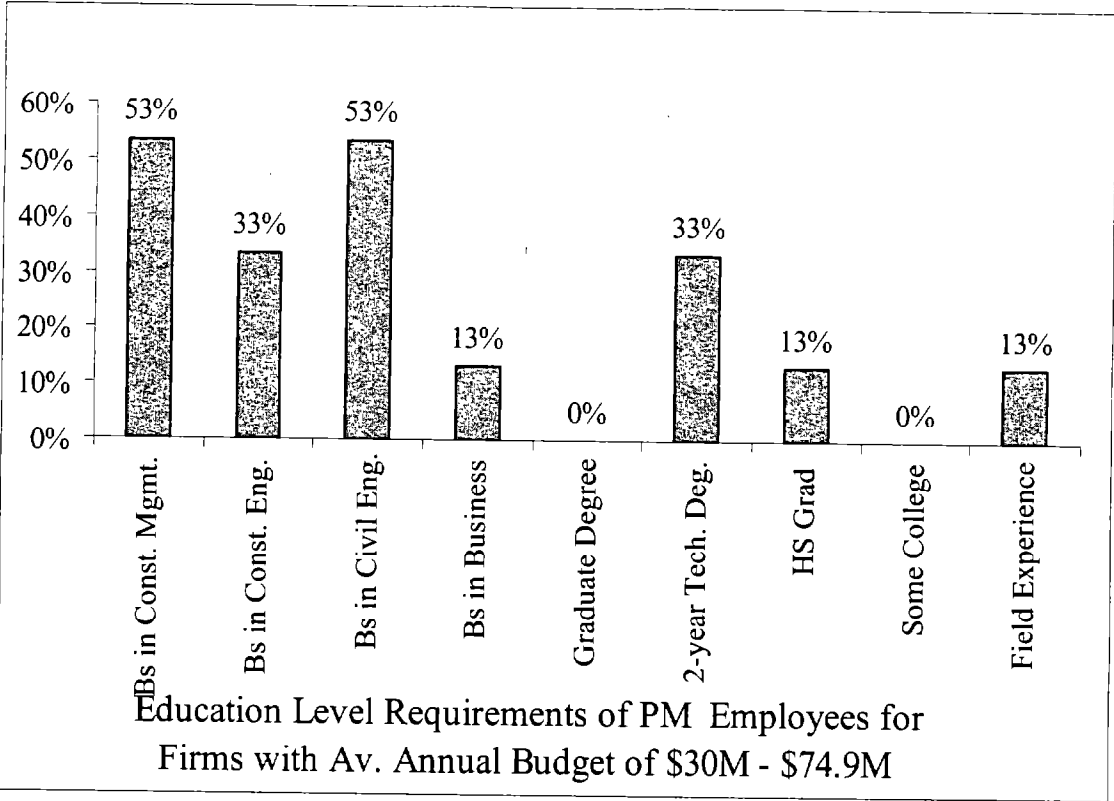


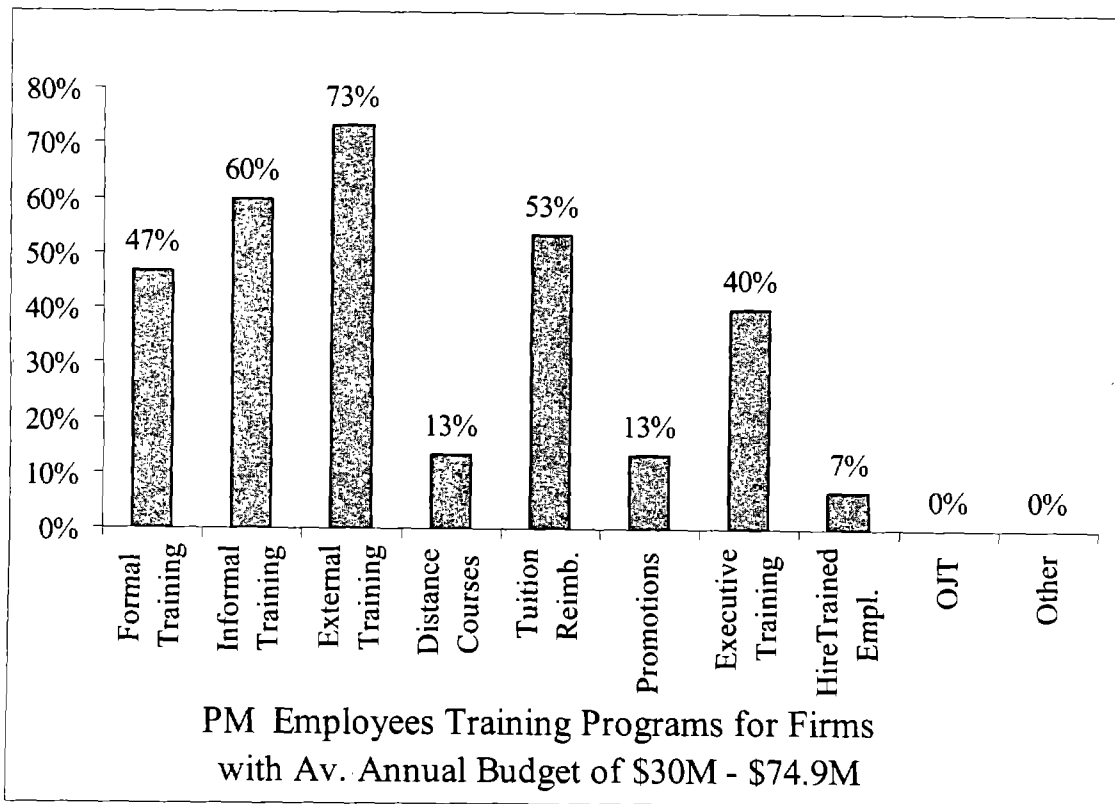
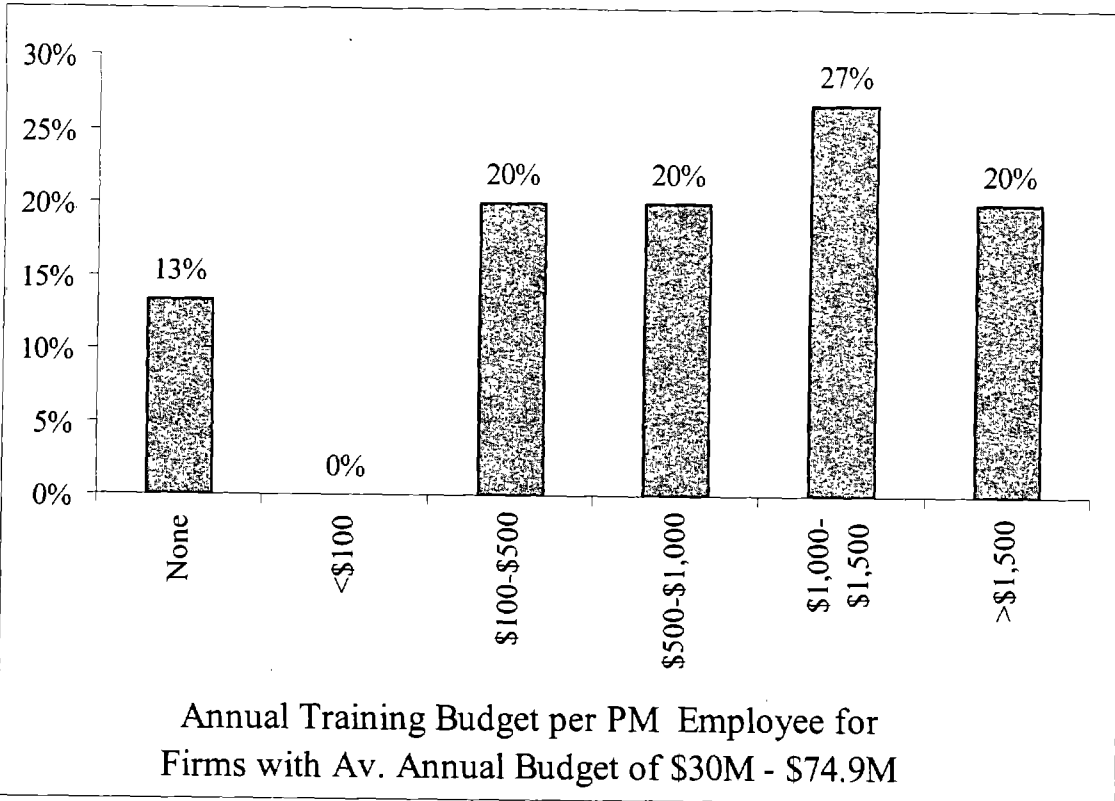


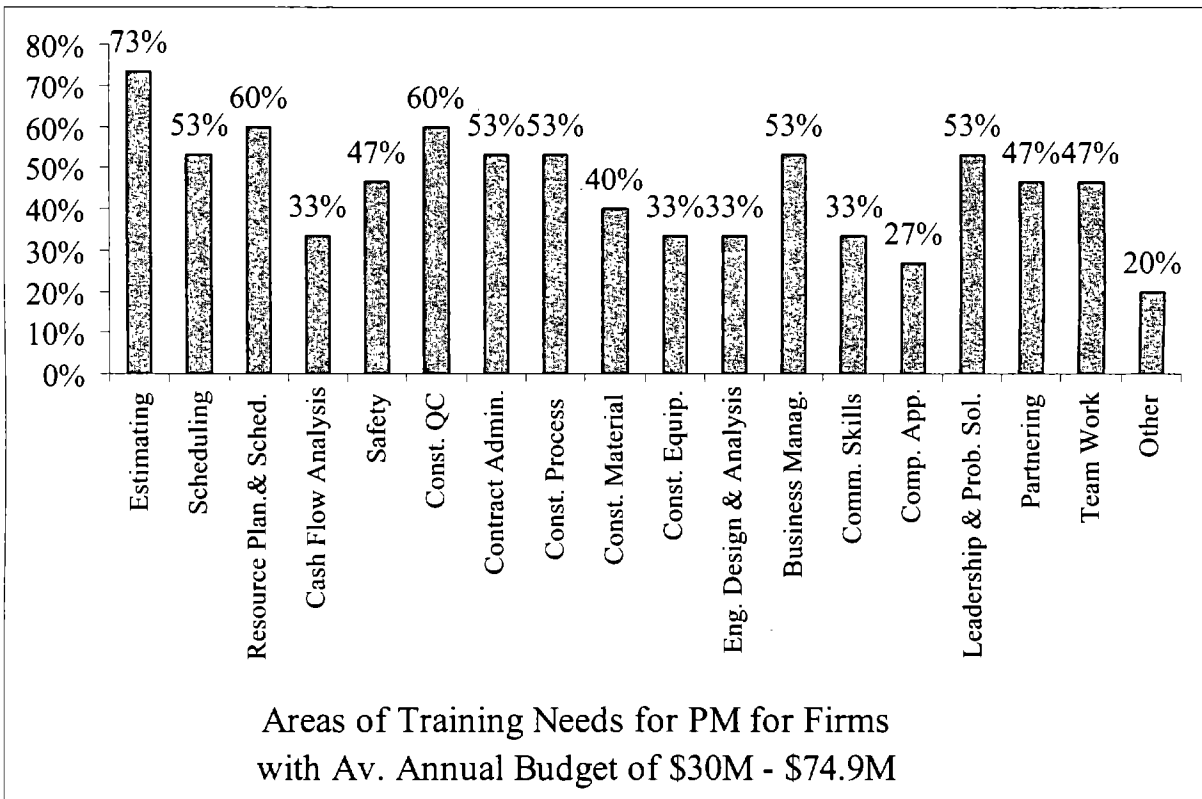
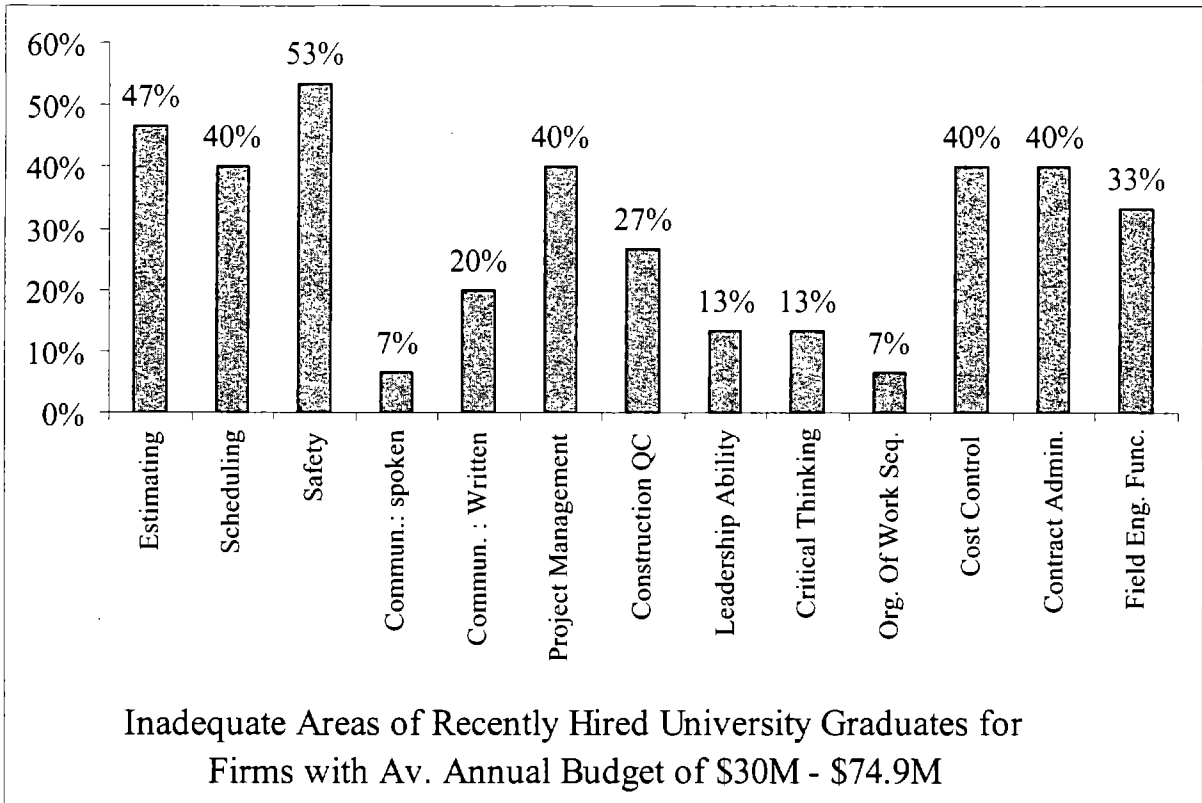


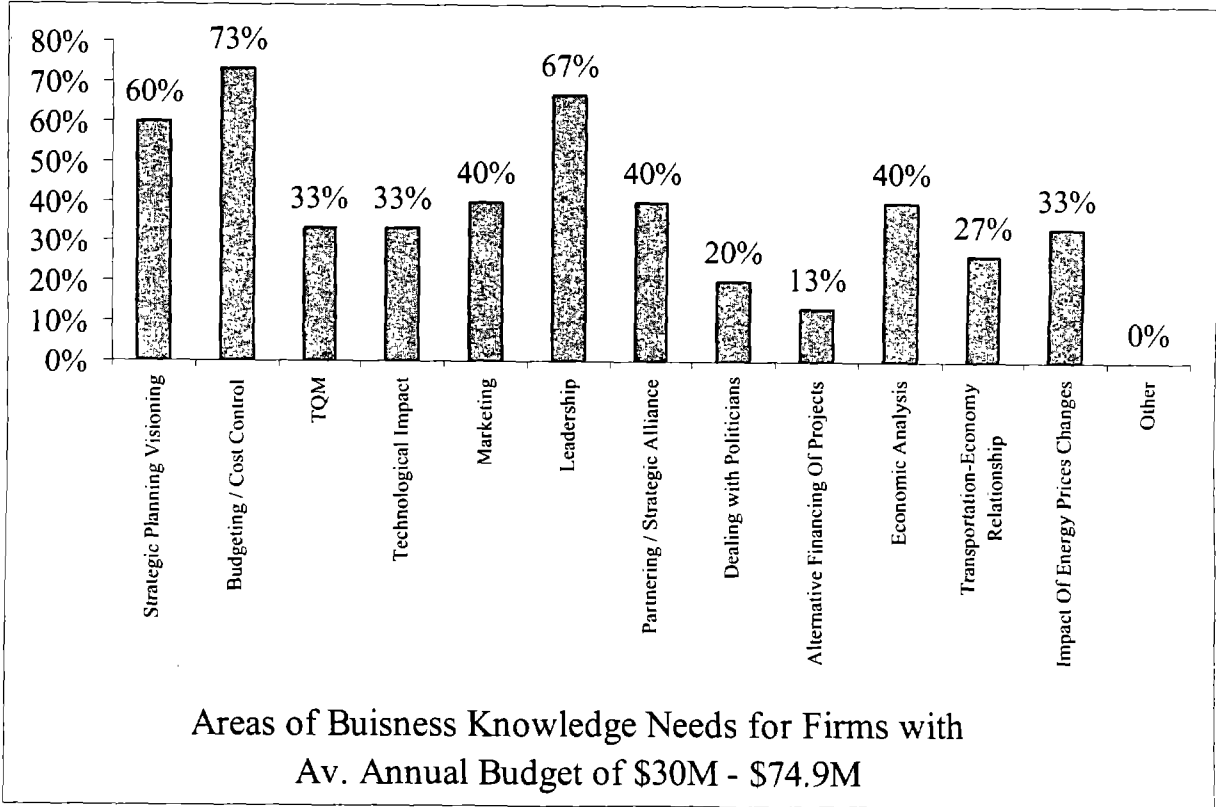
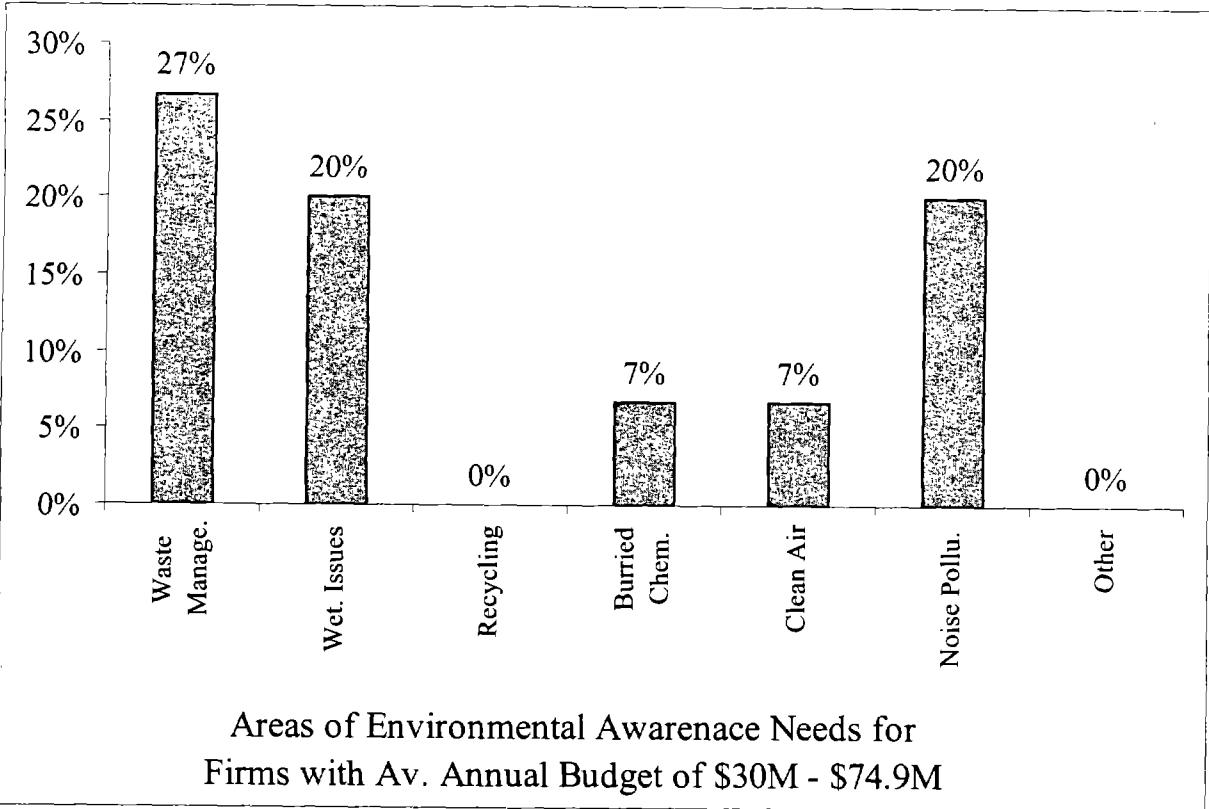


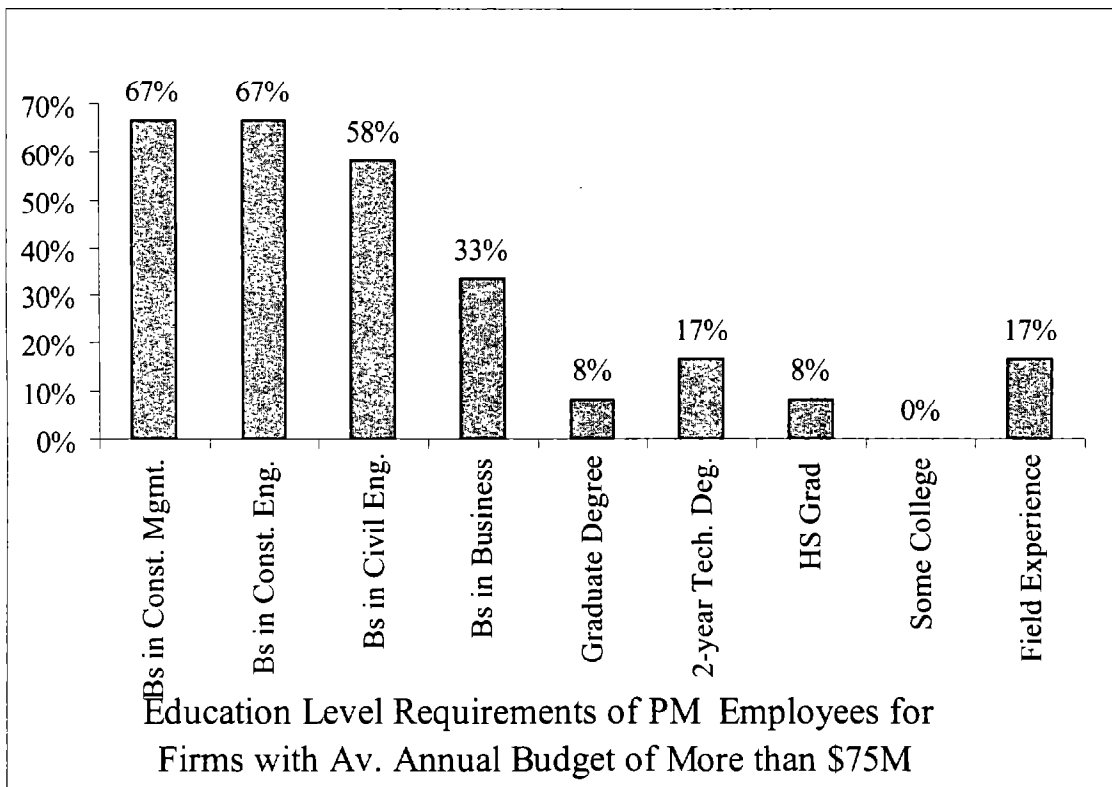
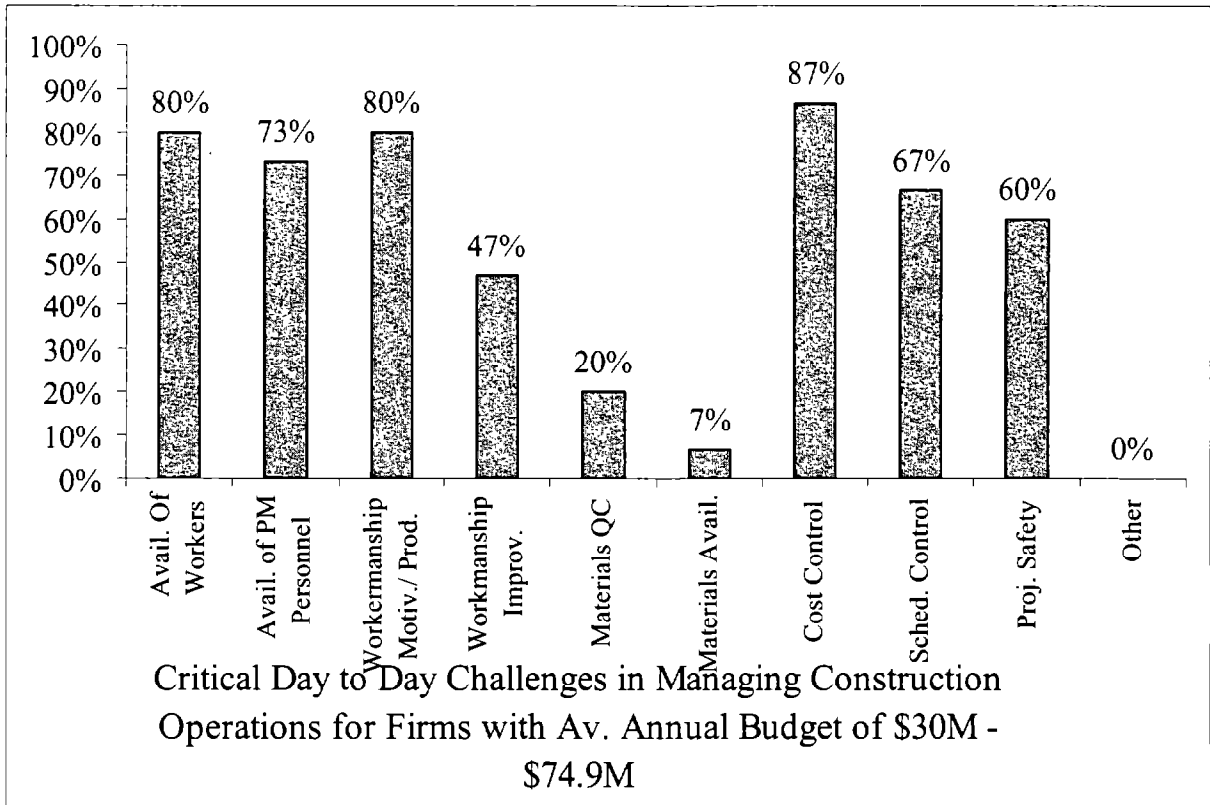


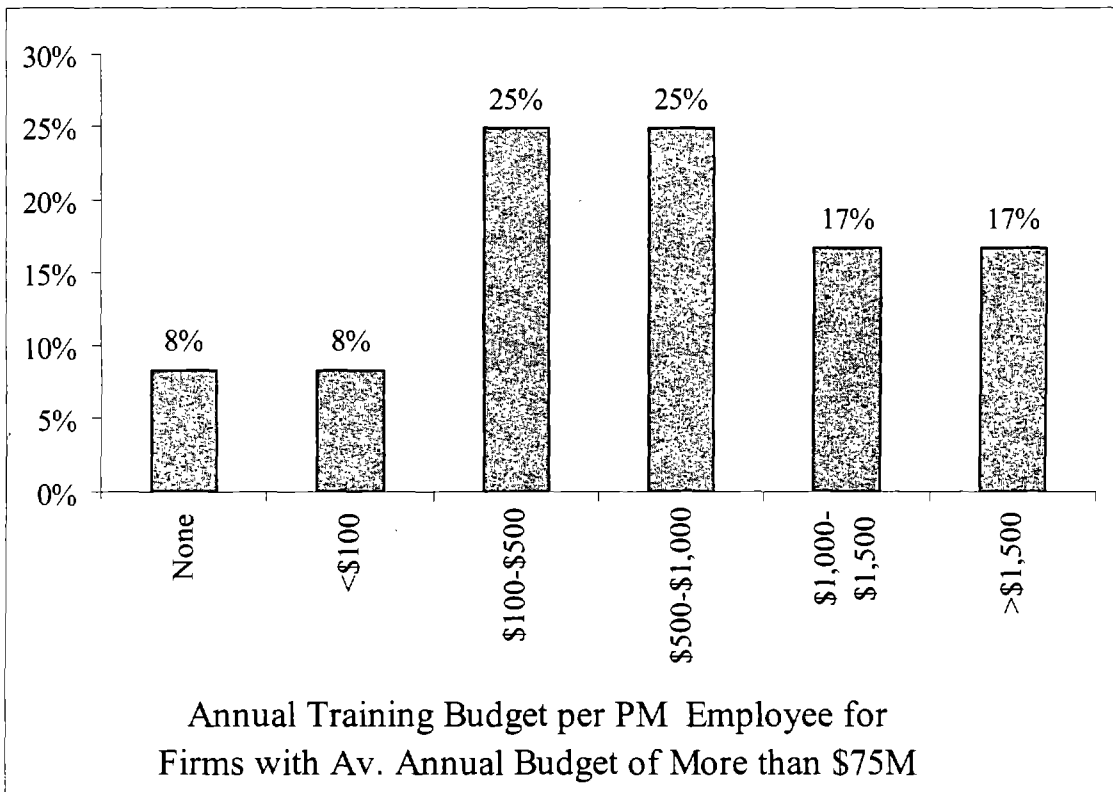
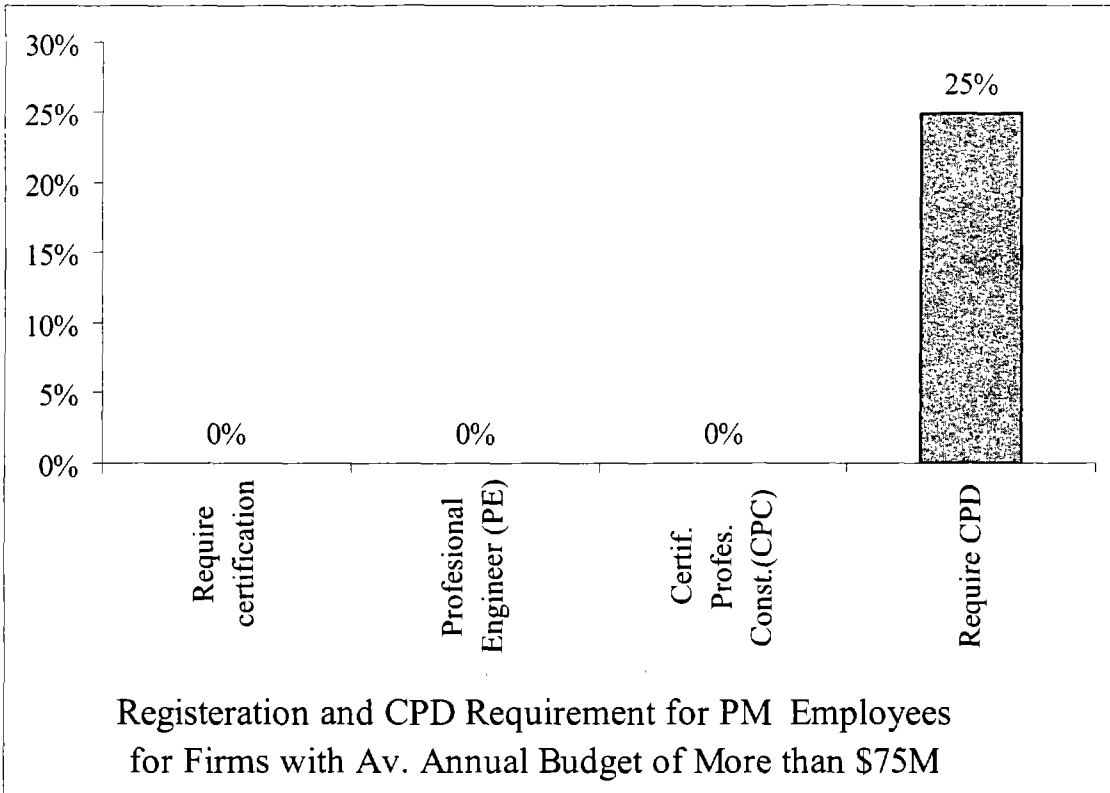


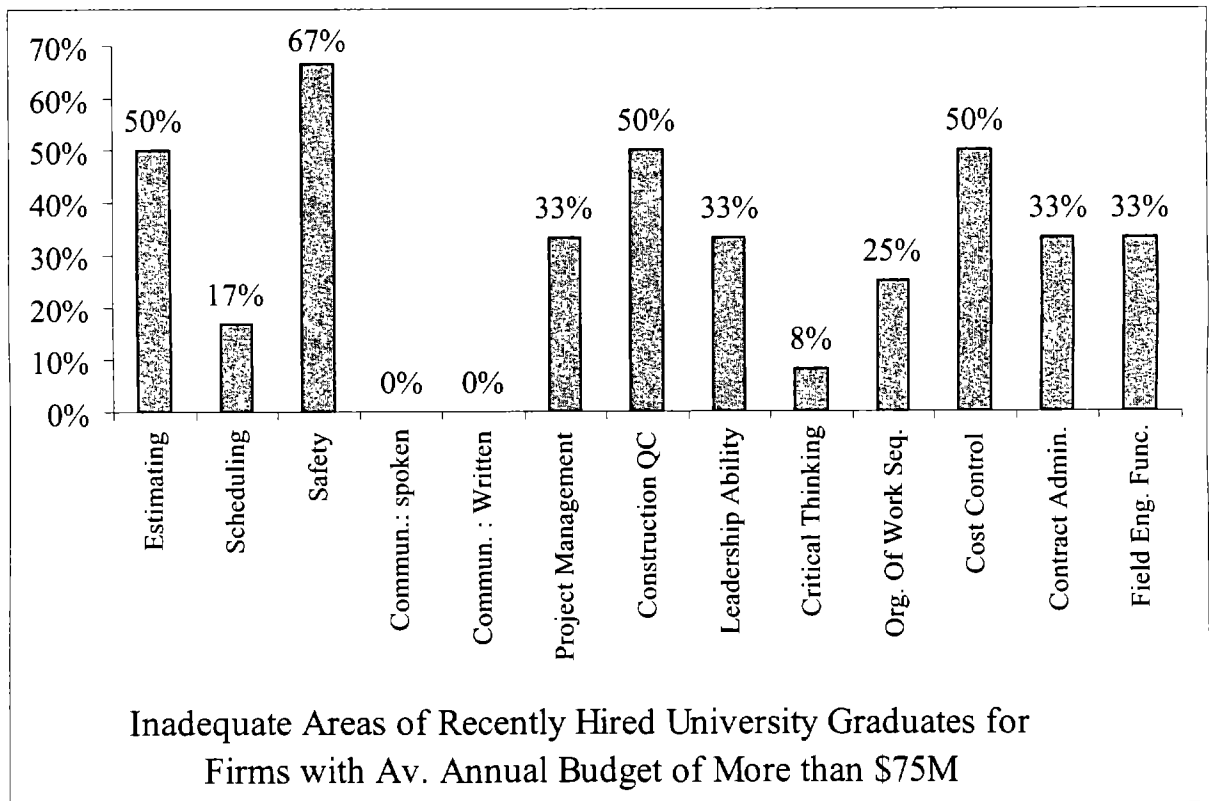
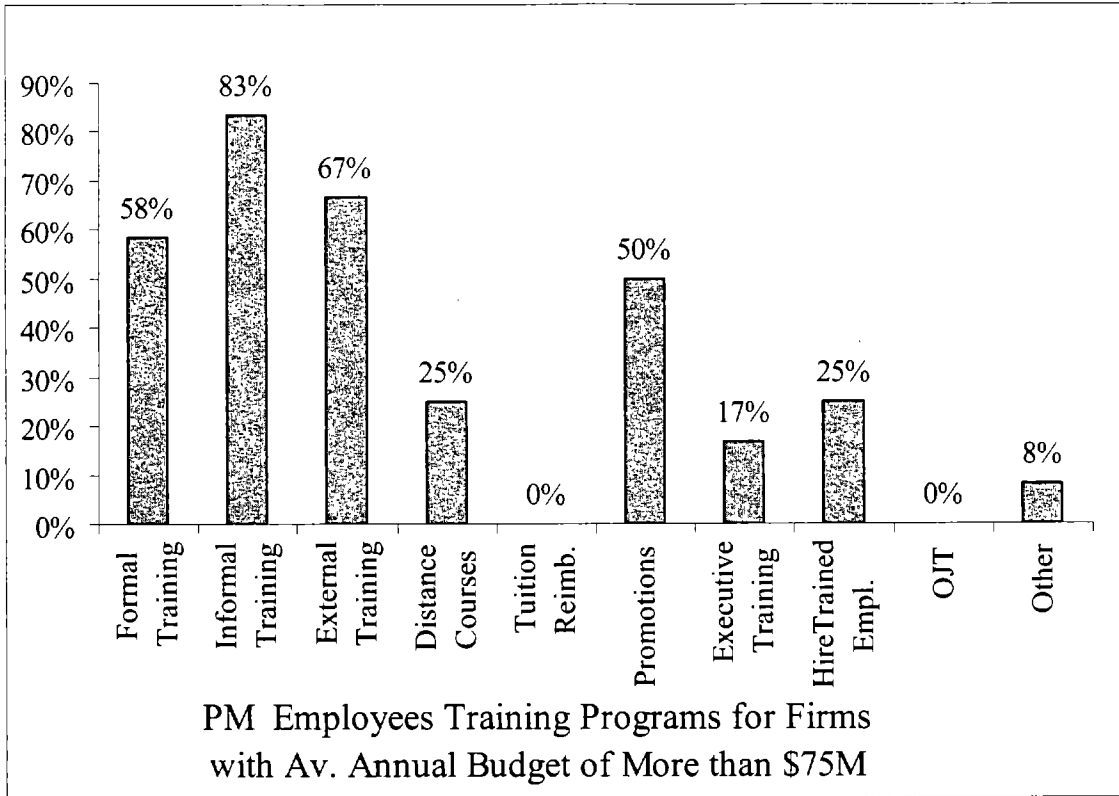




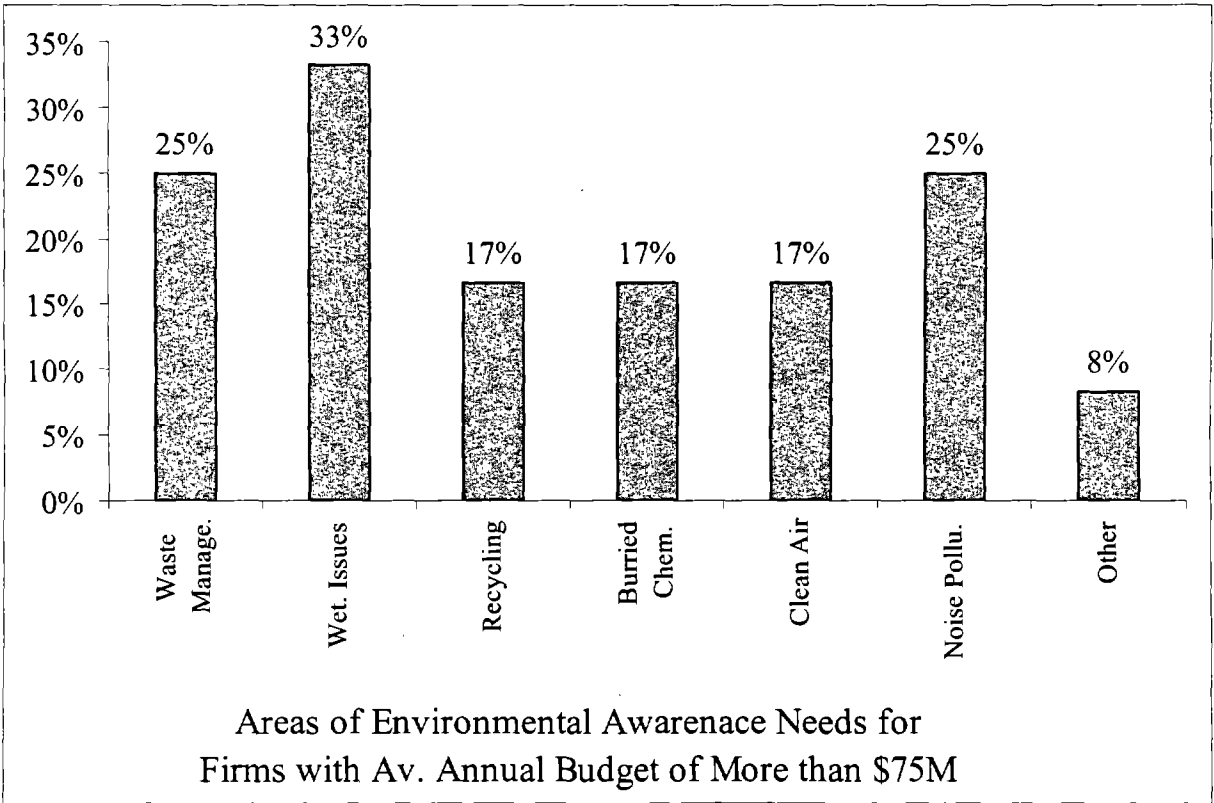
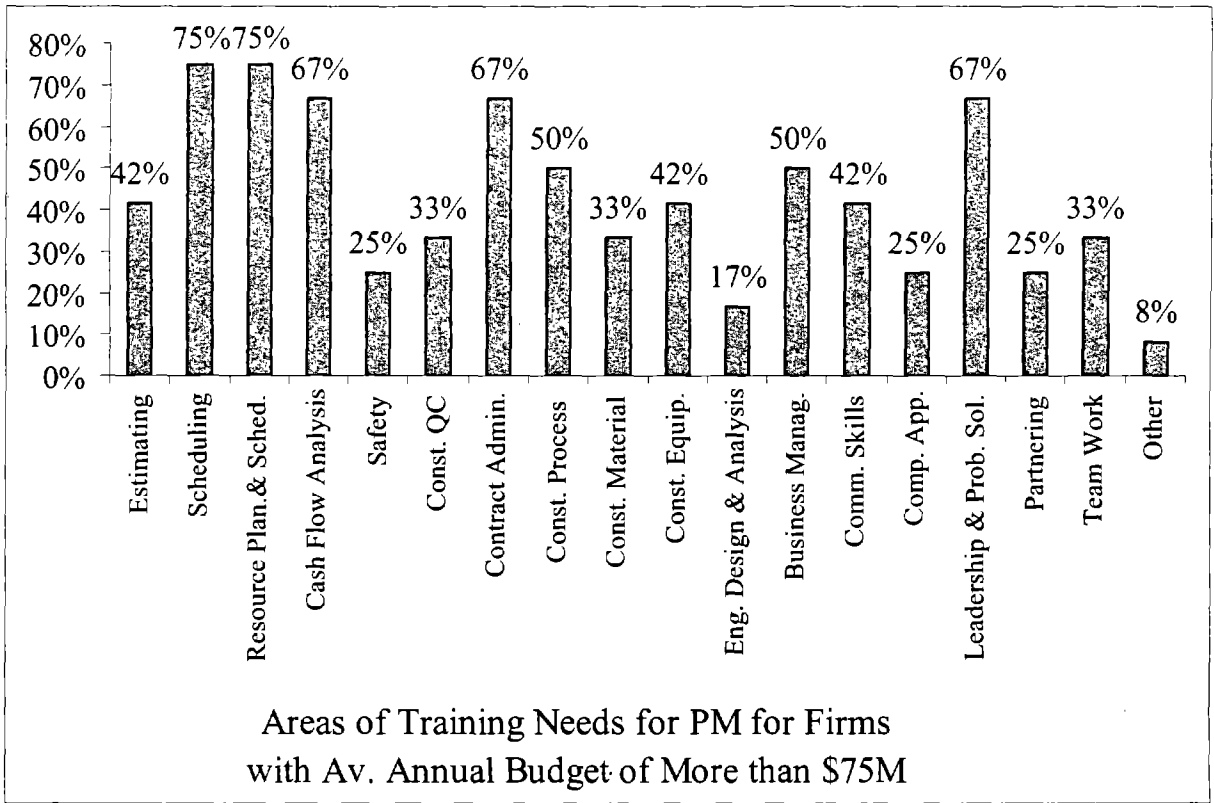


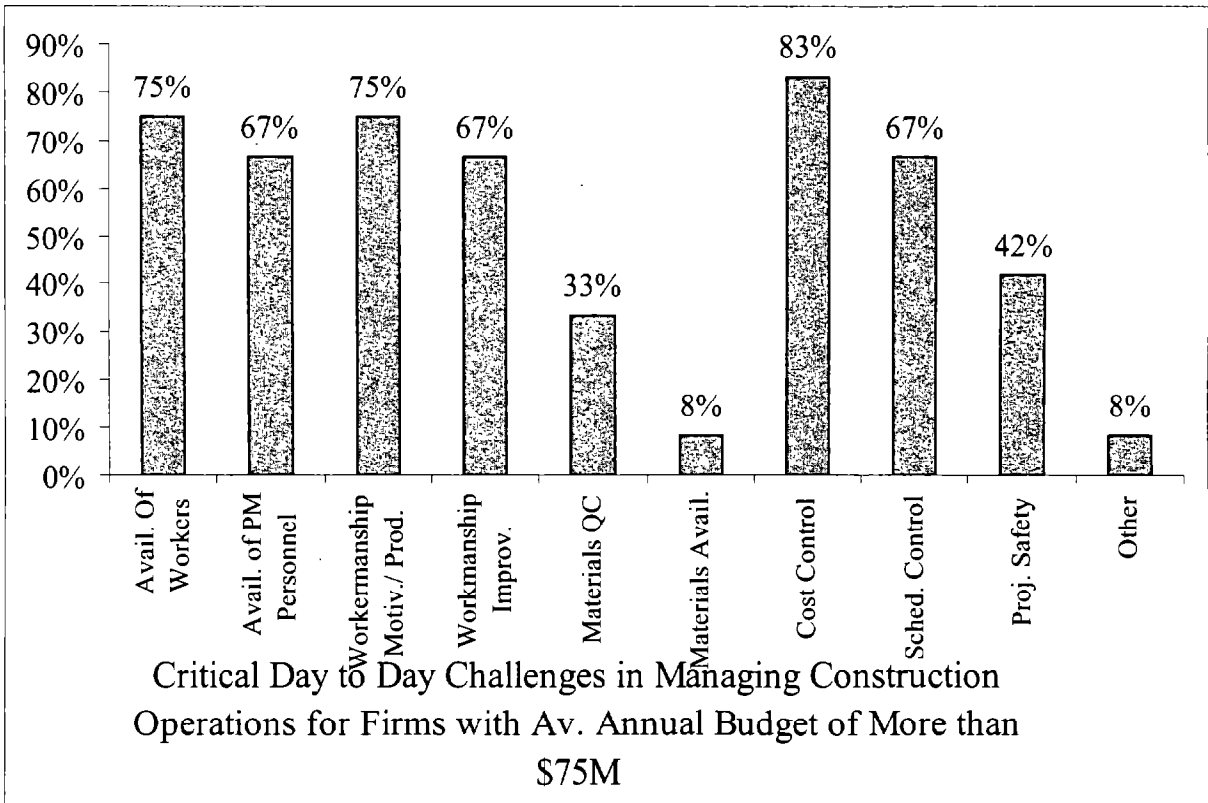
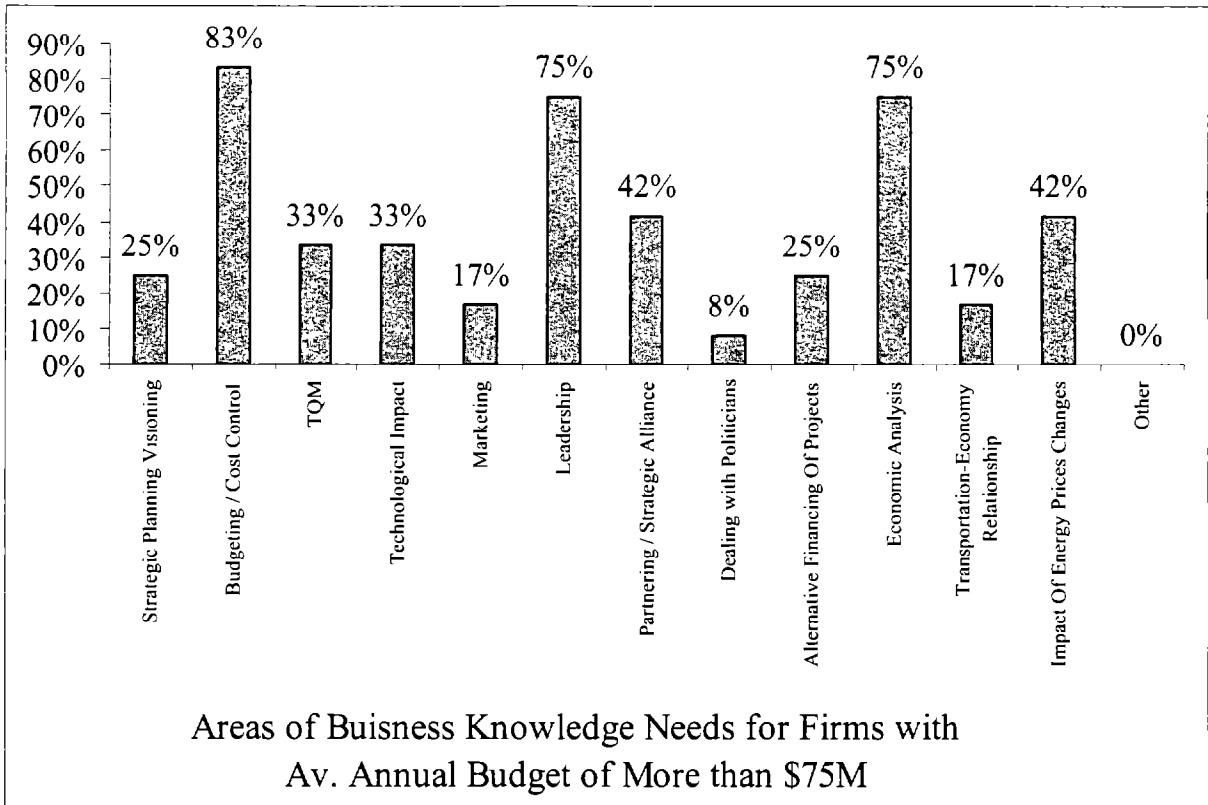








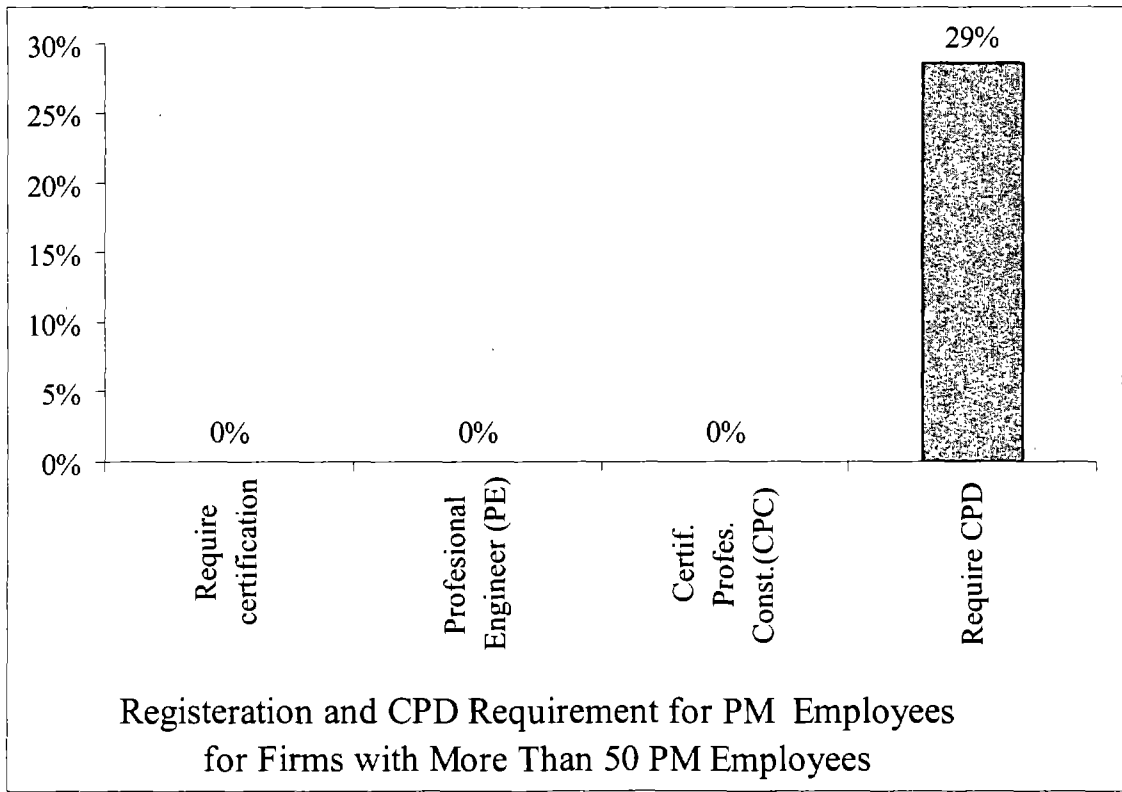
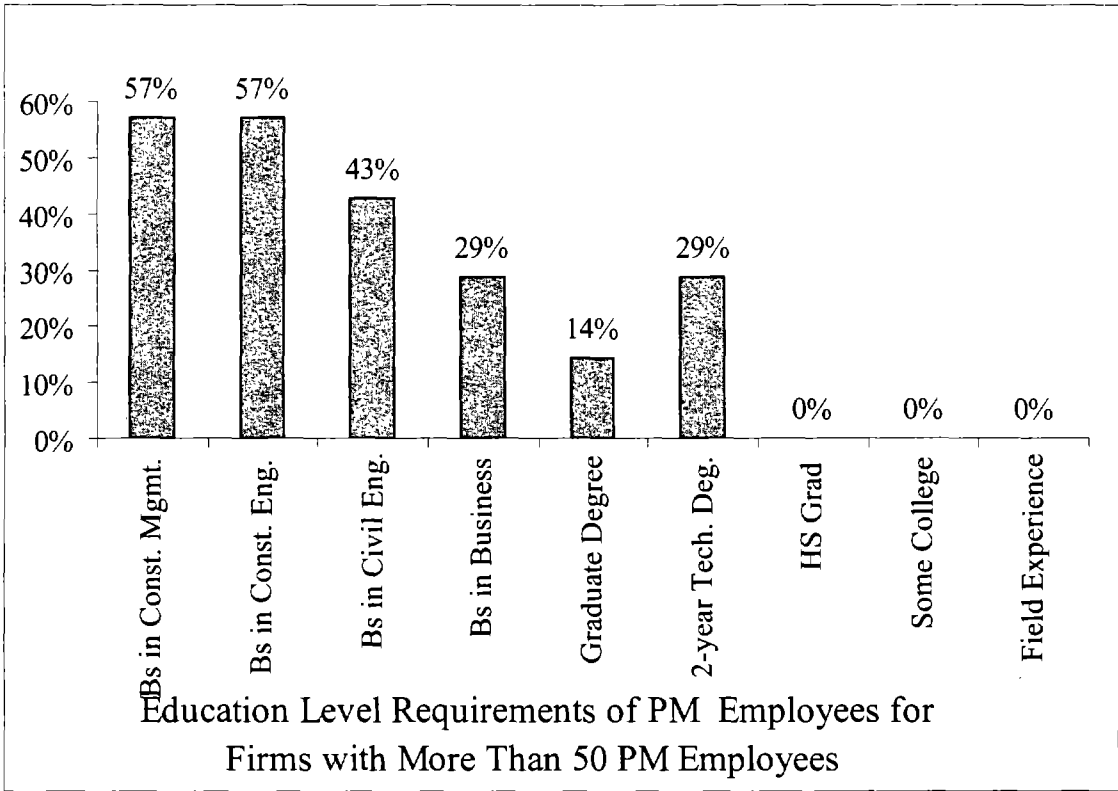


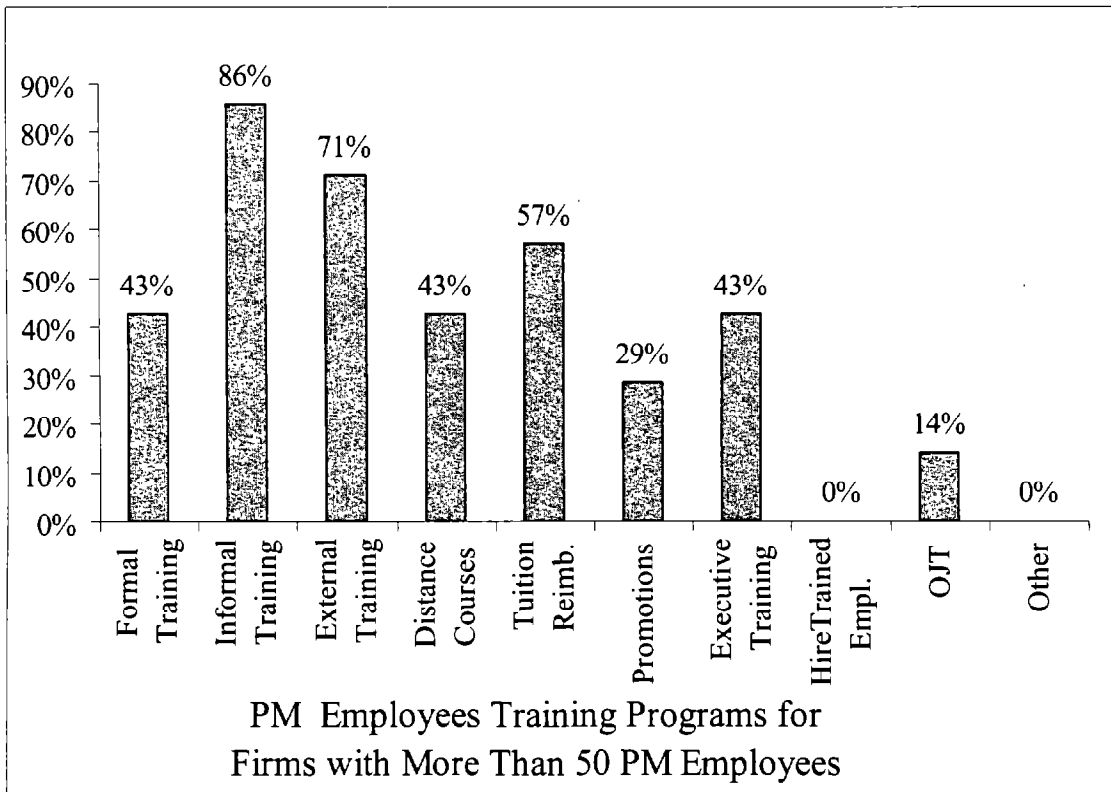
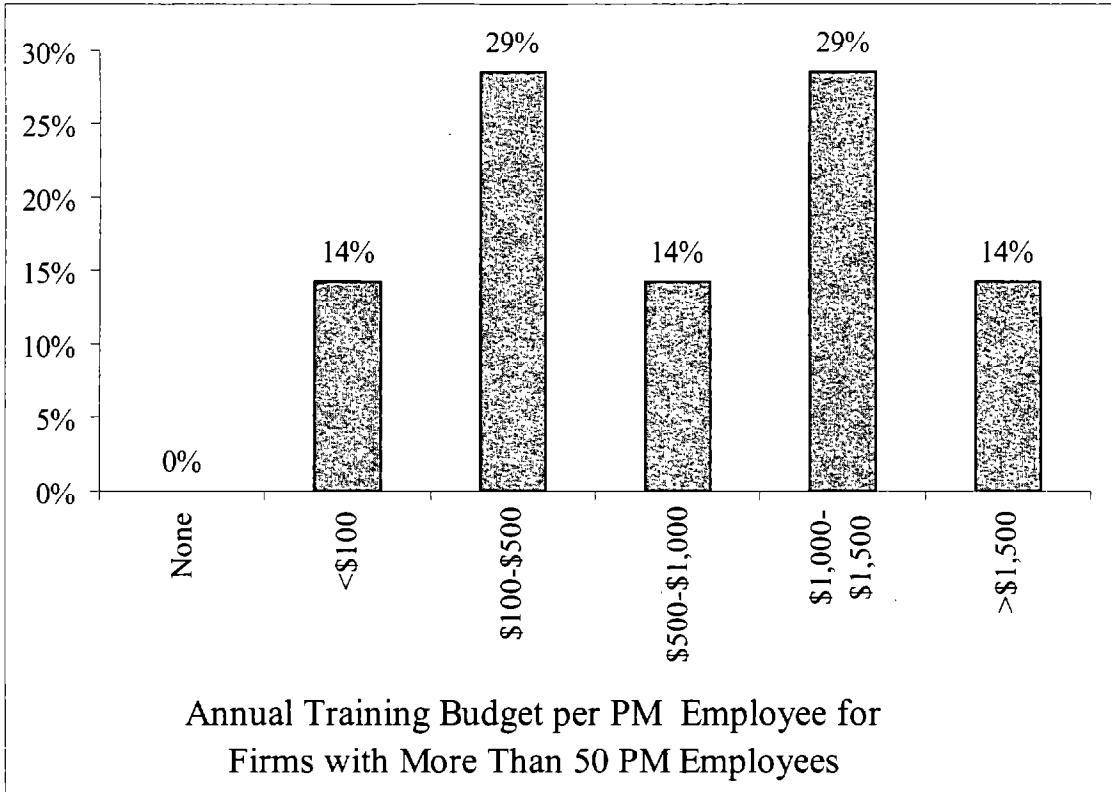


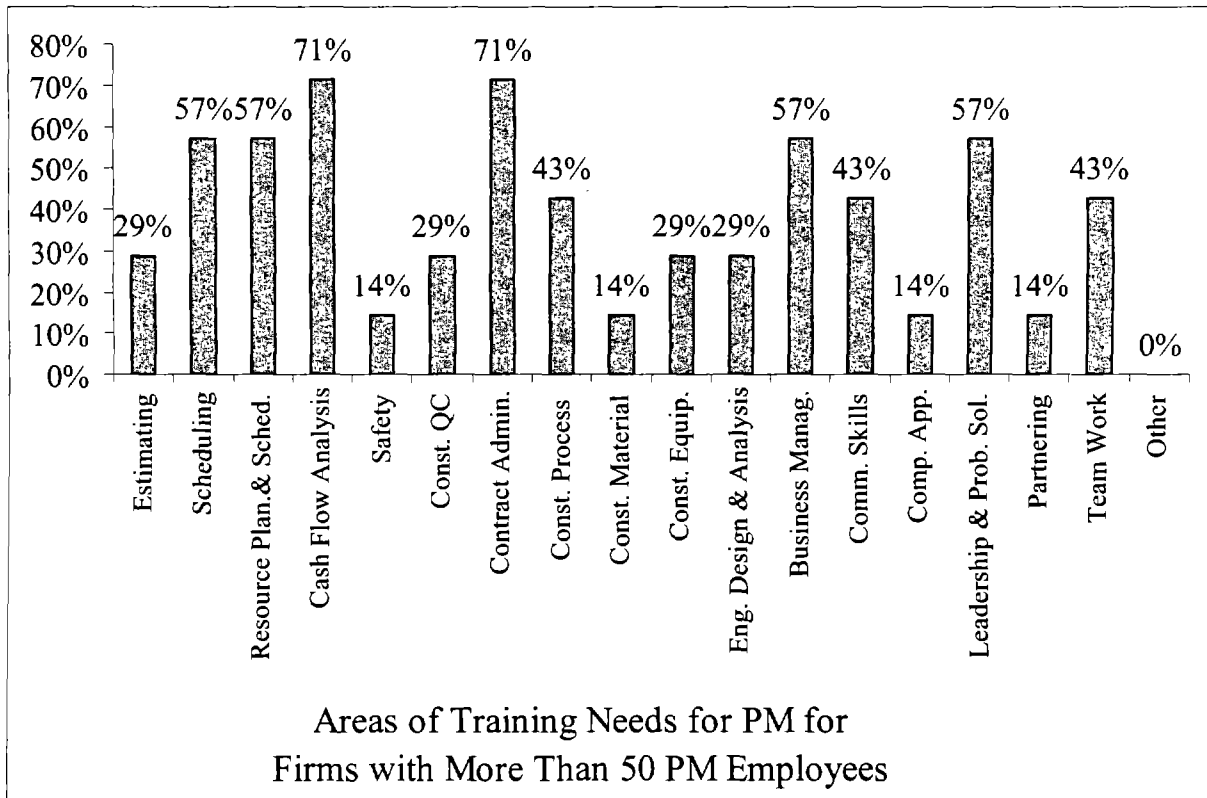
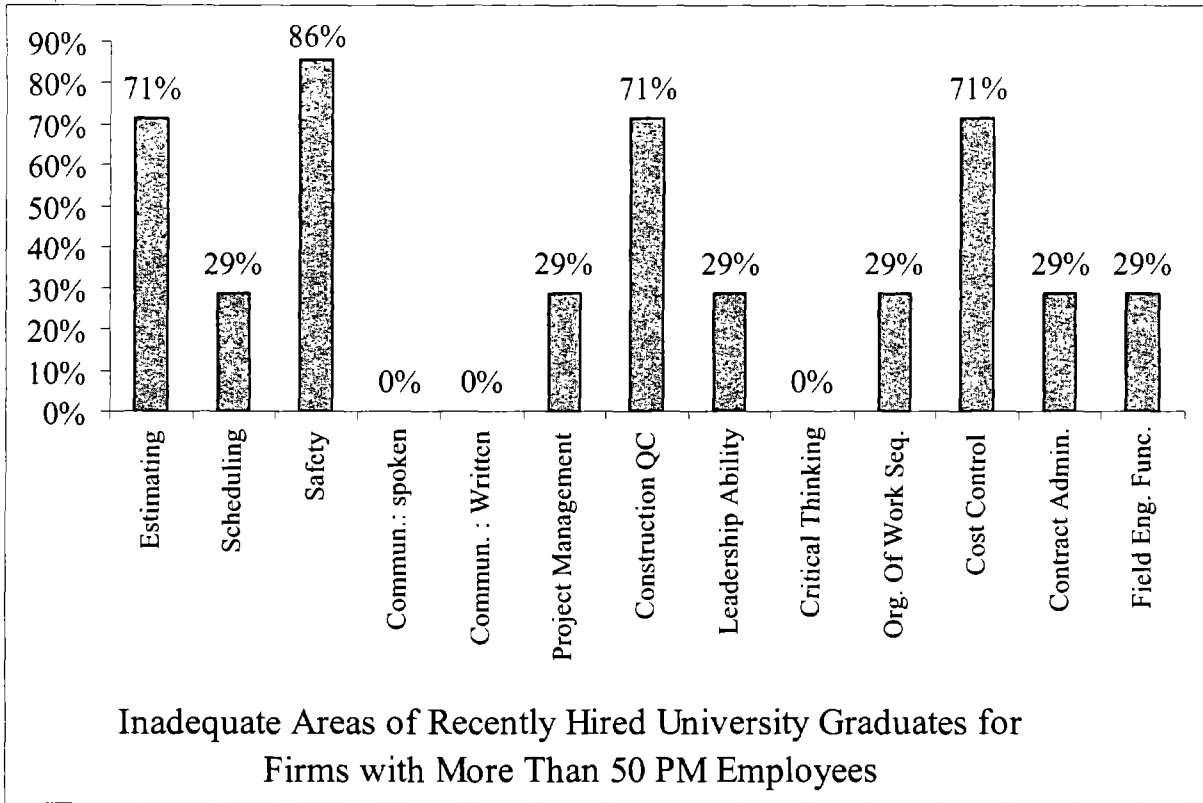
## **Appendix D**

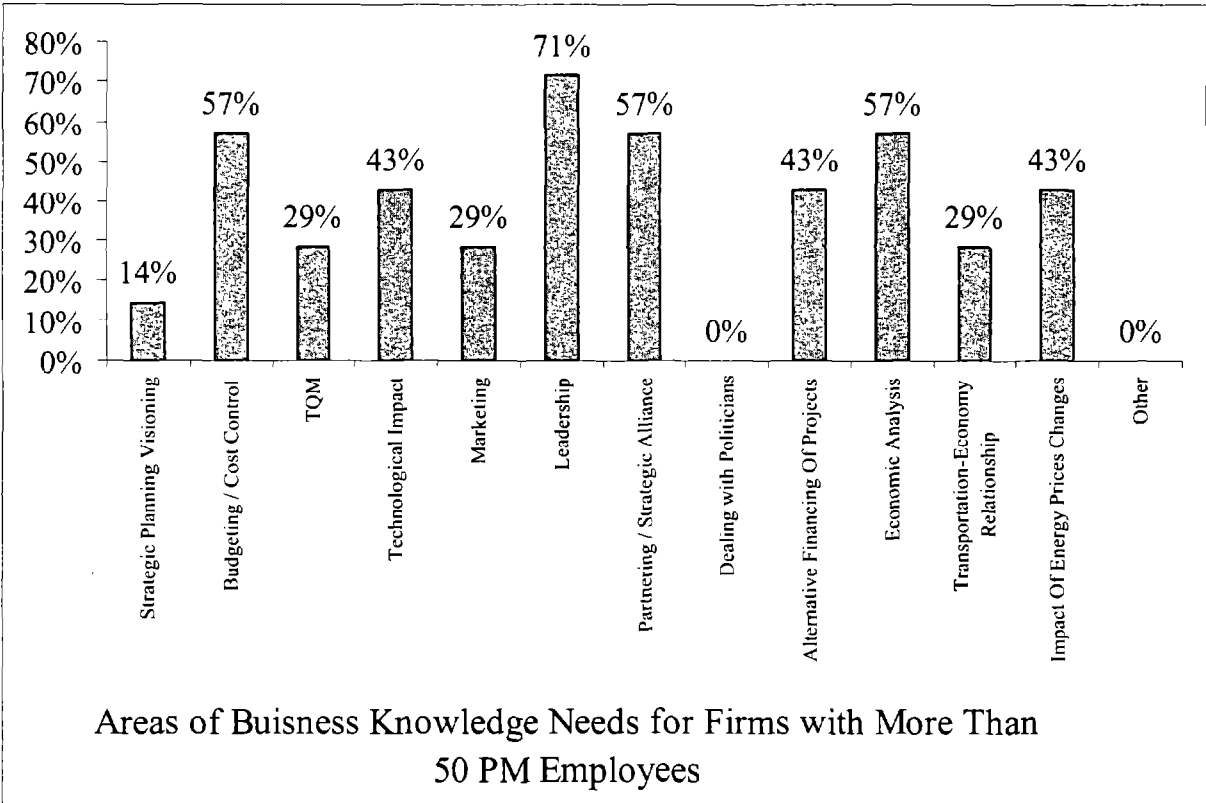
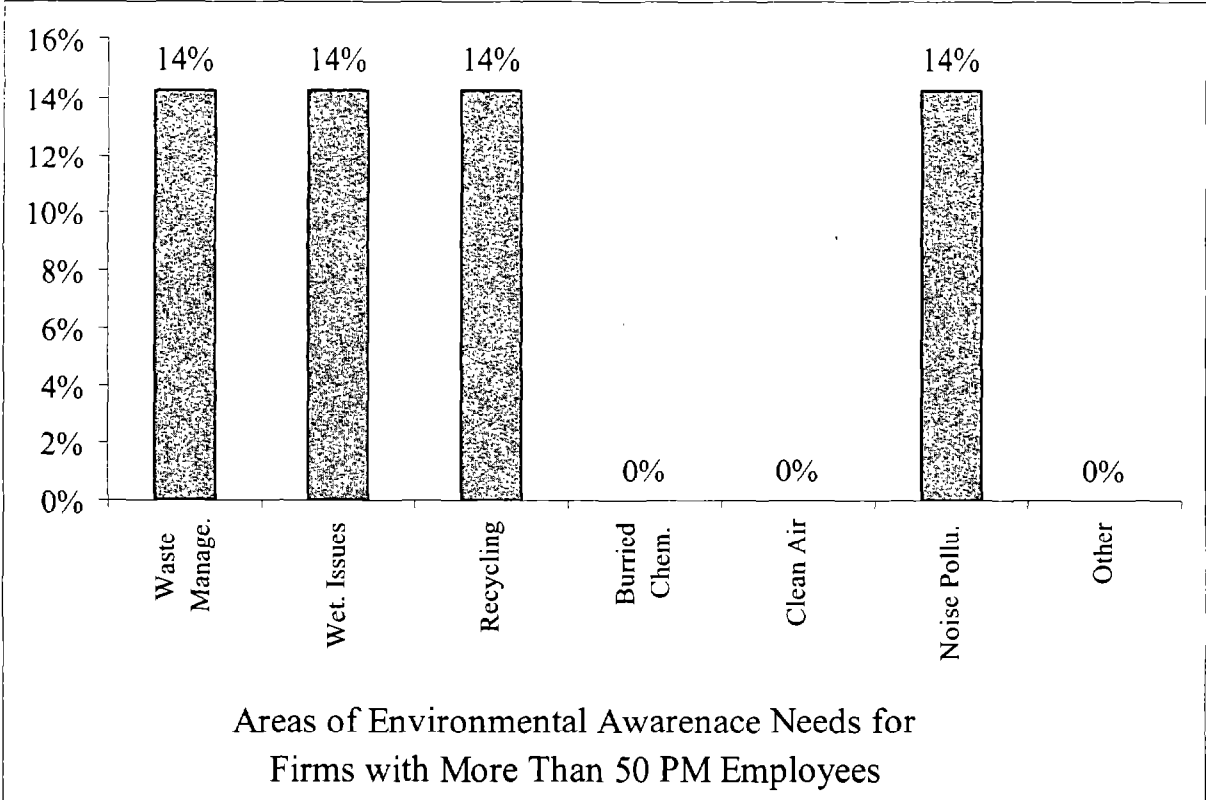
### **Analysis of PM Data by Company's Number of PM Employees**



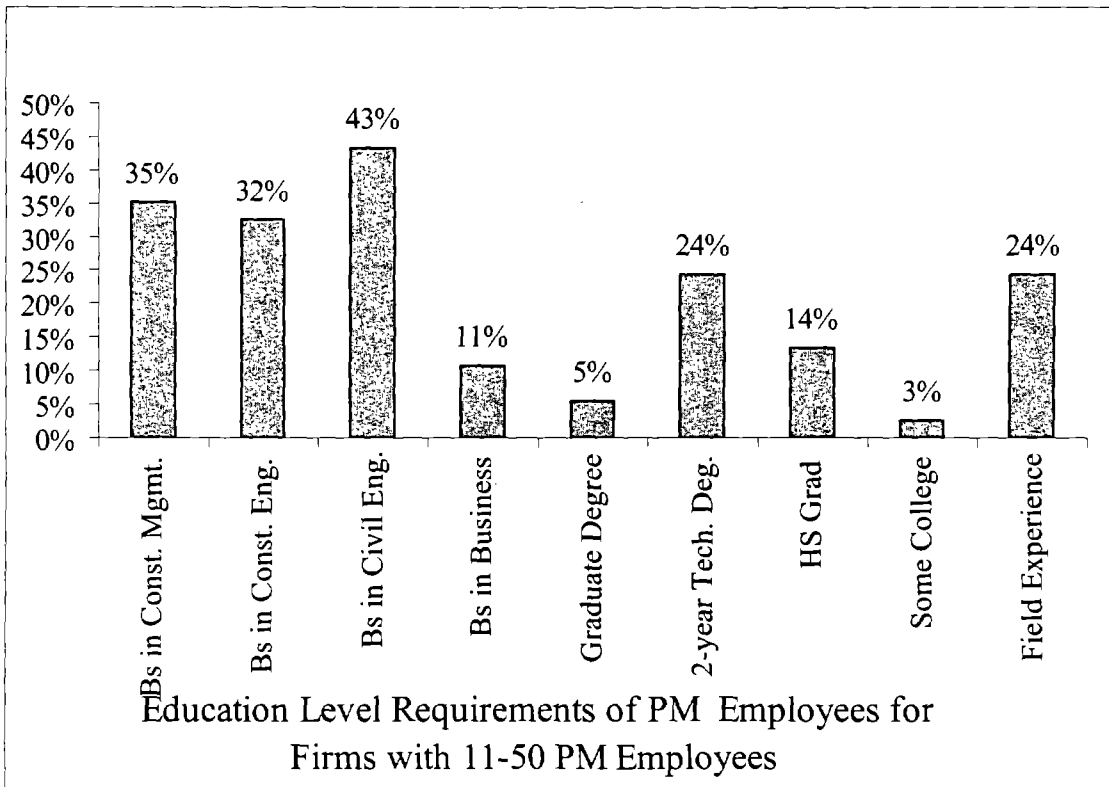
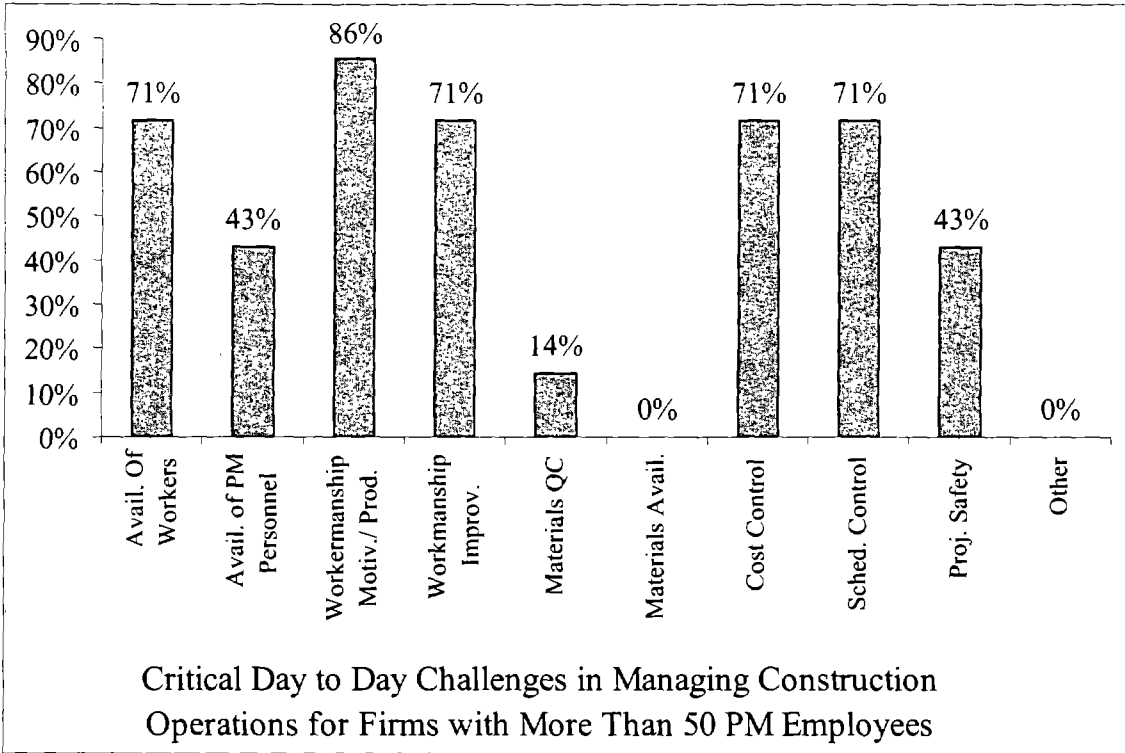


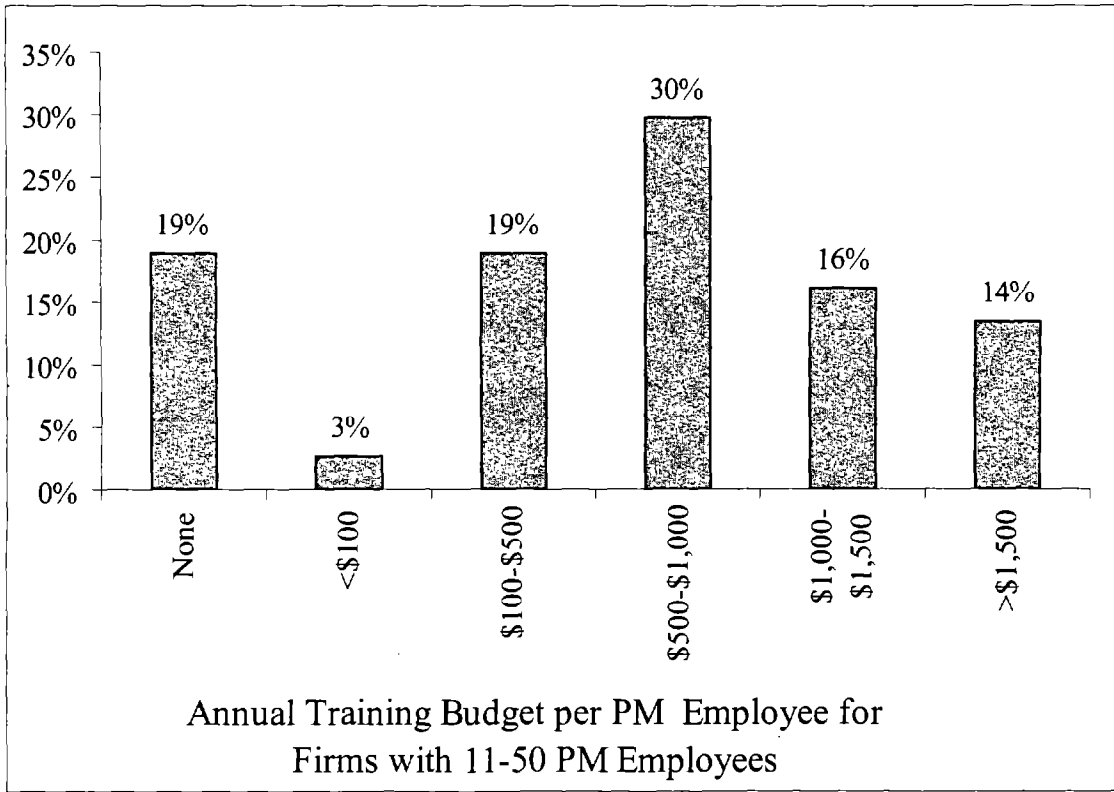
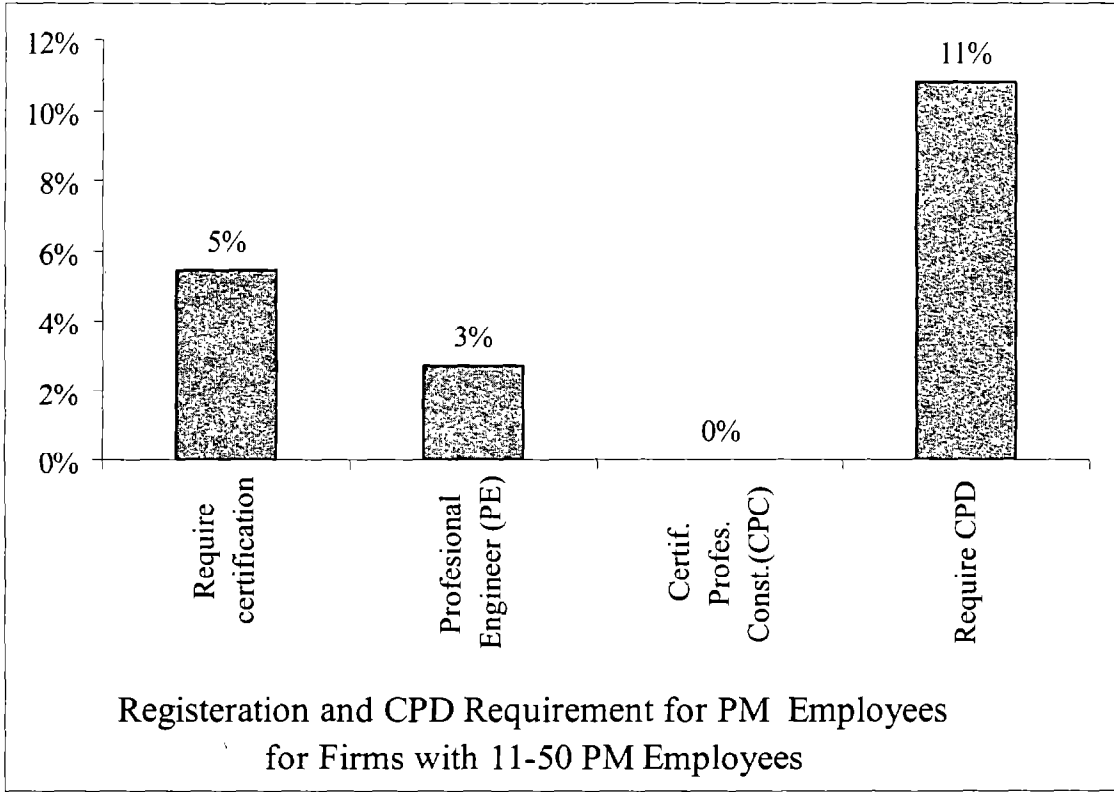


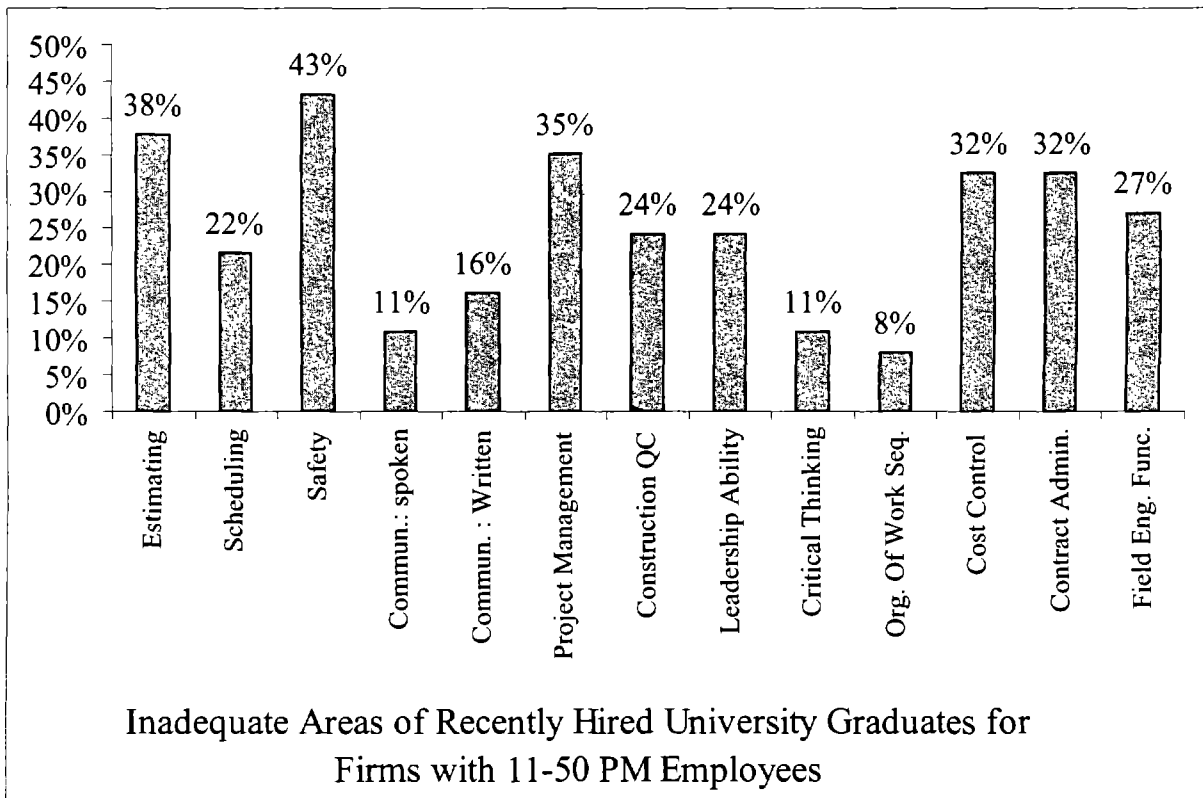
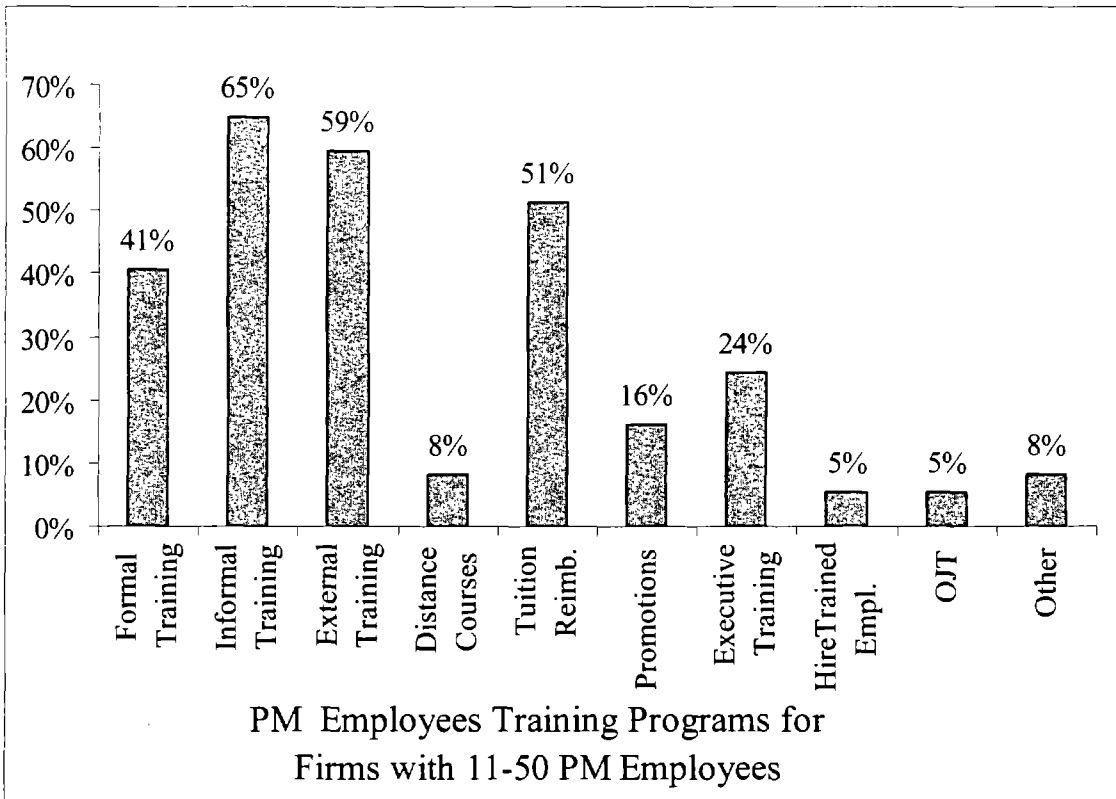


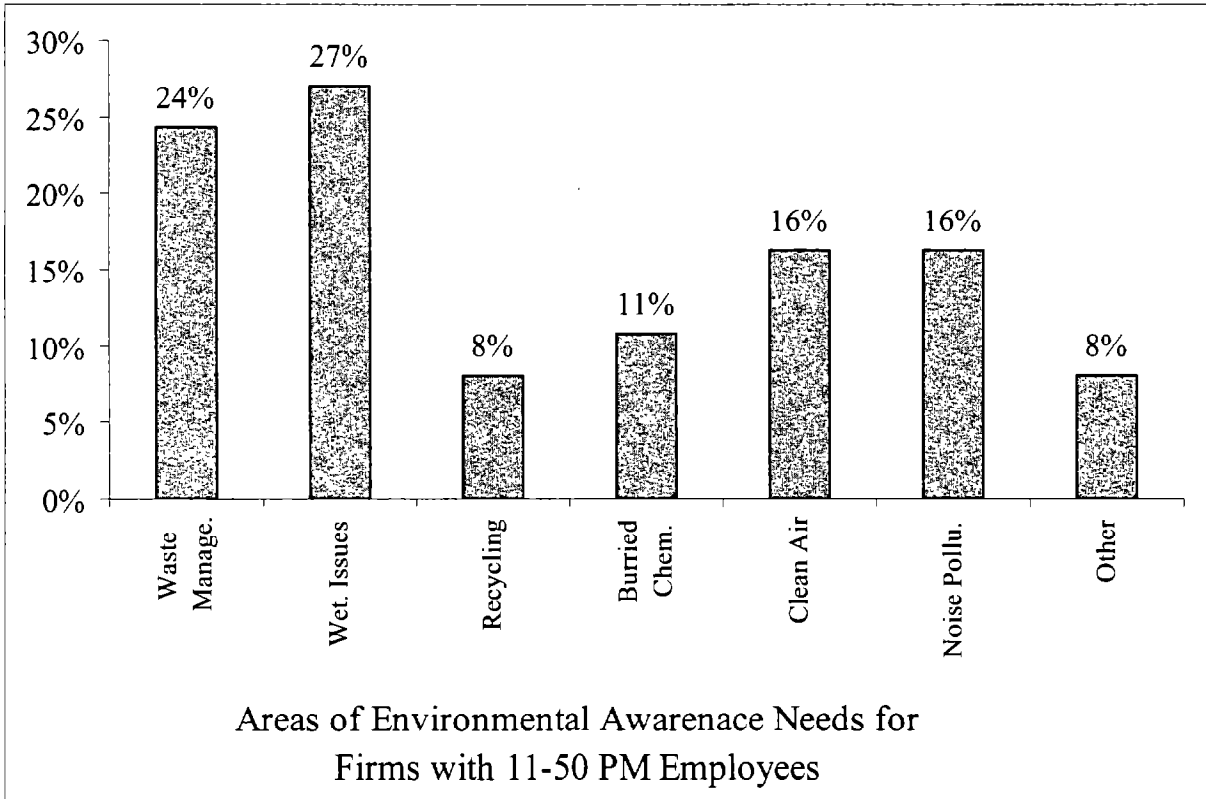
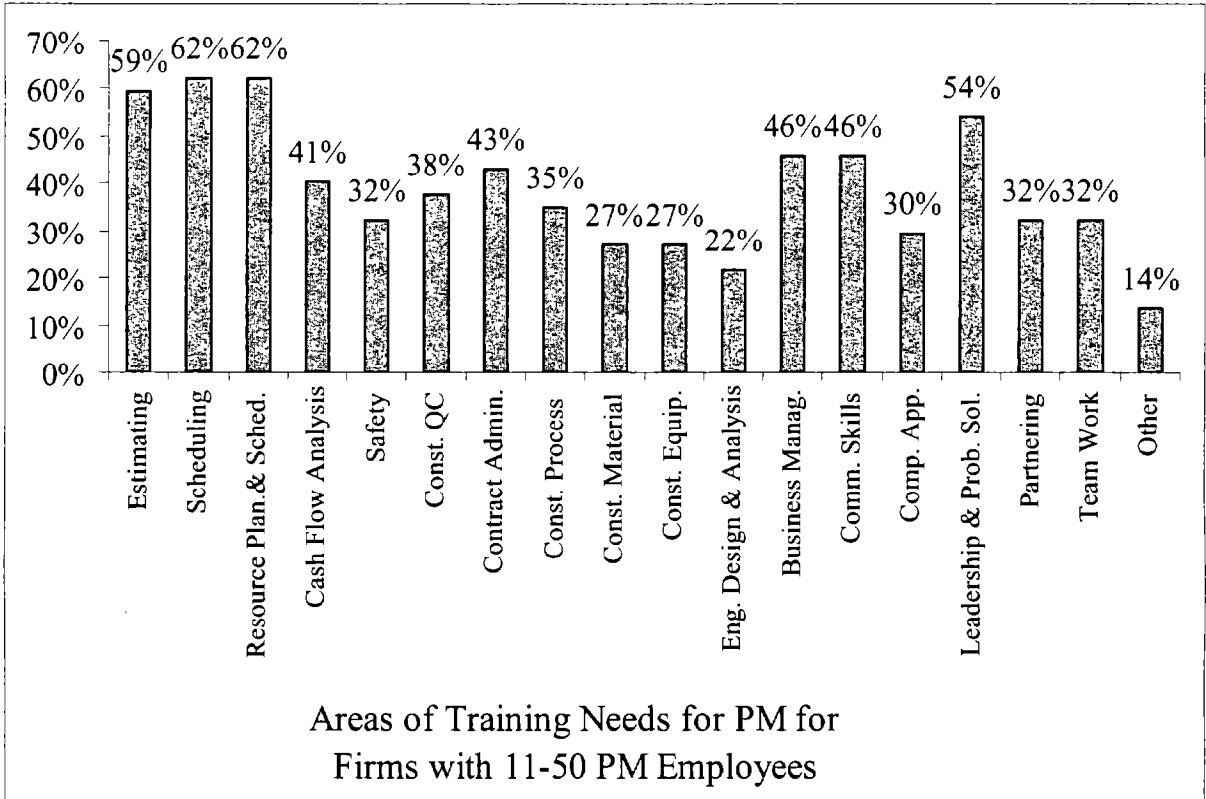


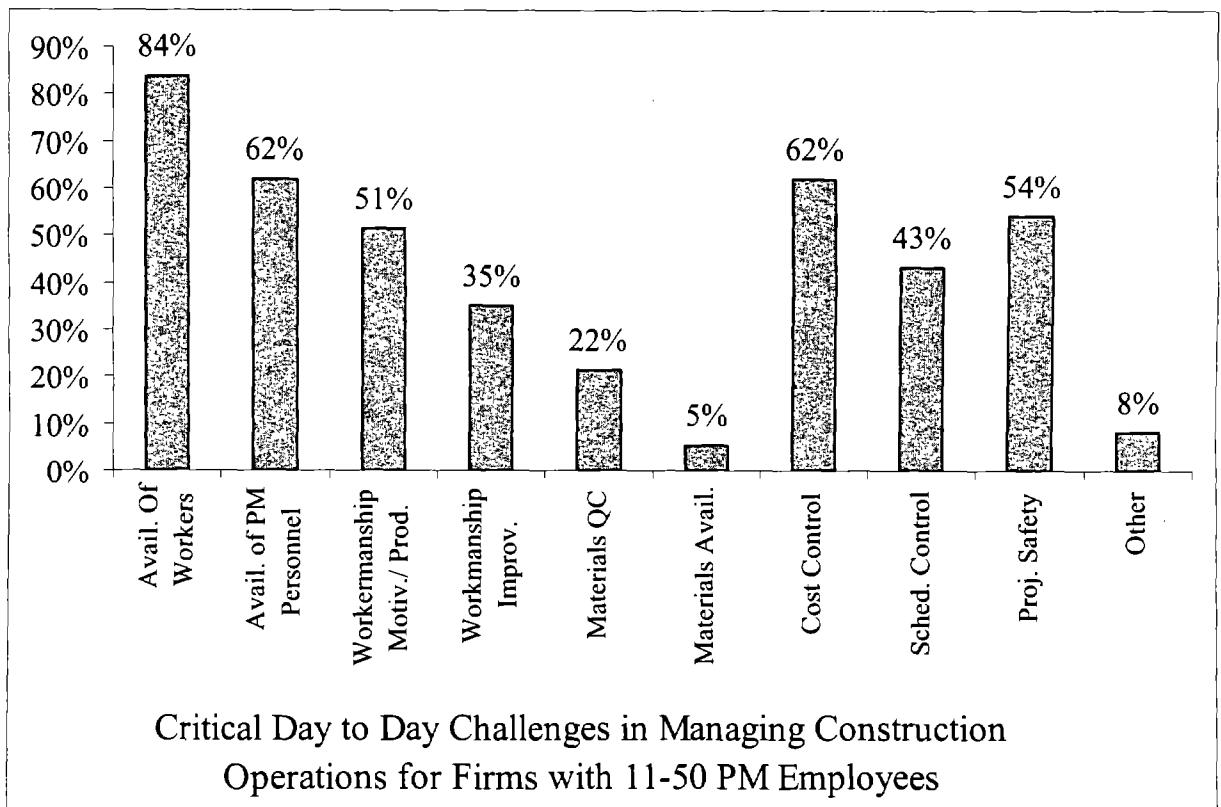
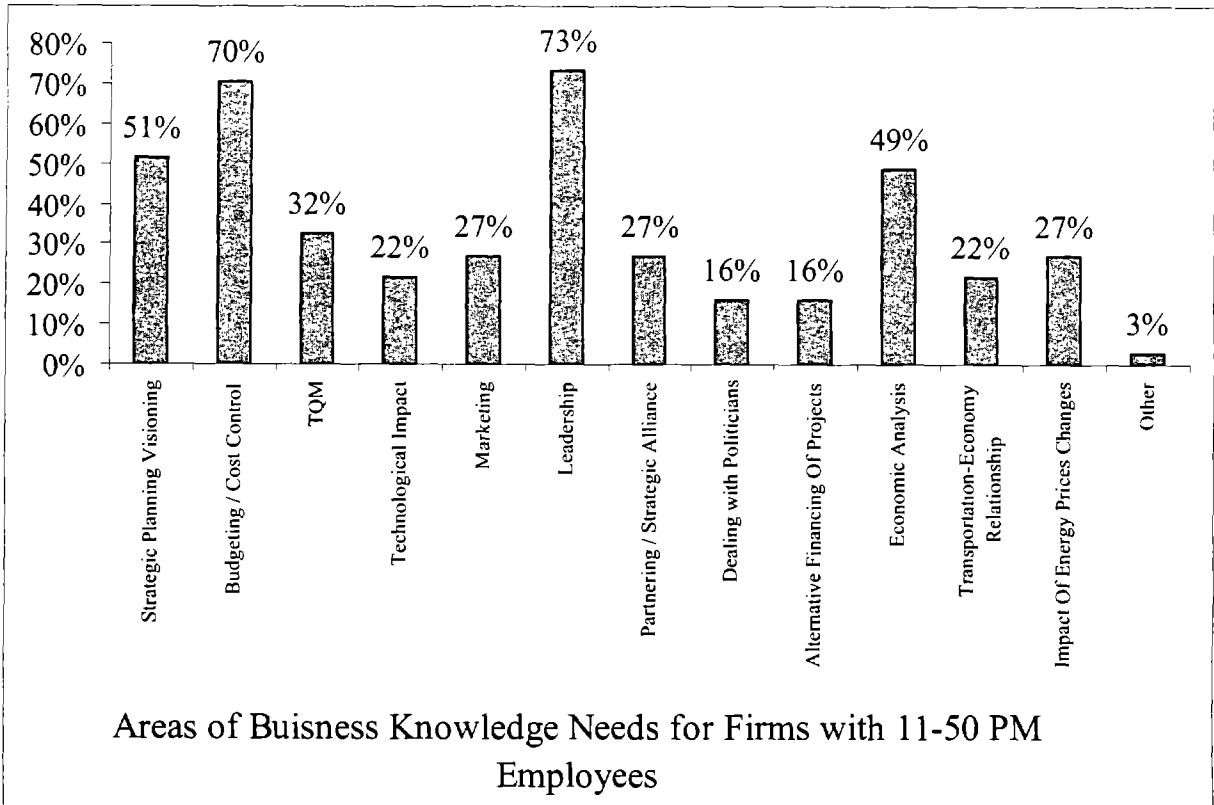


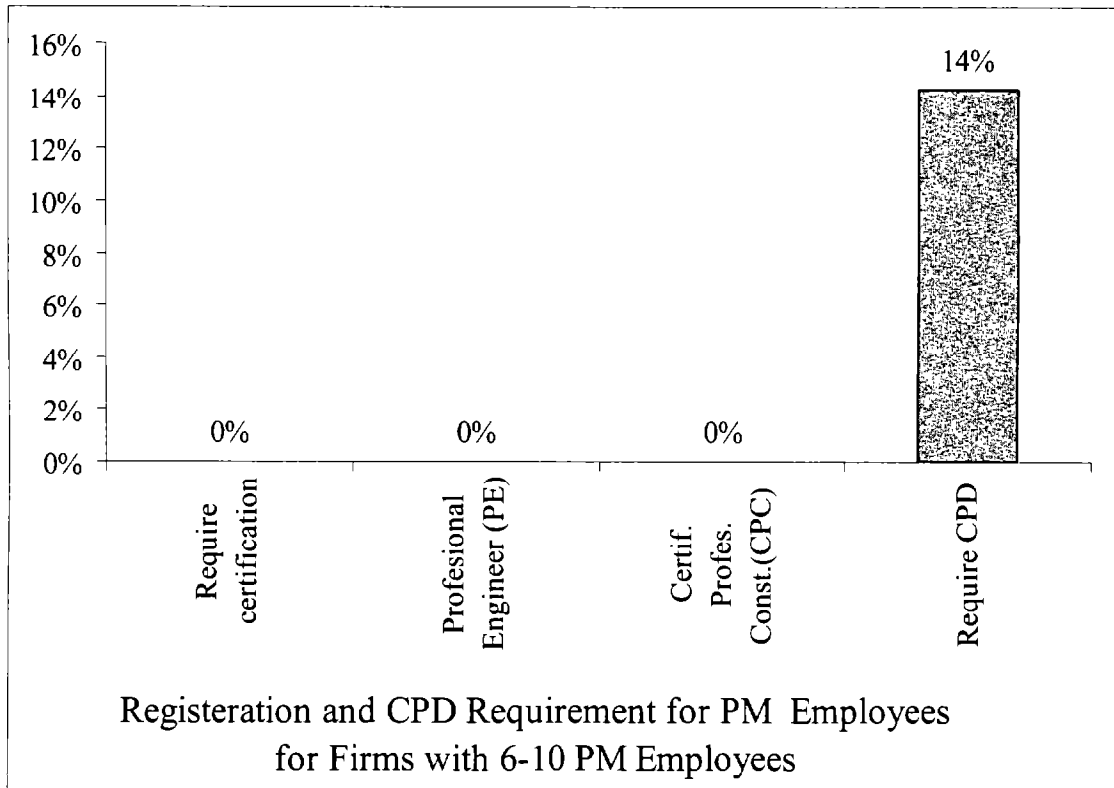
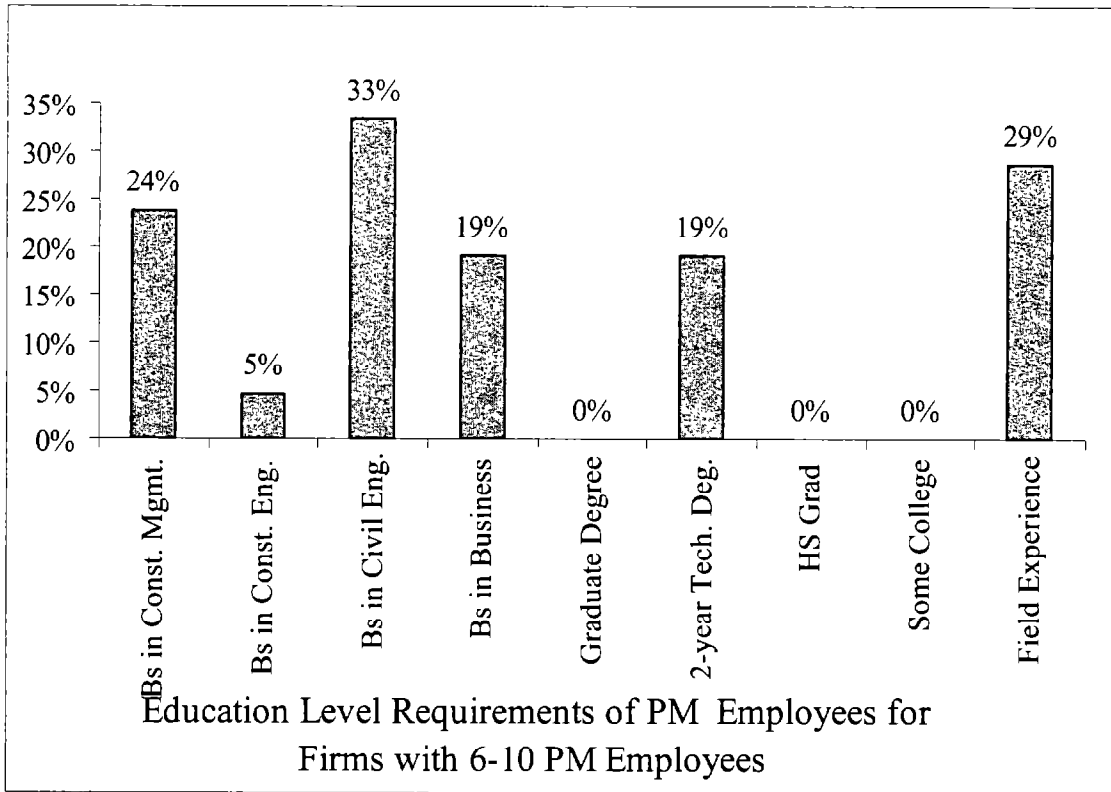


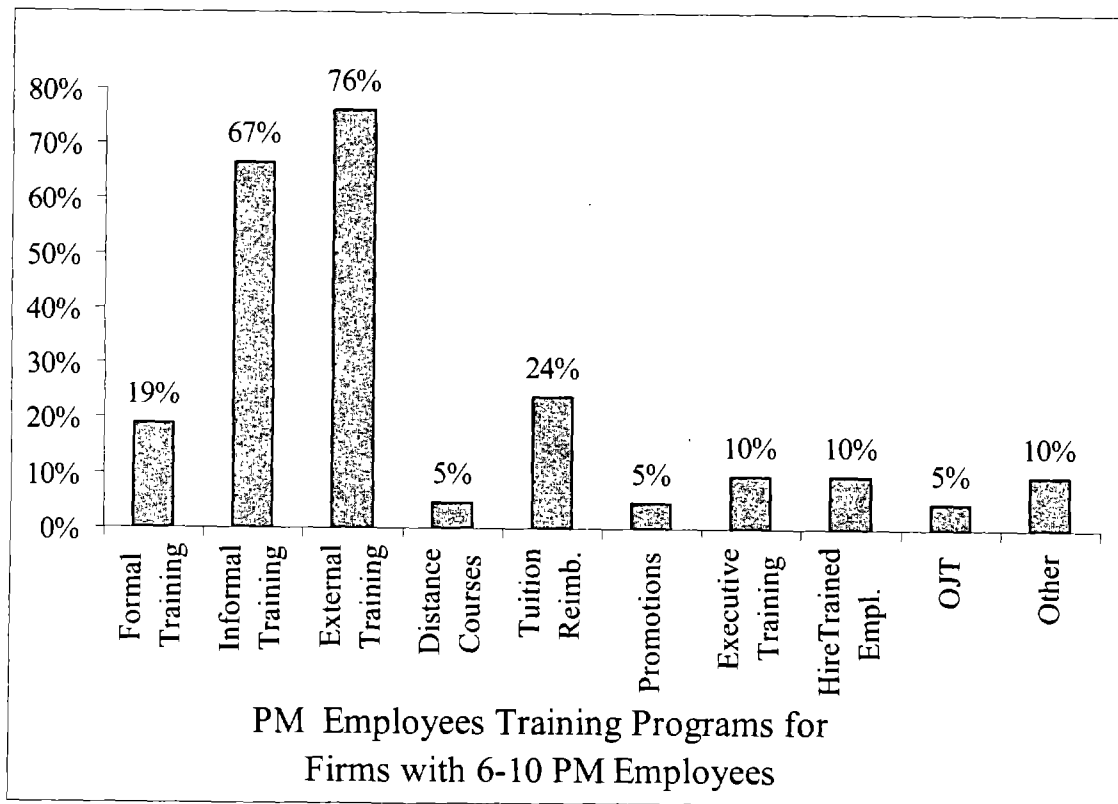
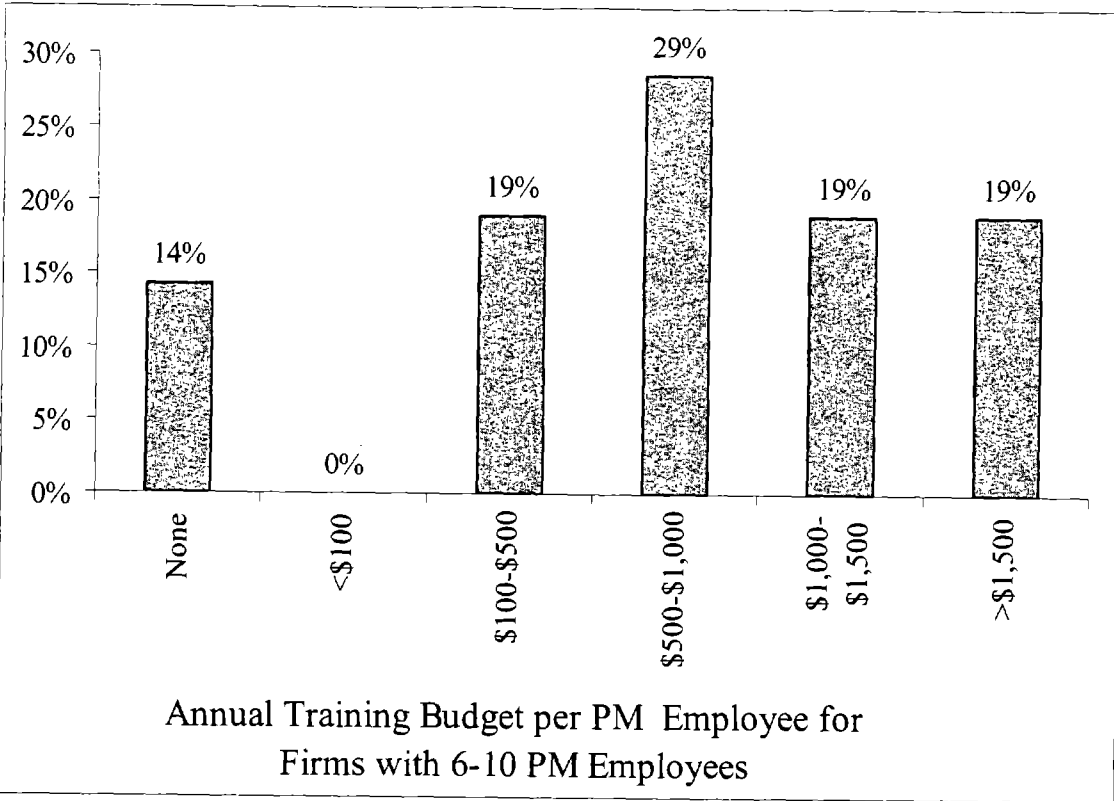


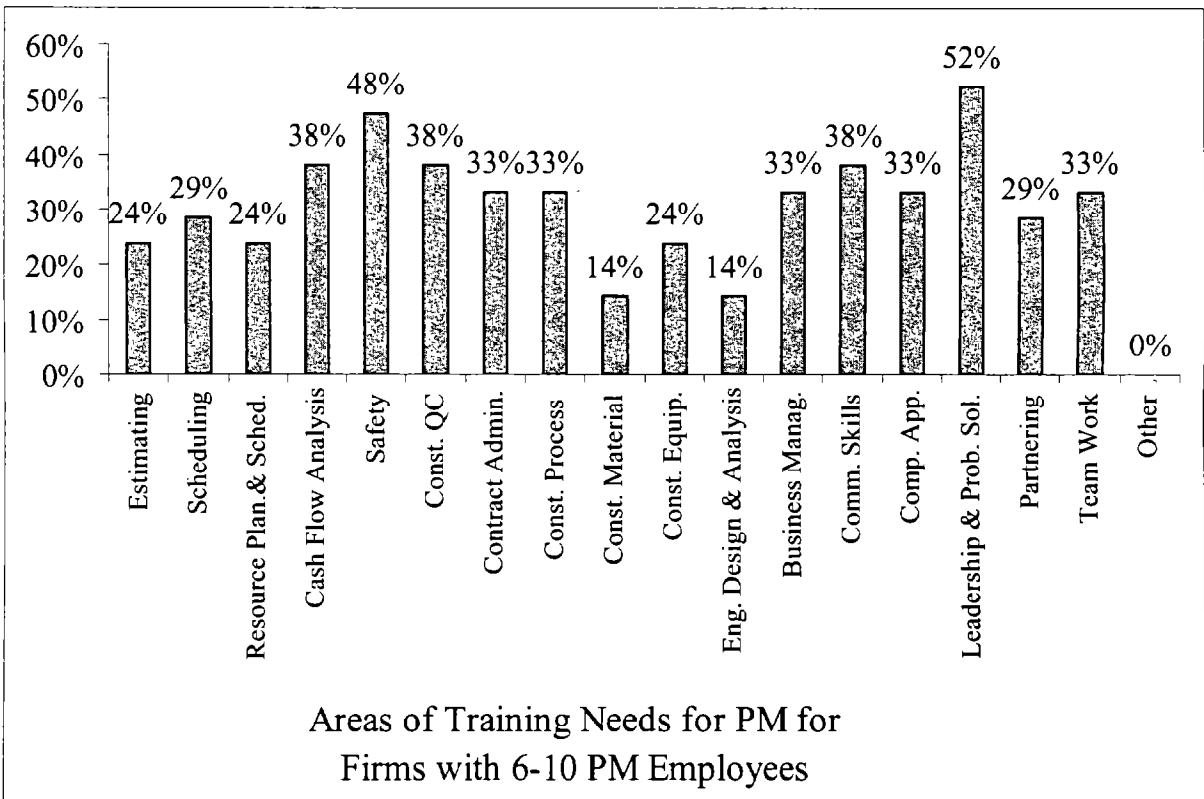
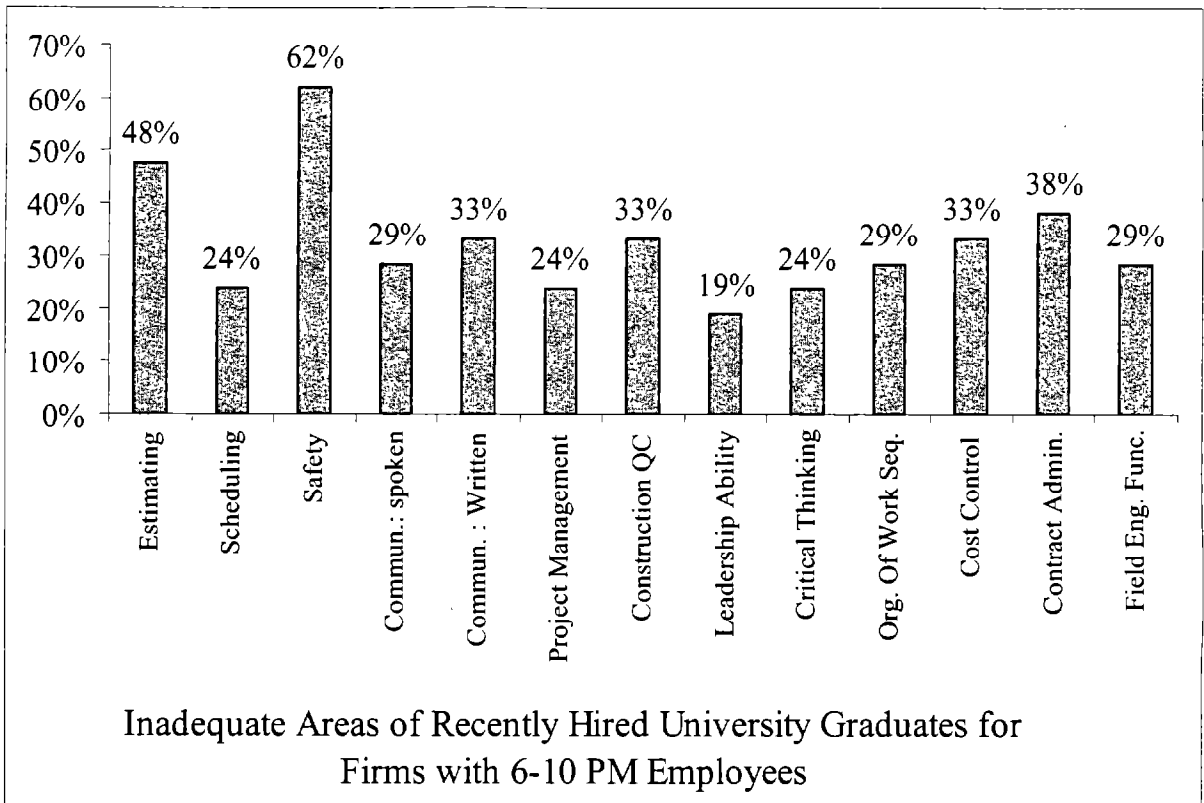




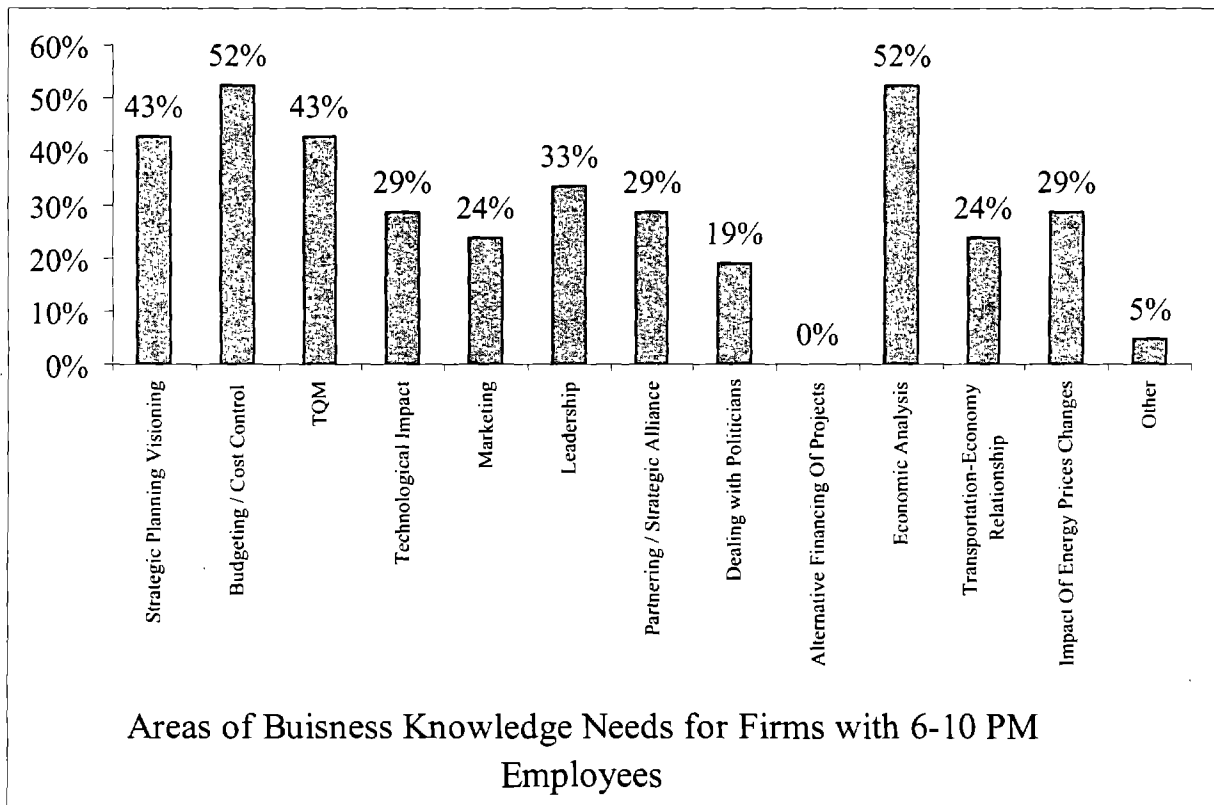
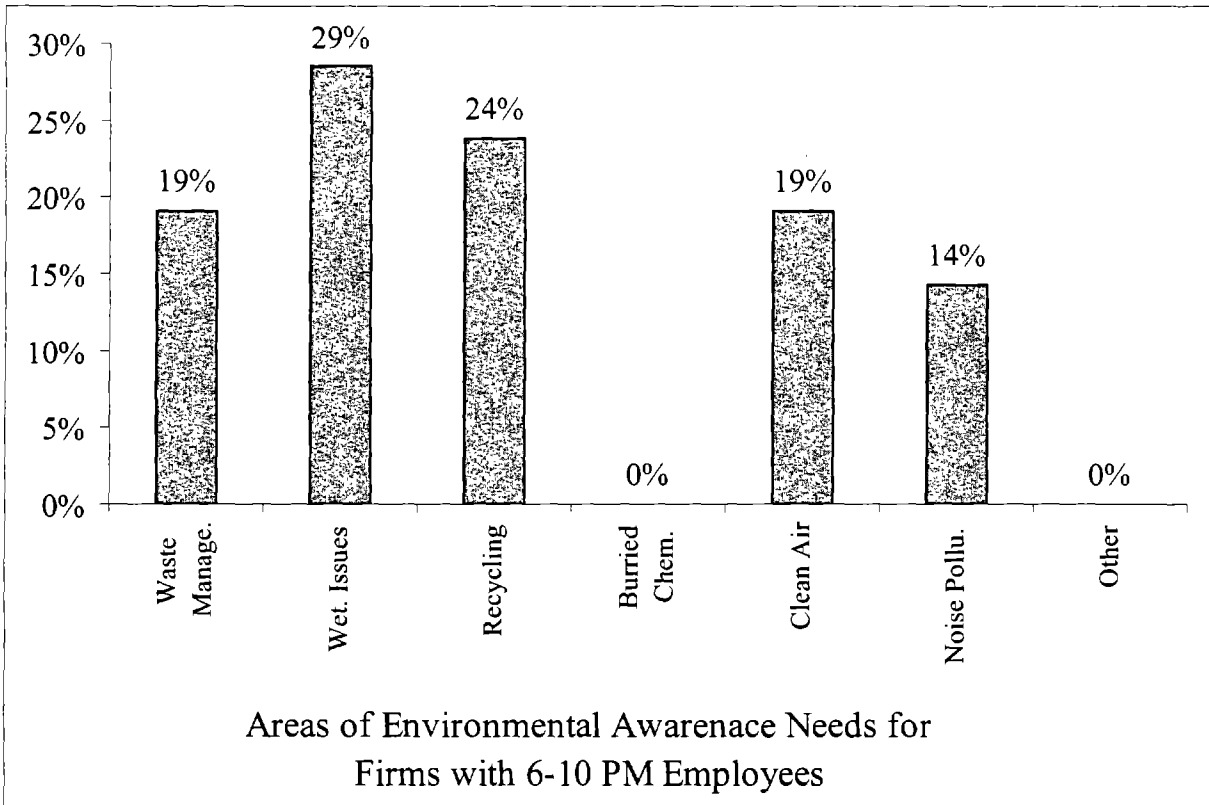


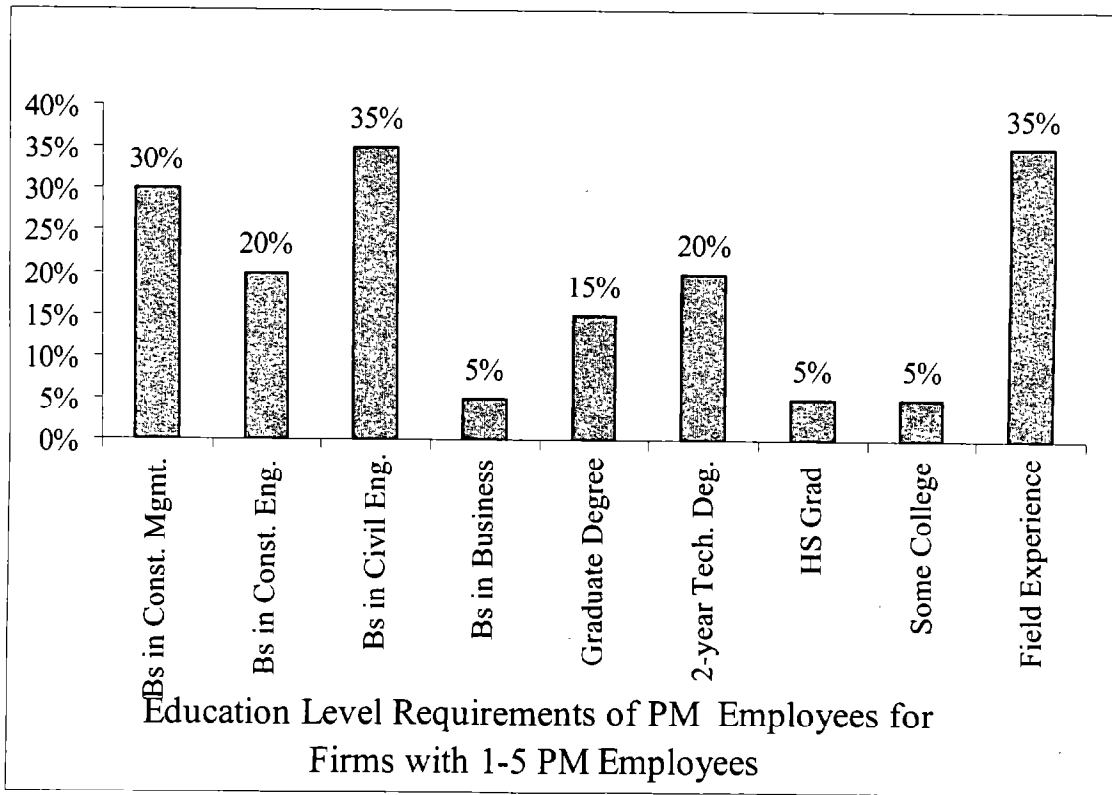
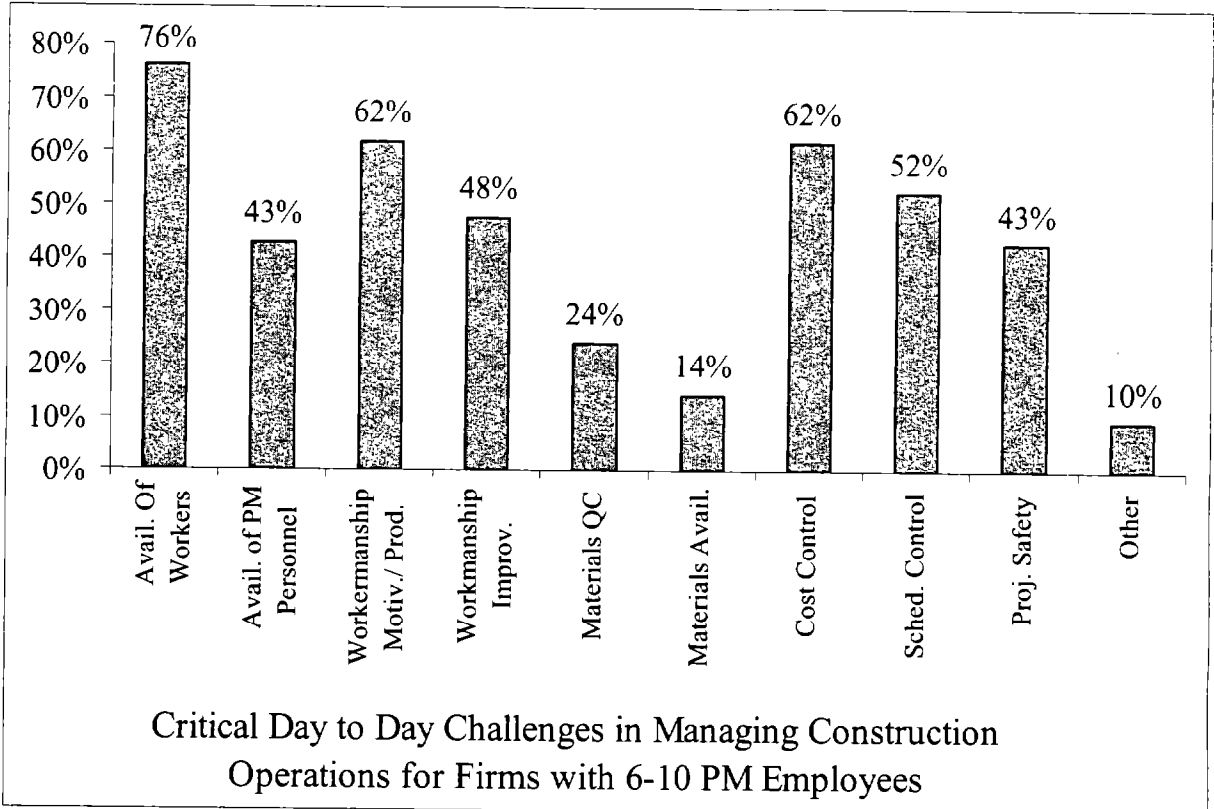


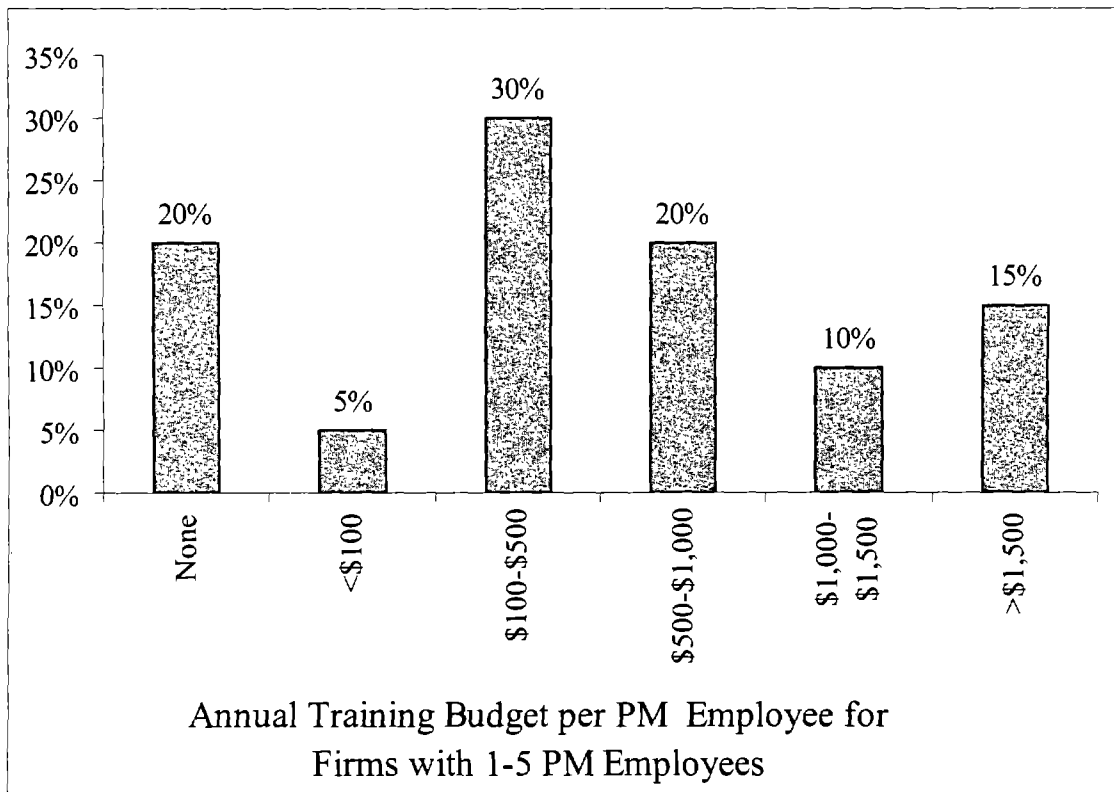
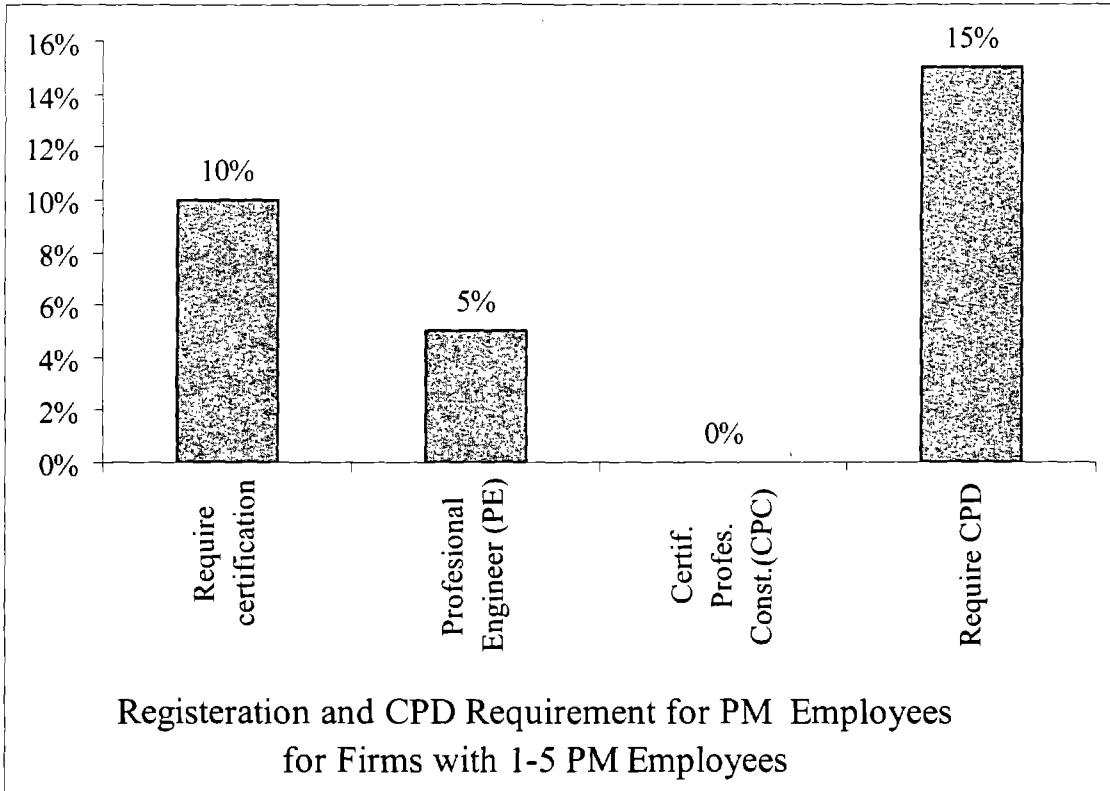


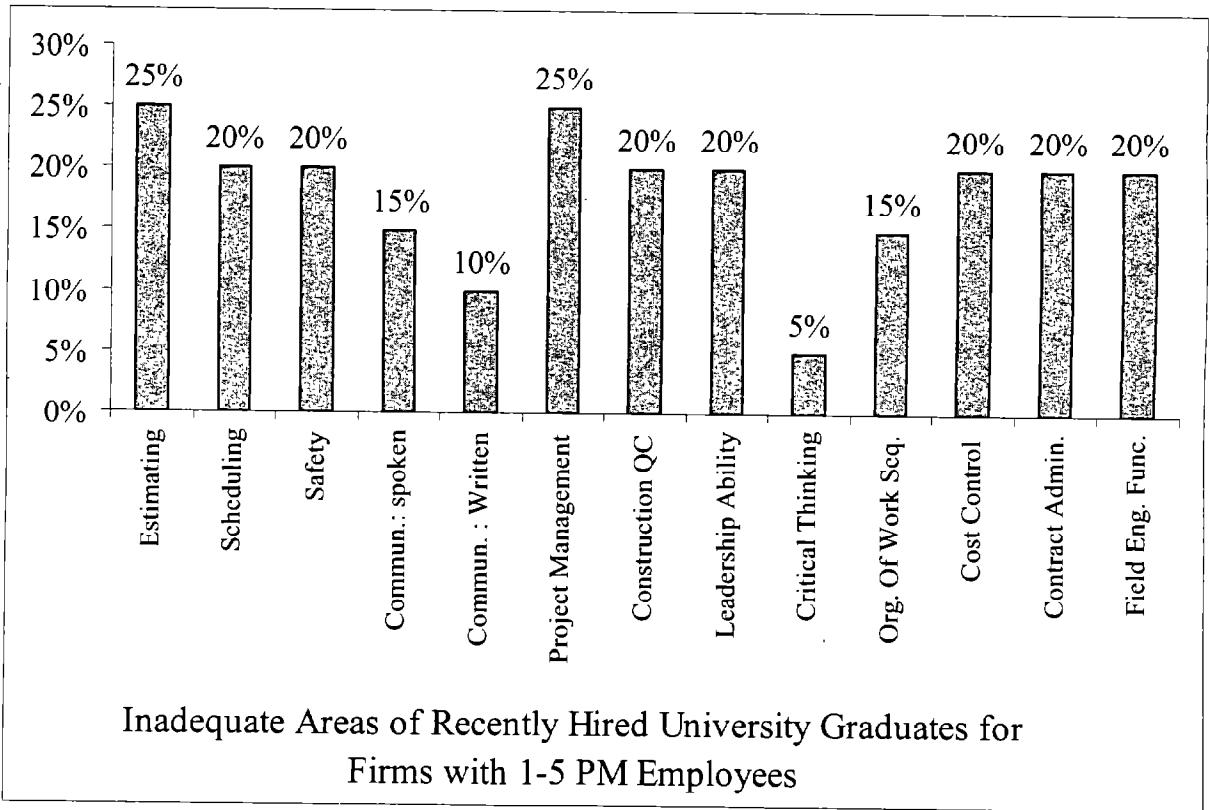
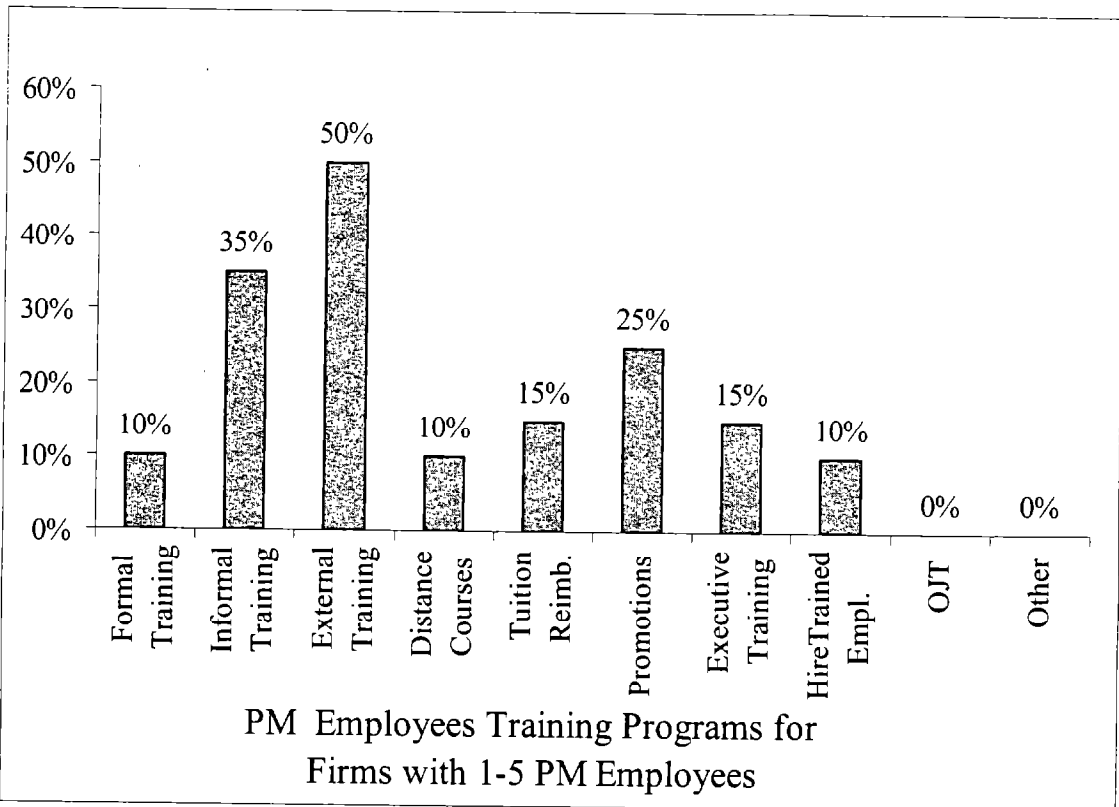


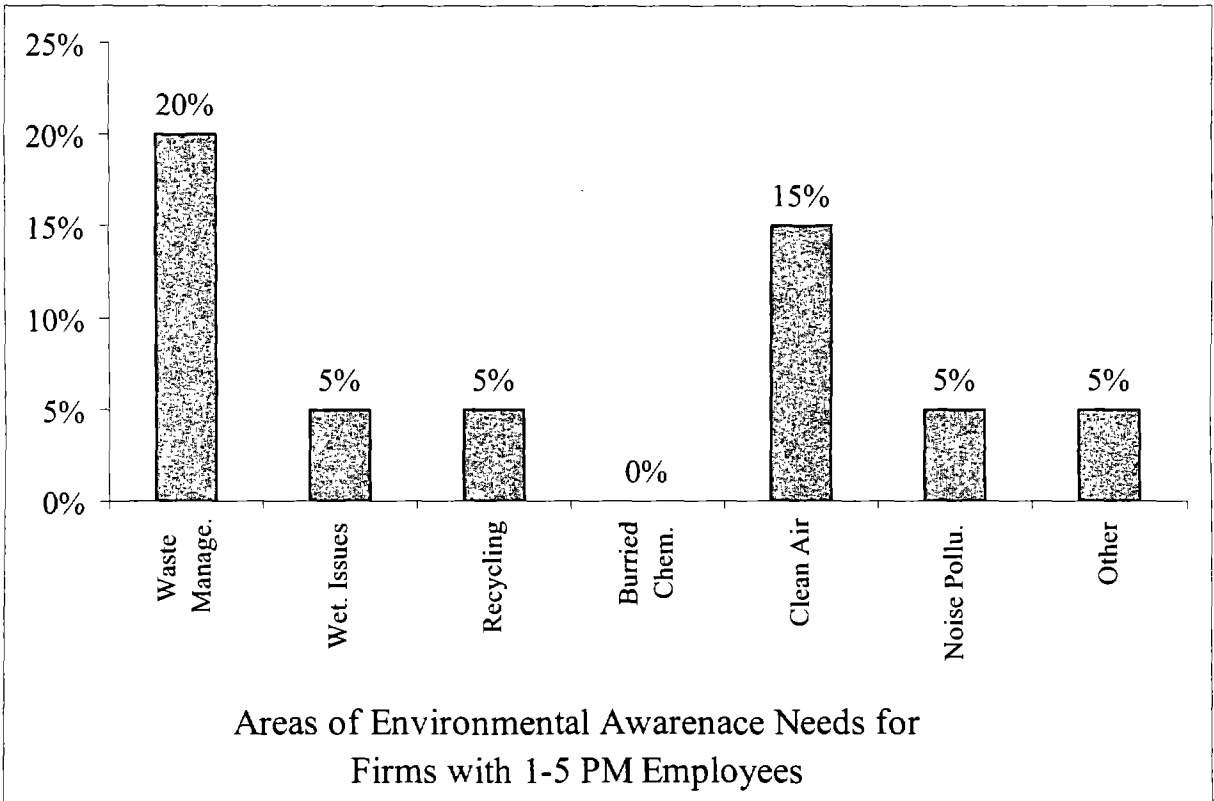
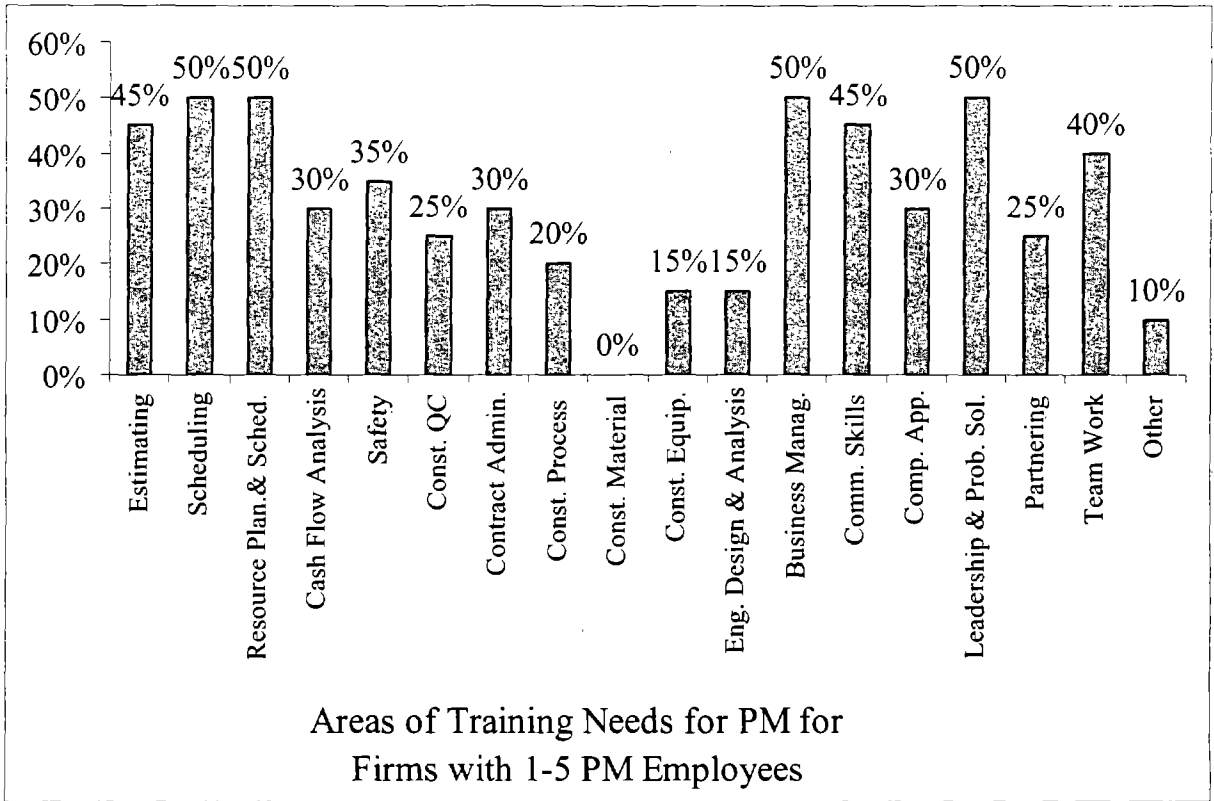


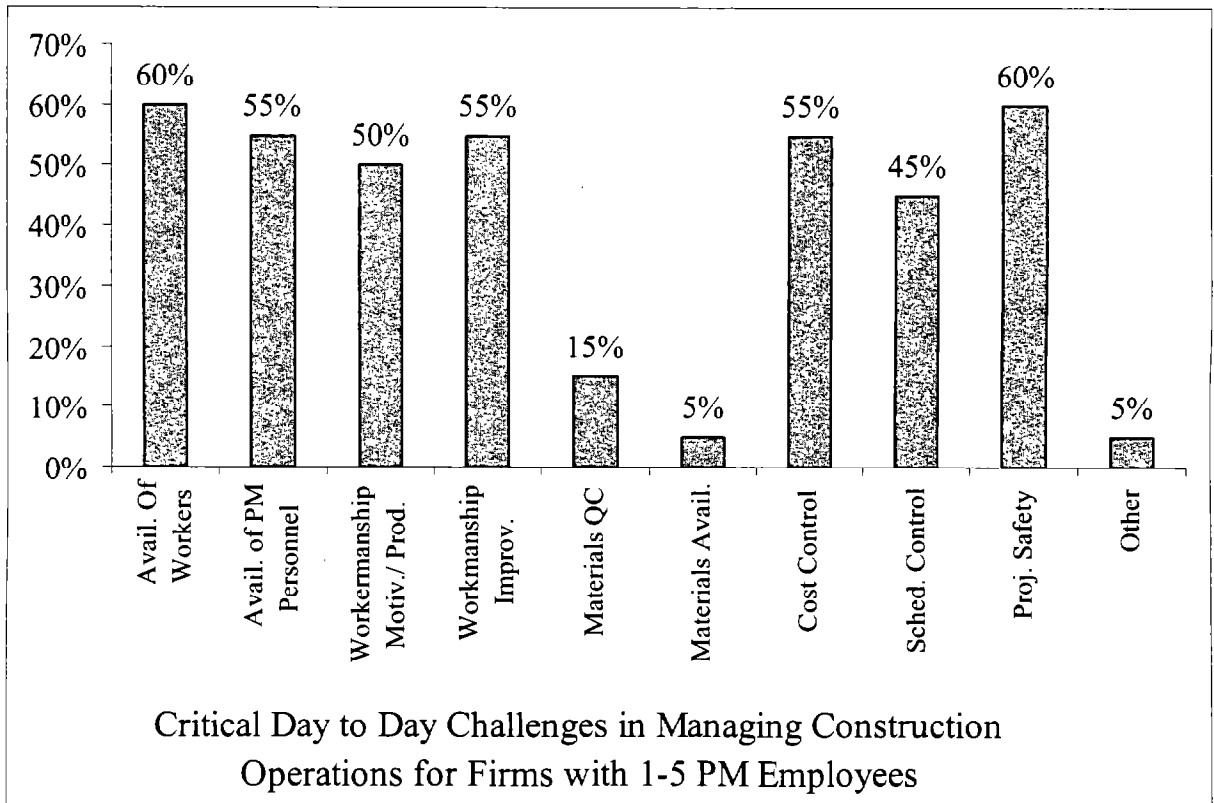
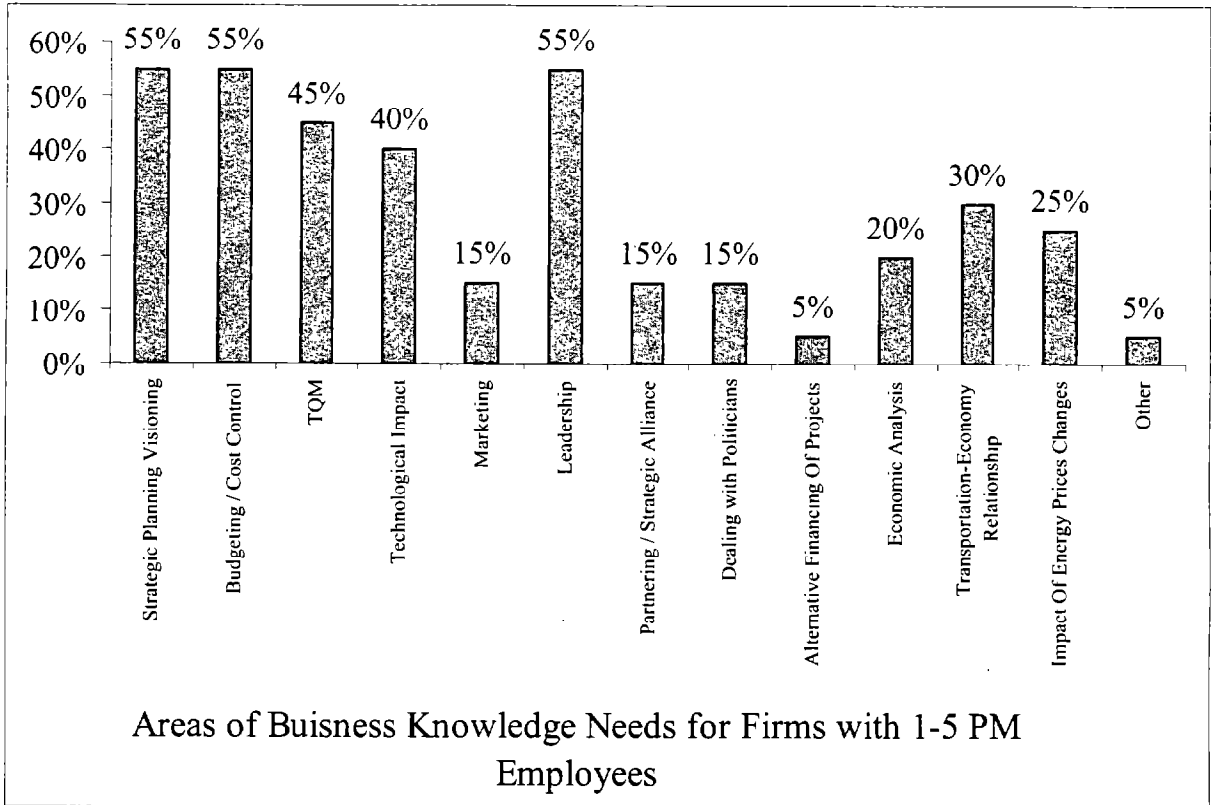






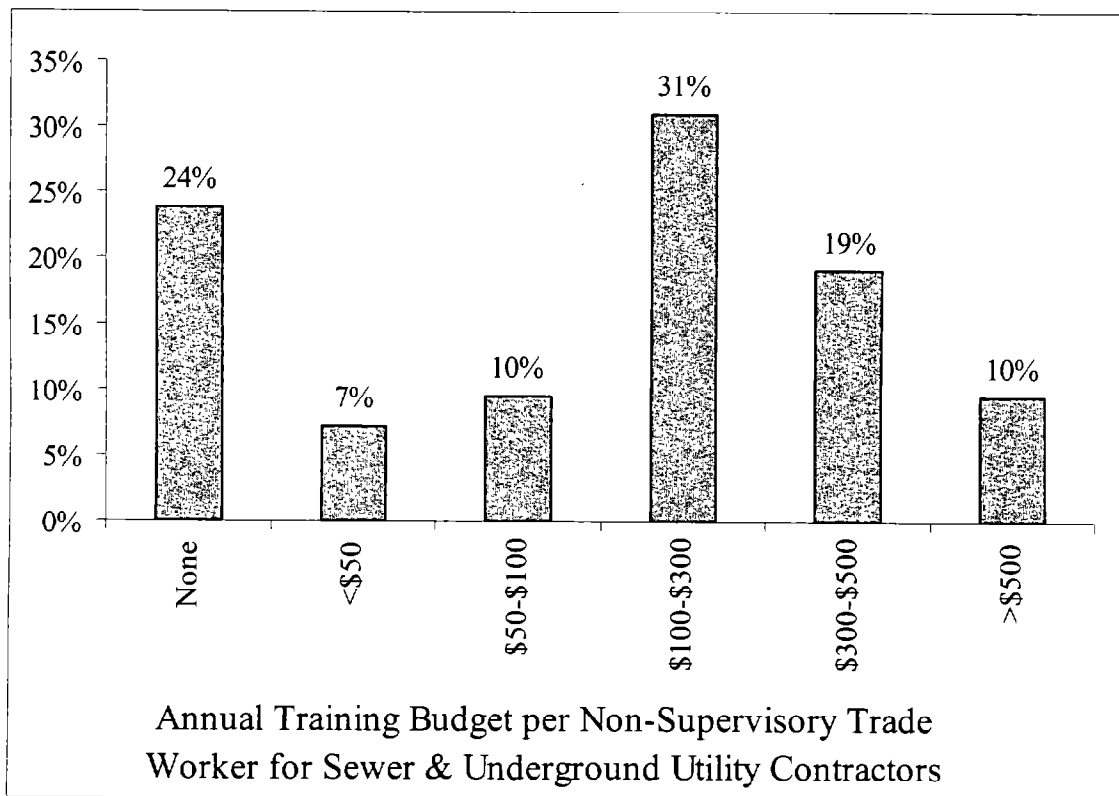
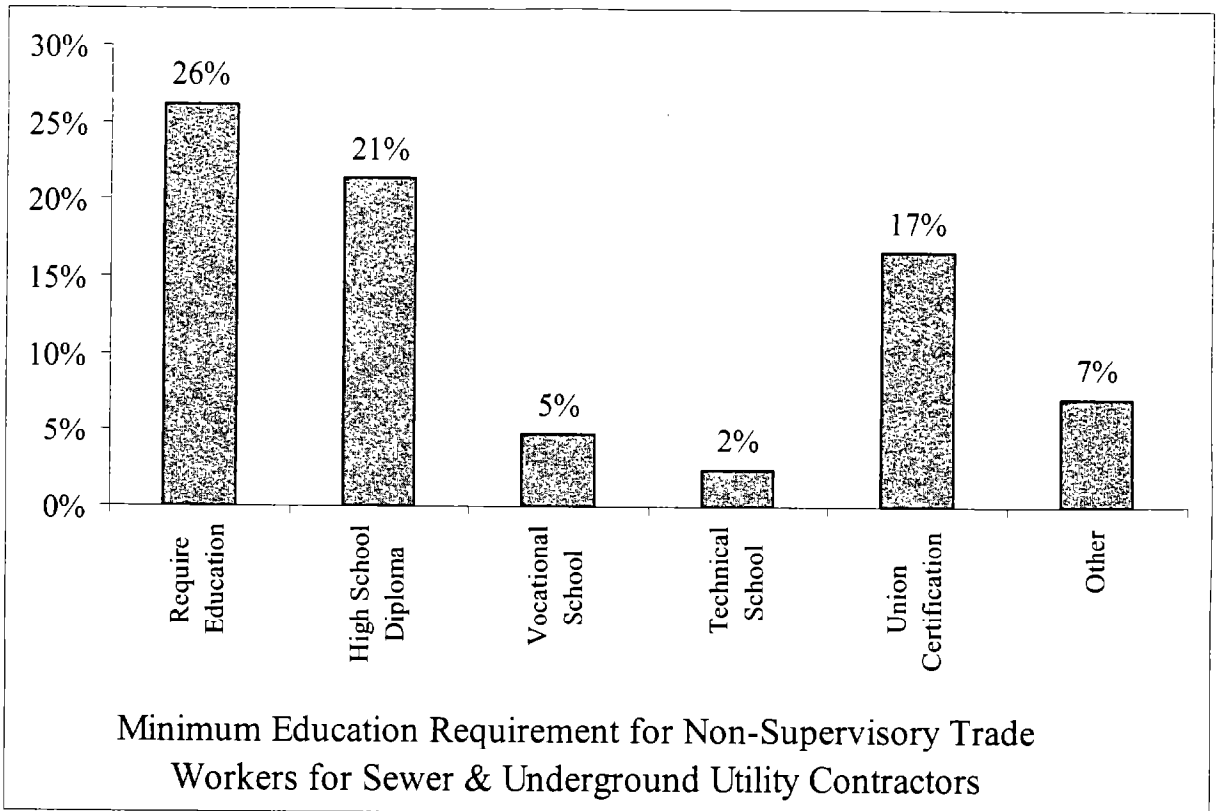




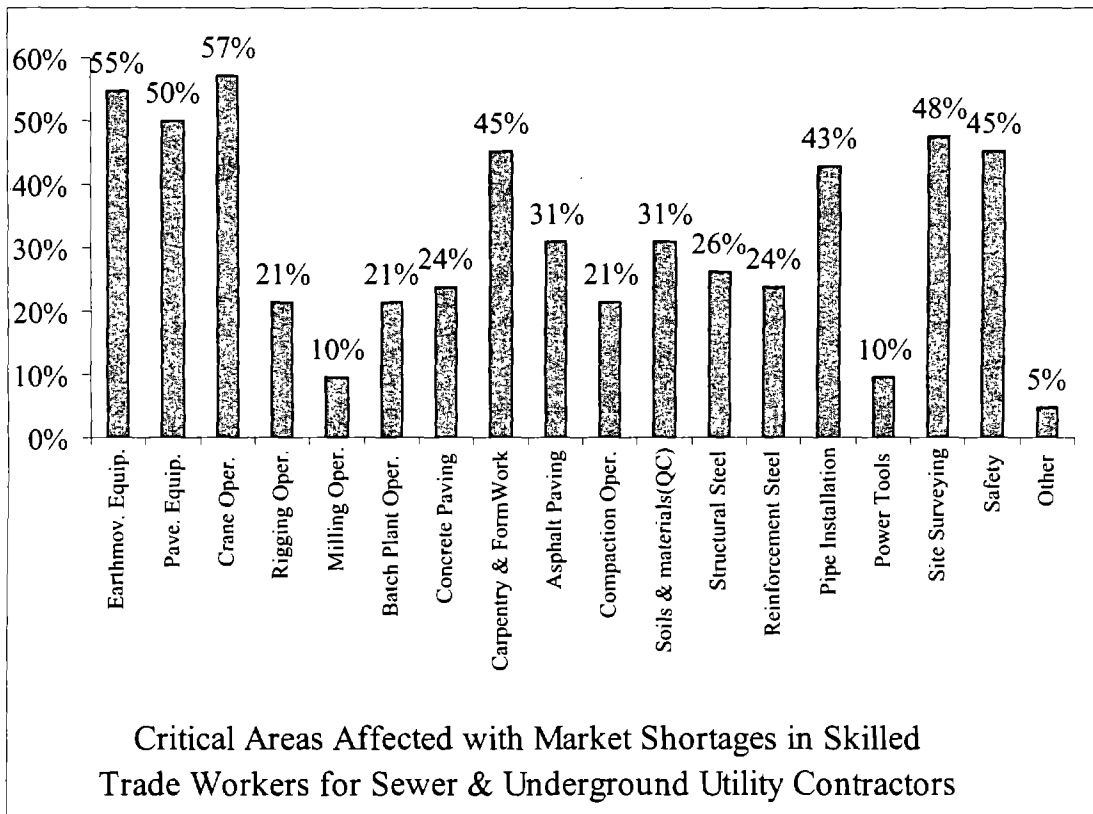
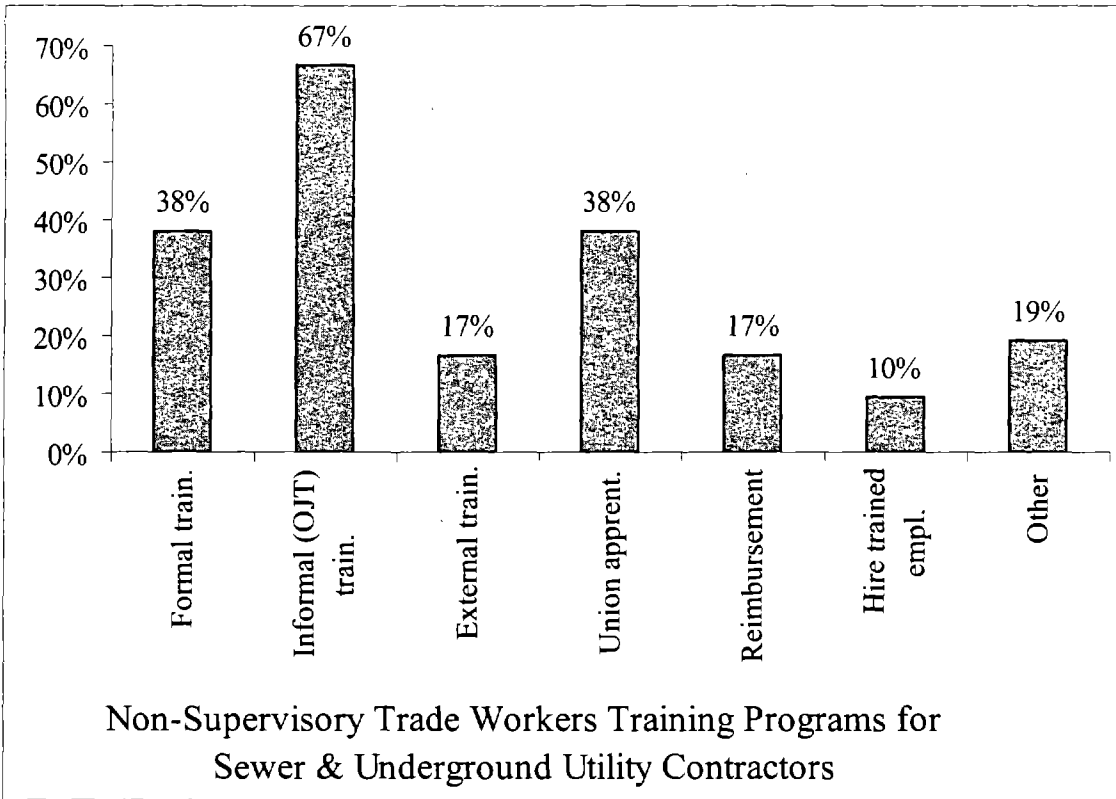


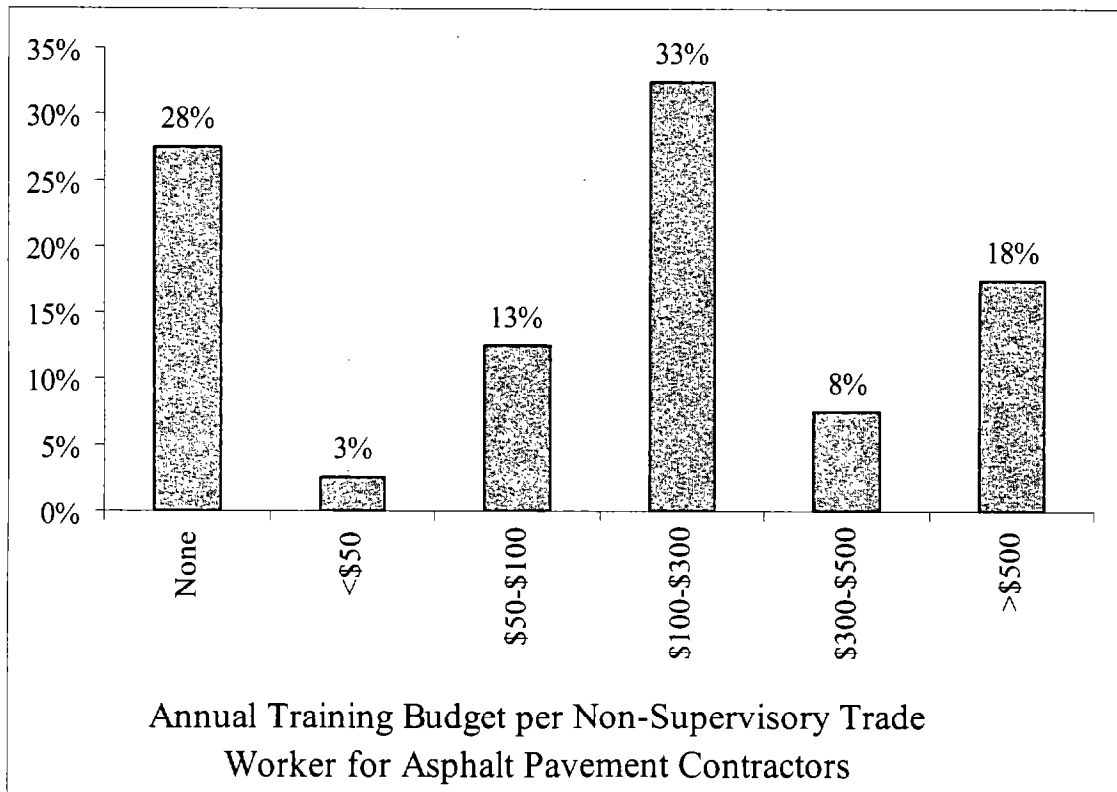
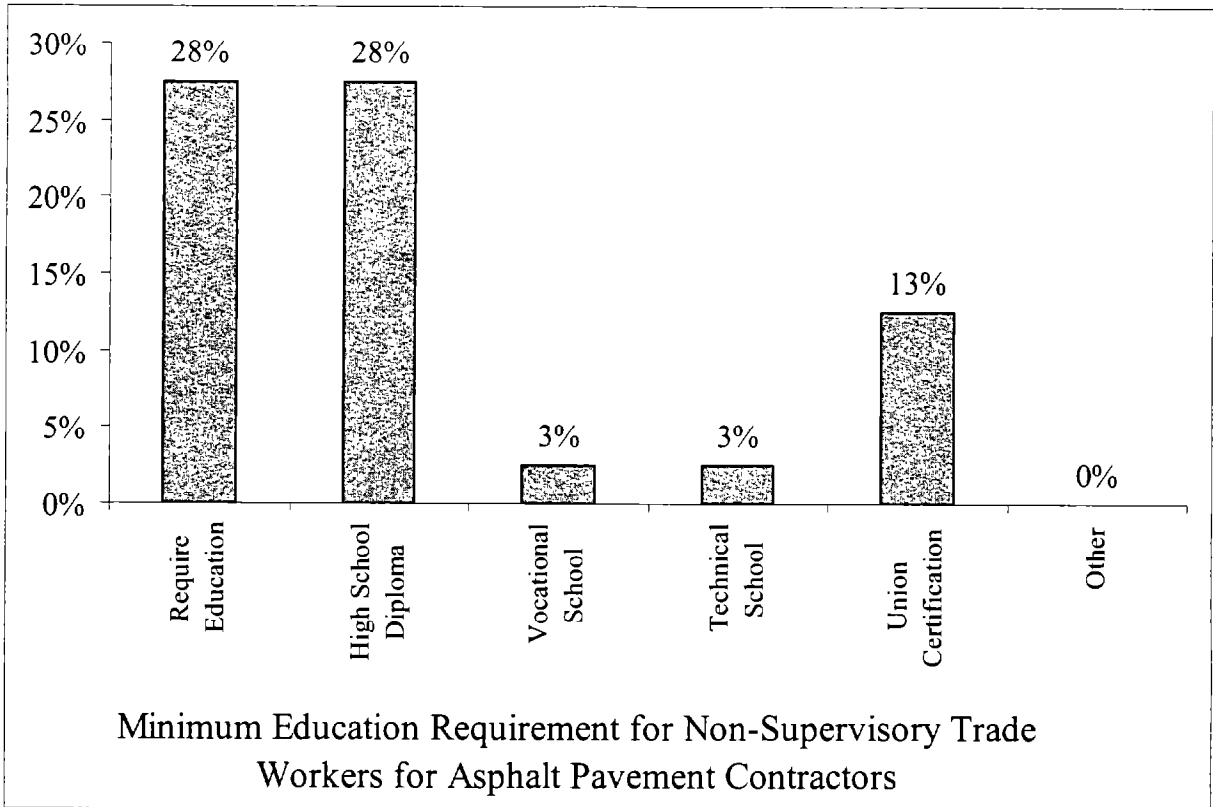
## **Appendix E**

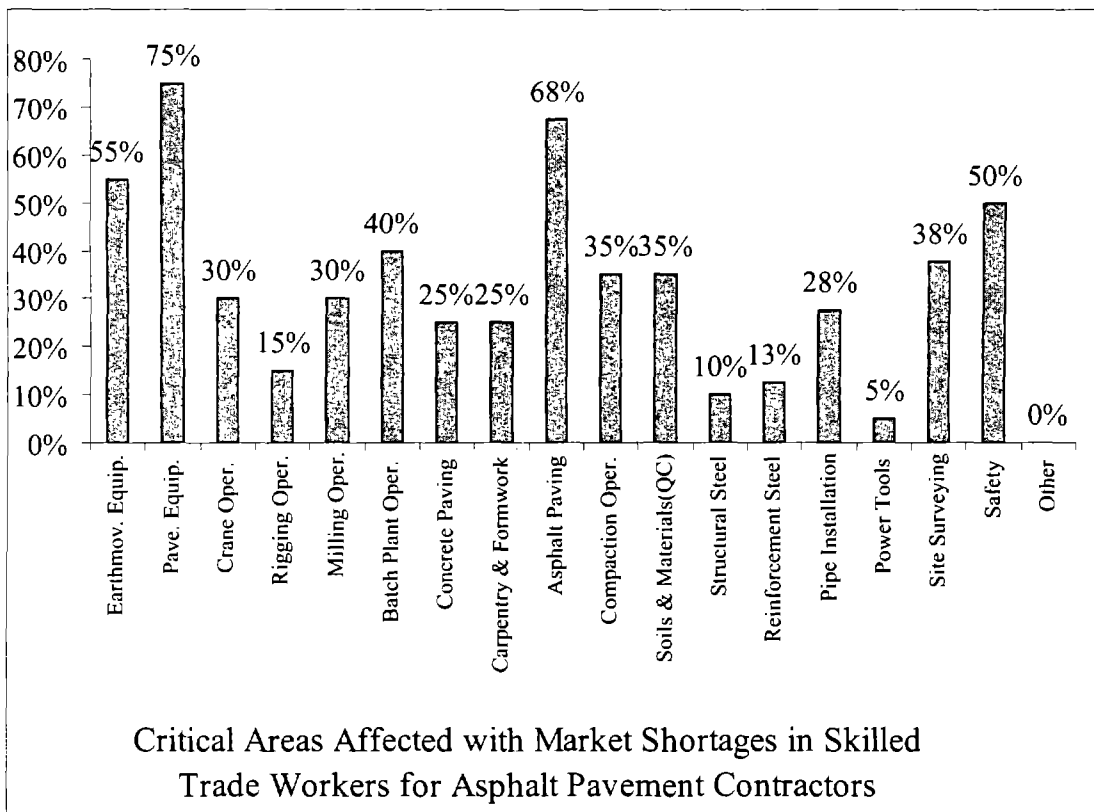
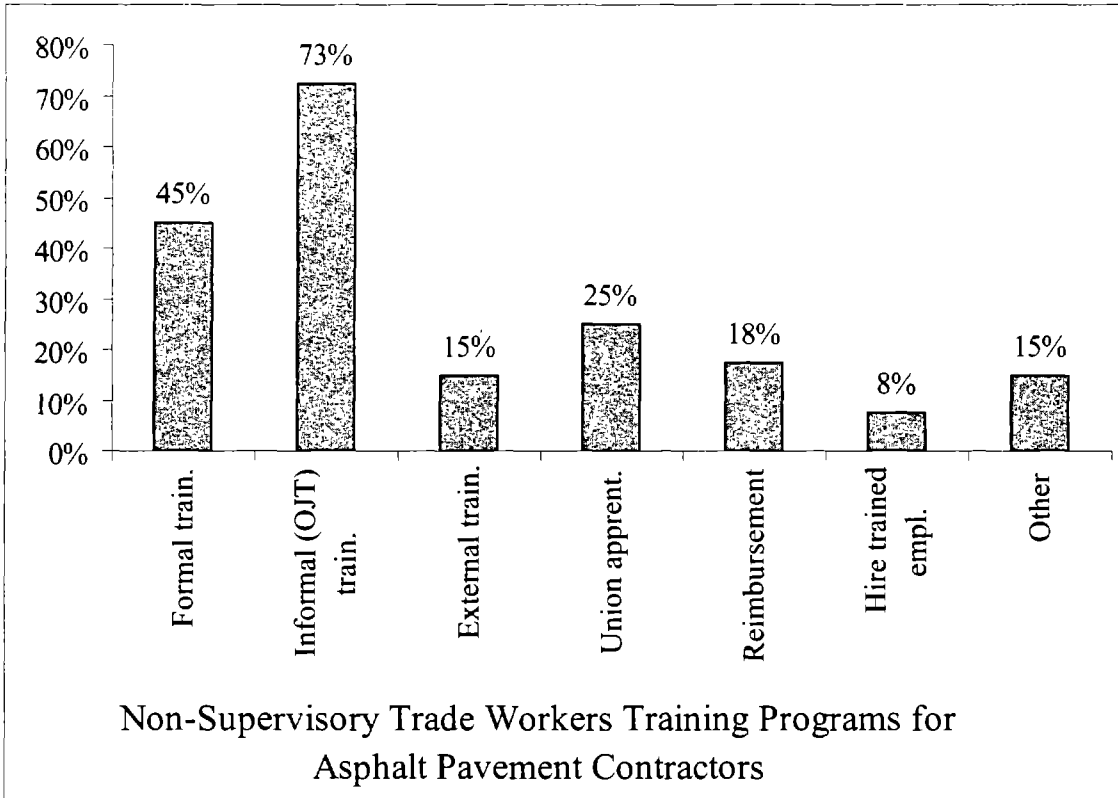
### **Analysis of Non-supervisory Skilled Workers Data by Construction Specialty**

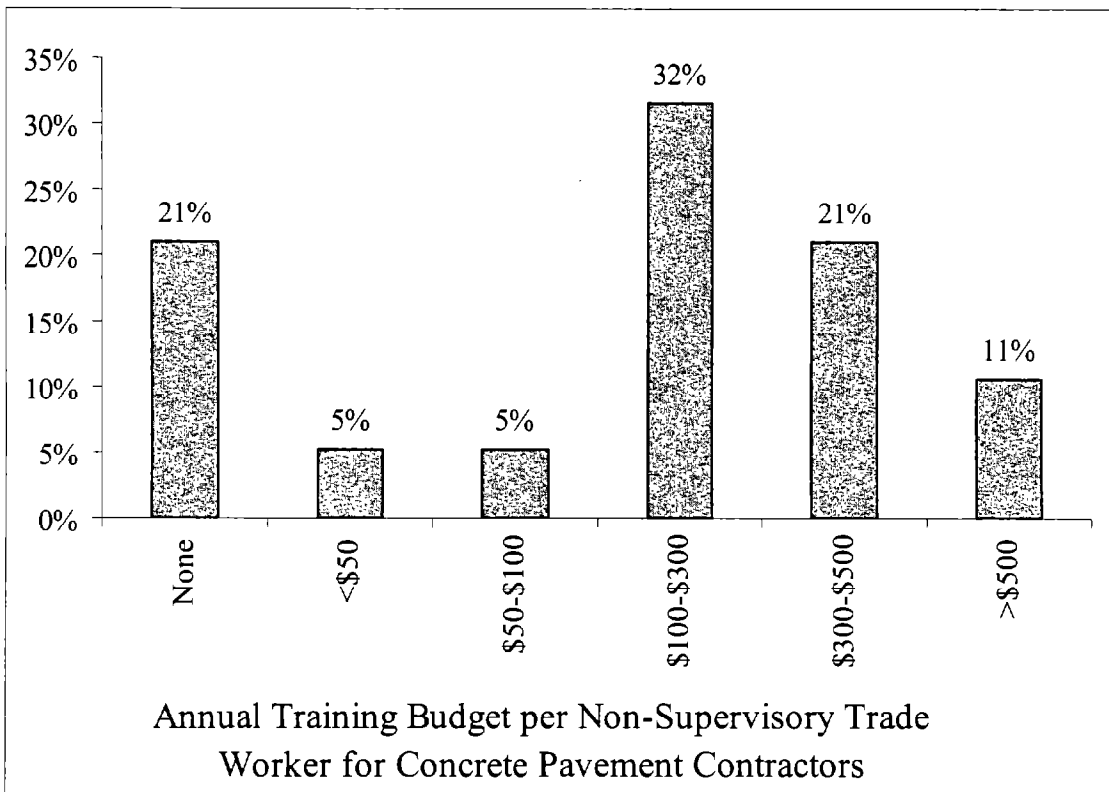
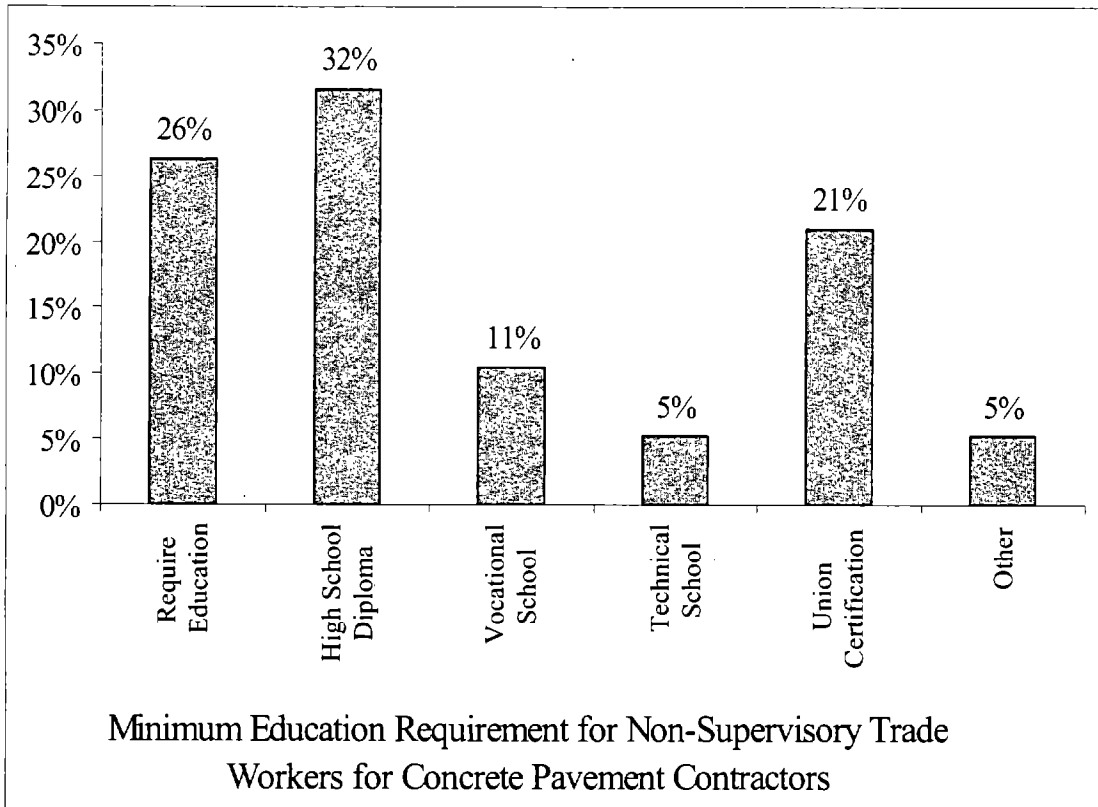


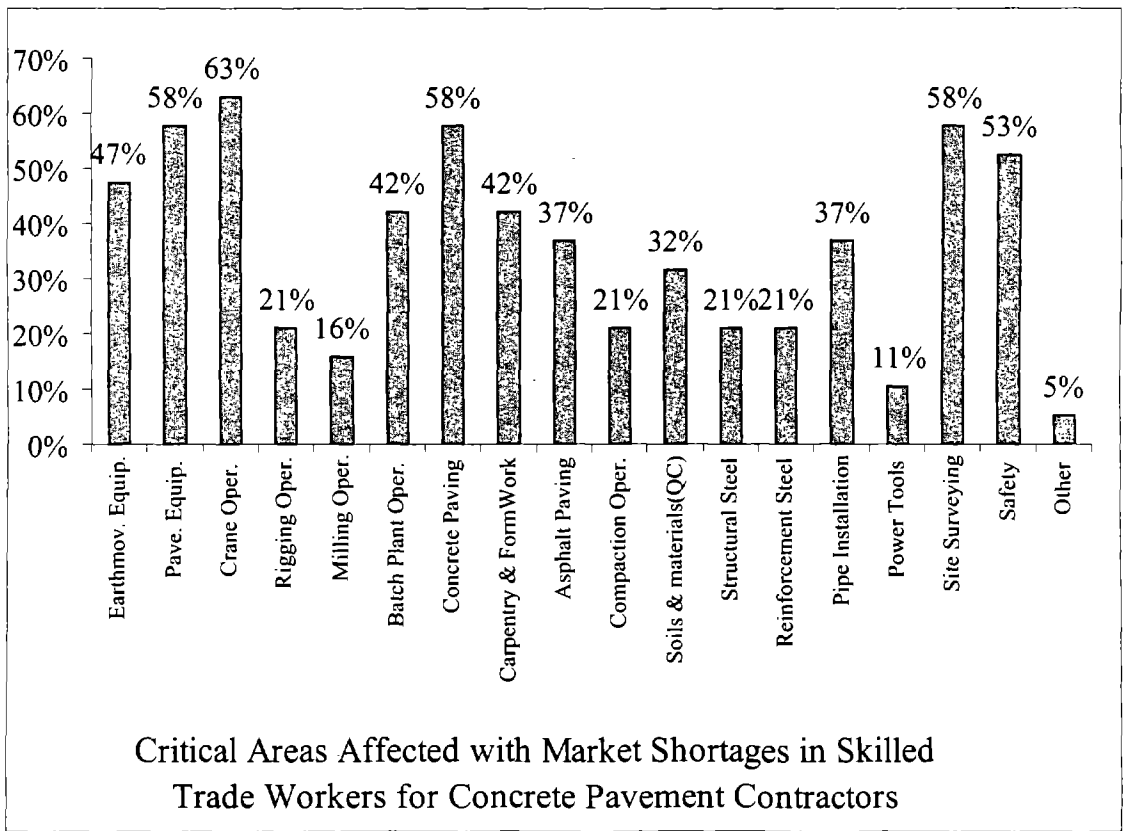
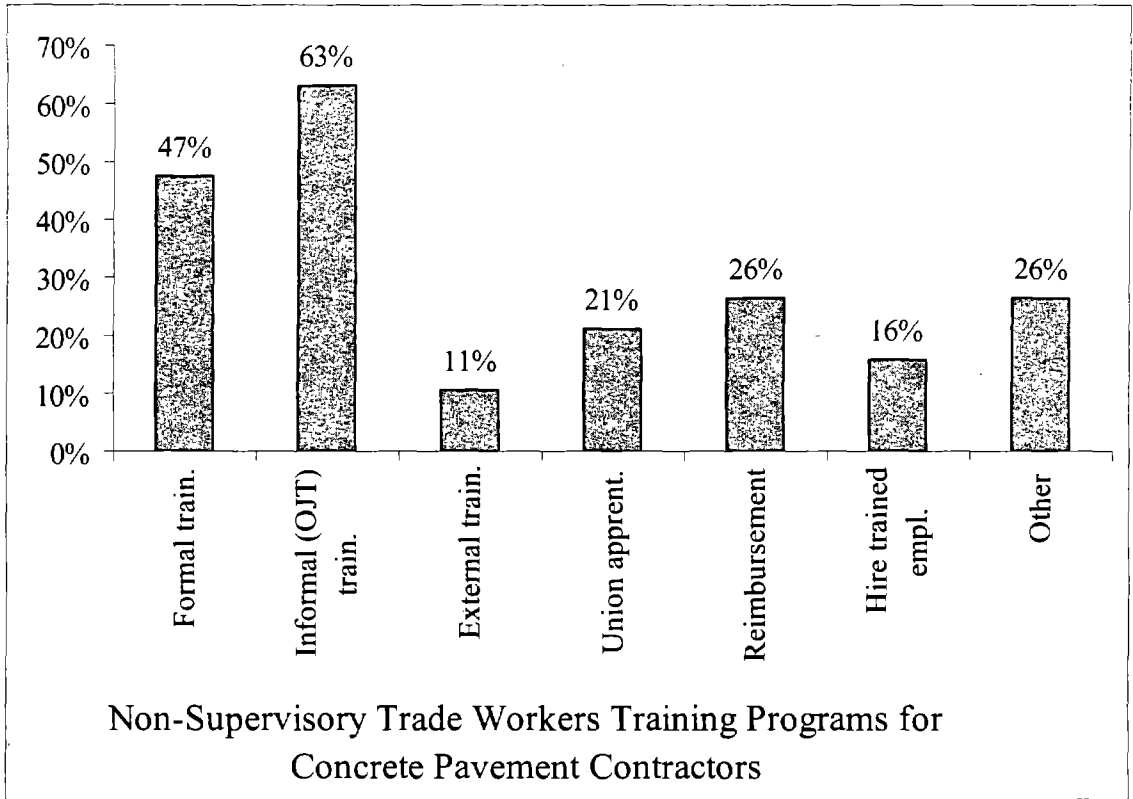


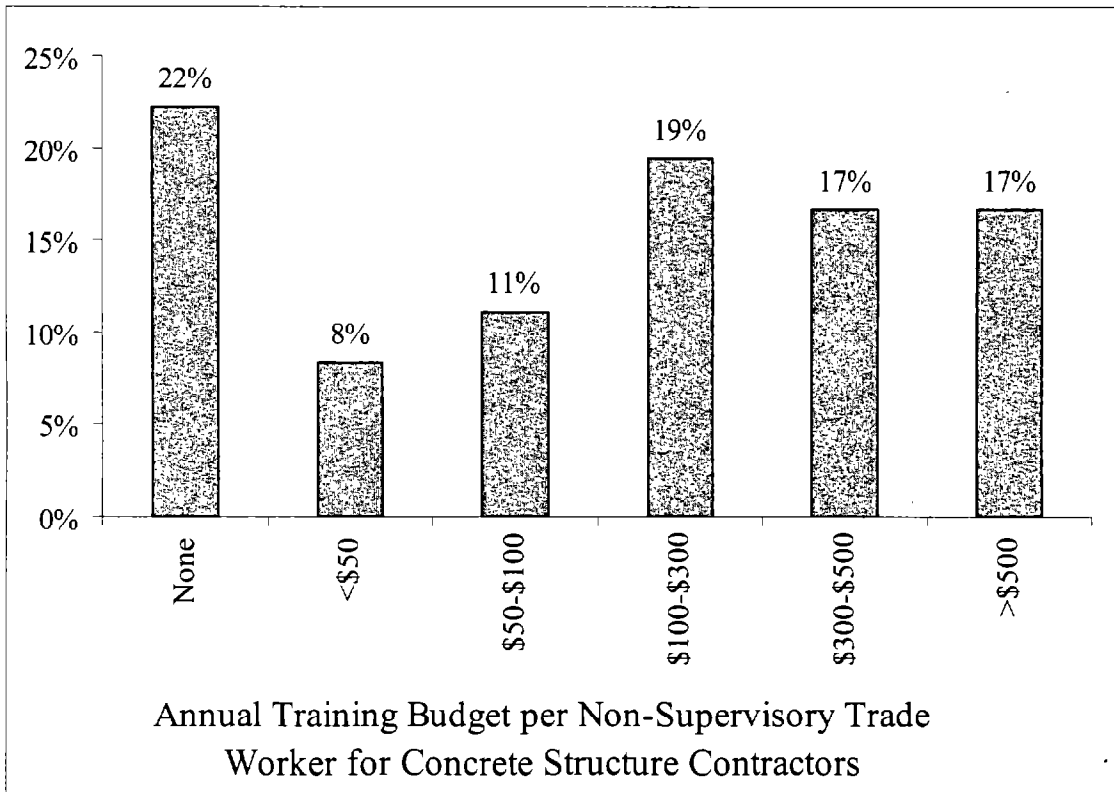
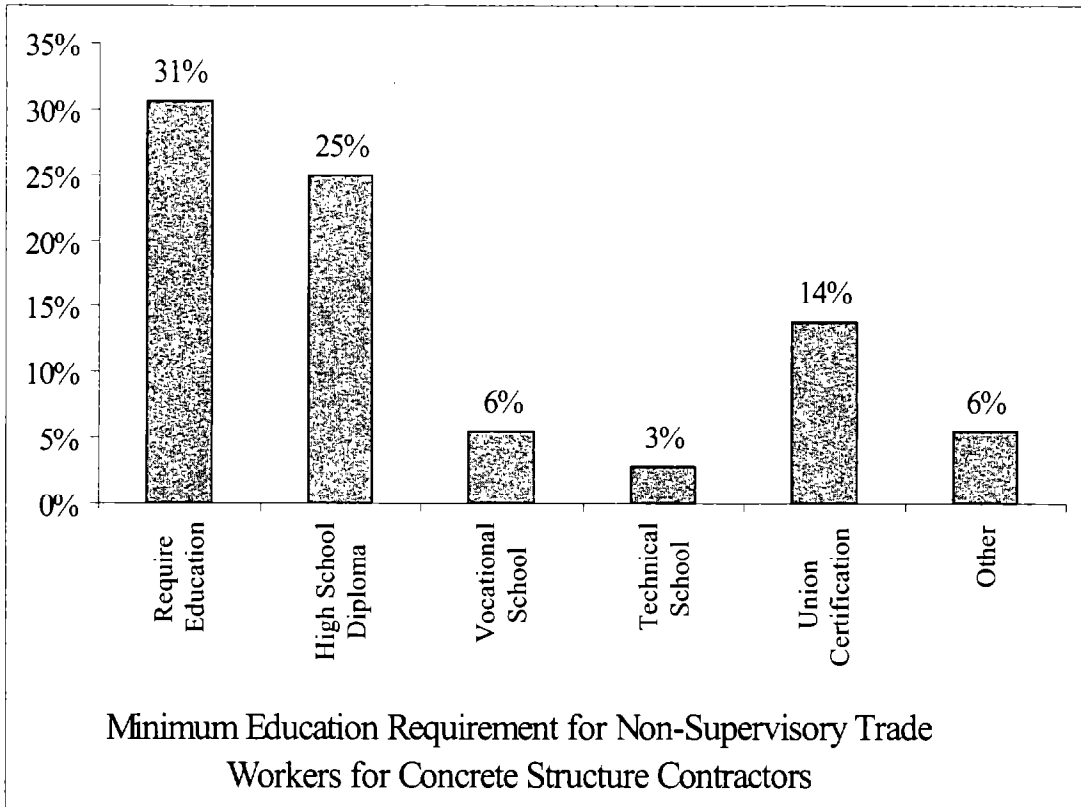


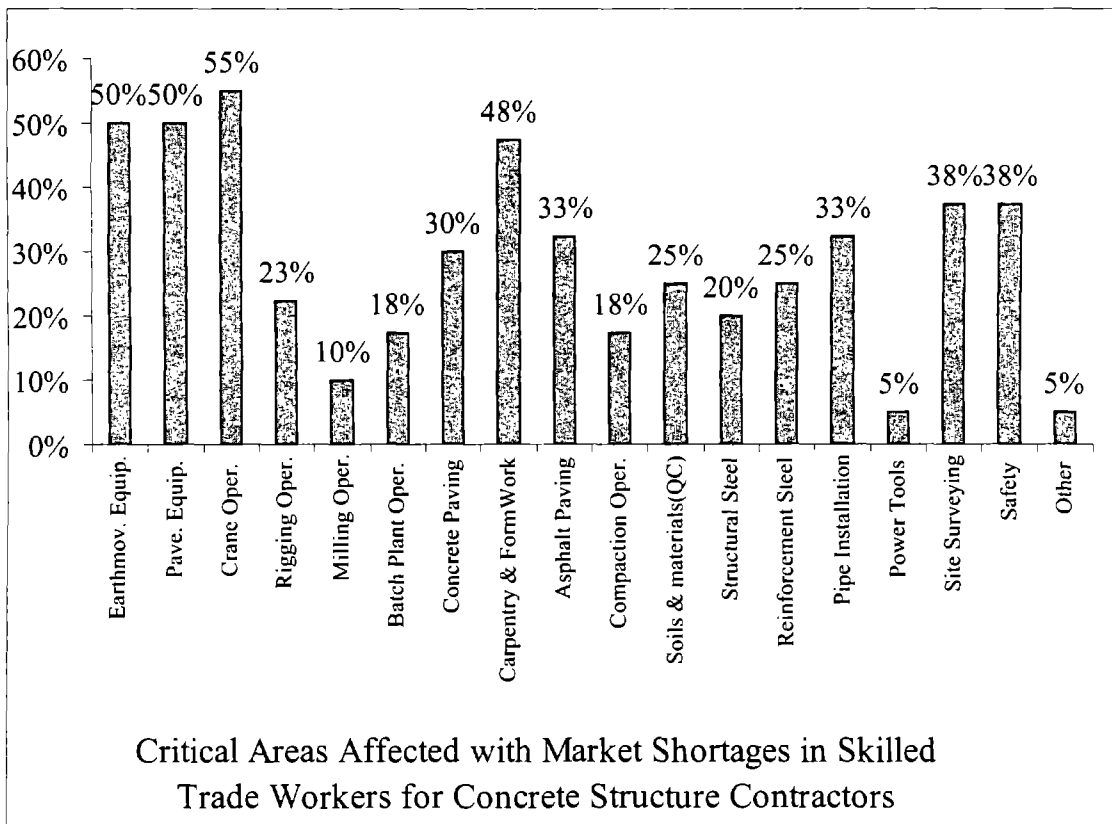
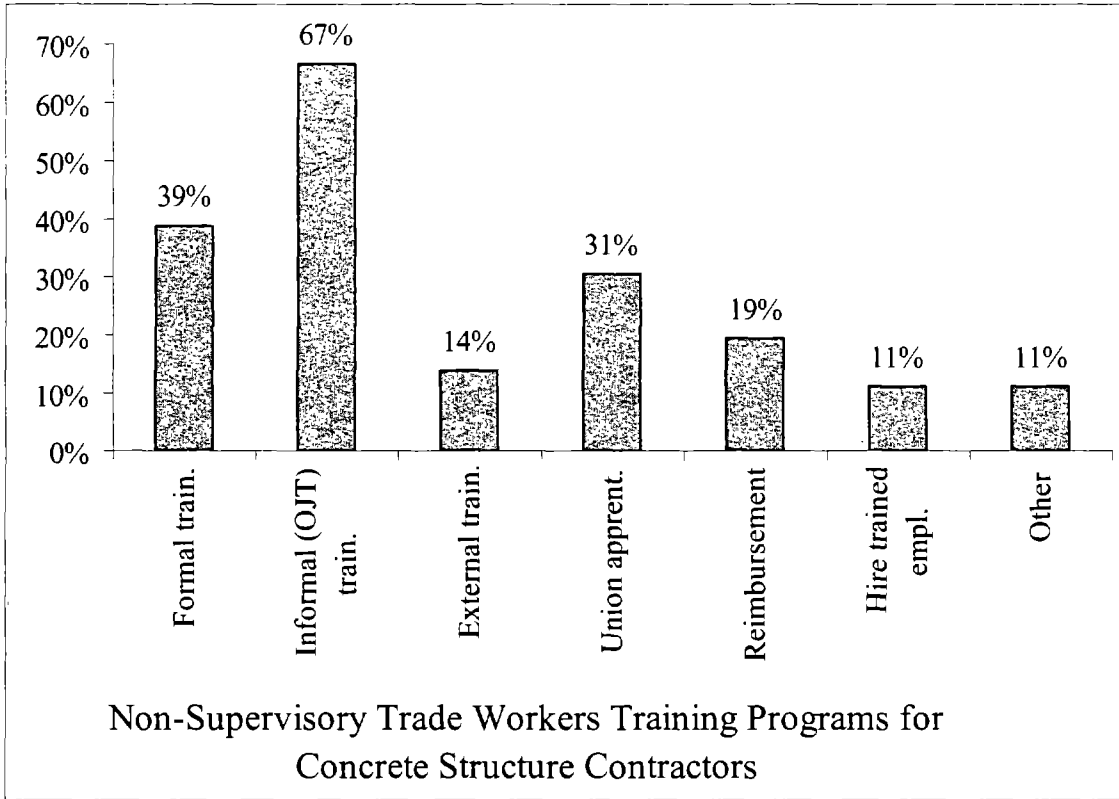


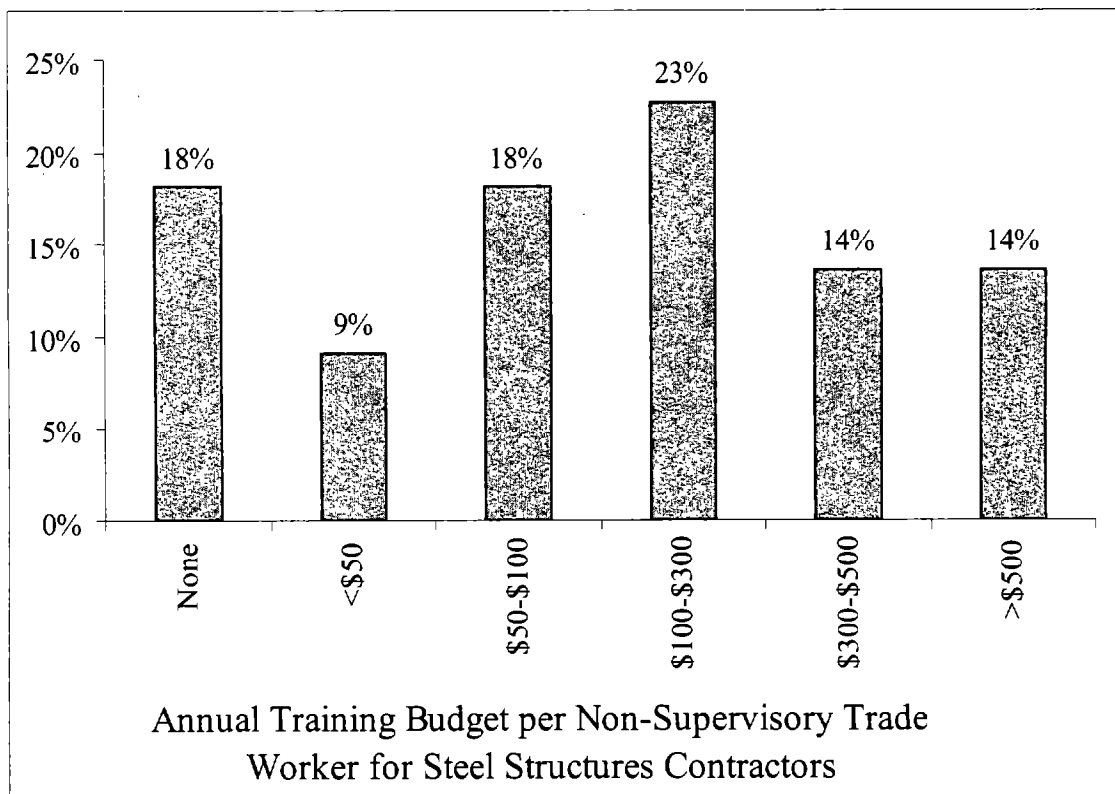
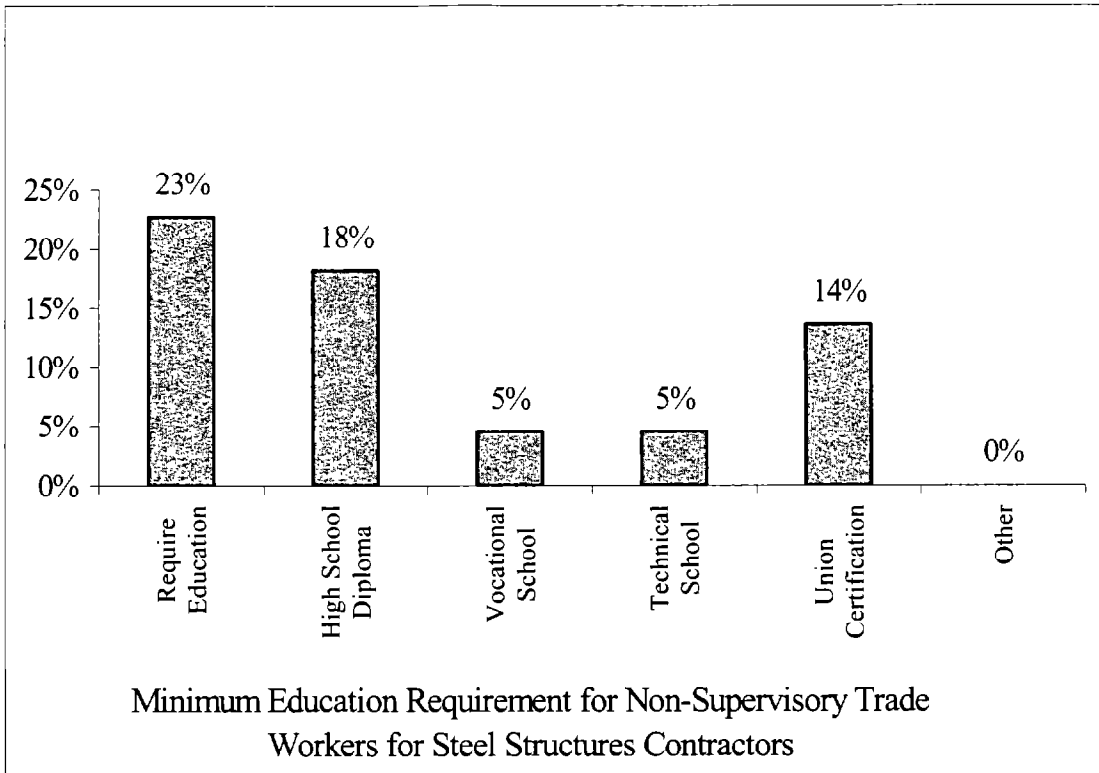




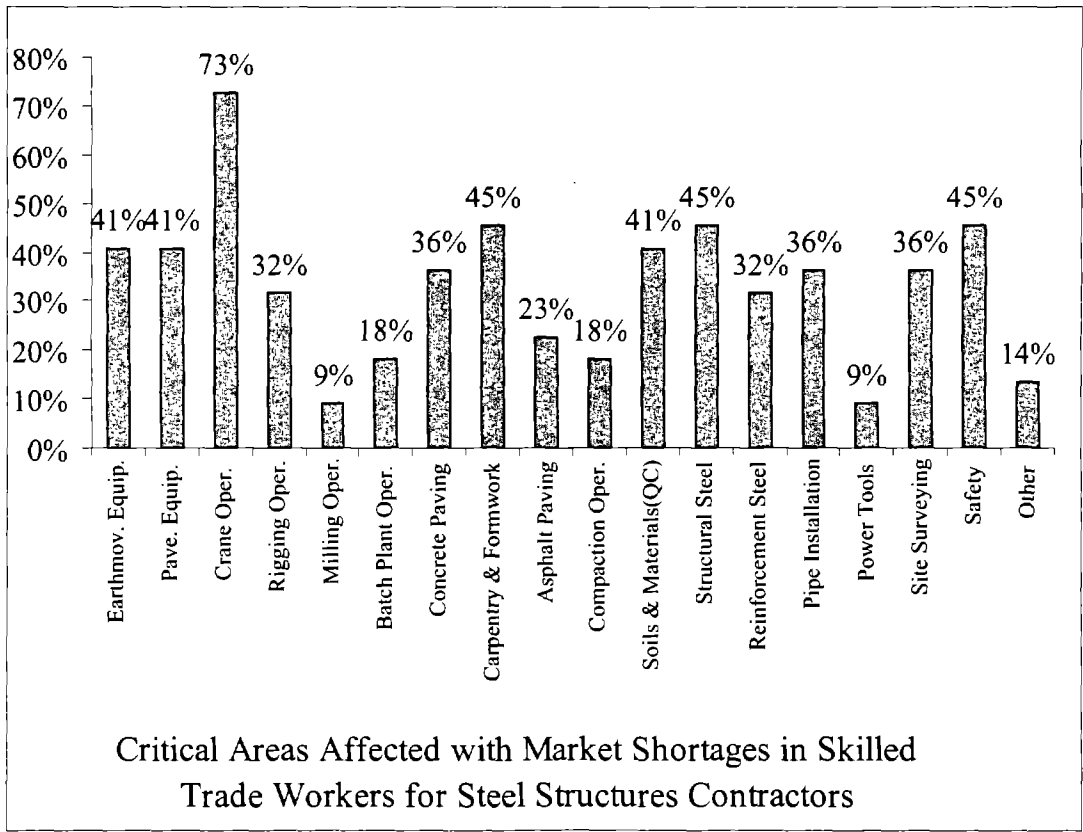
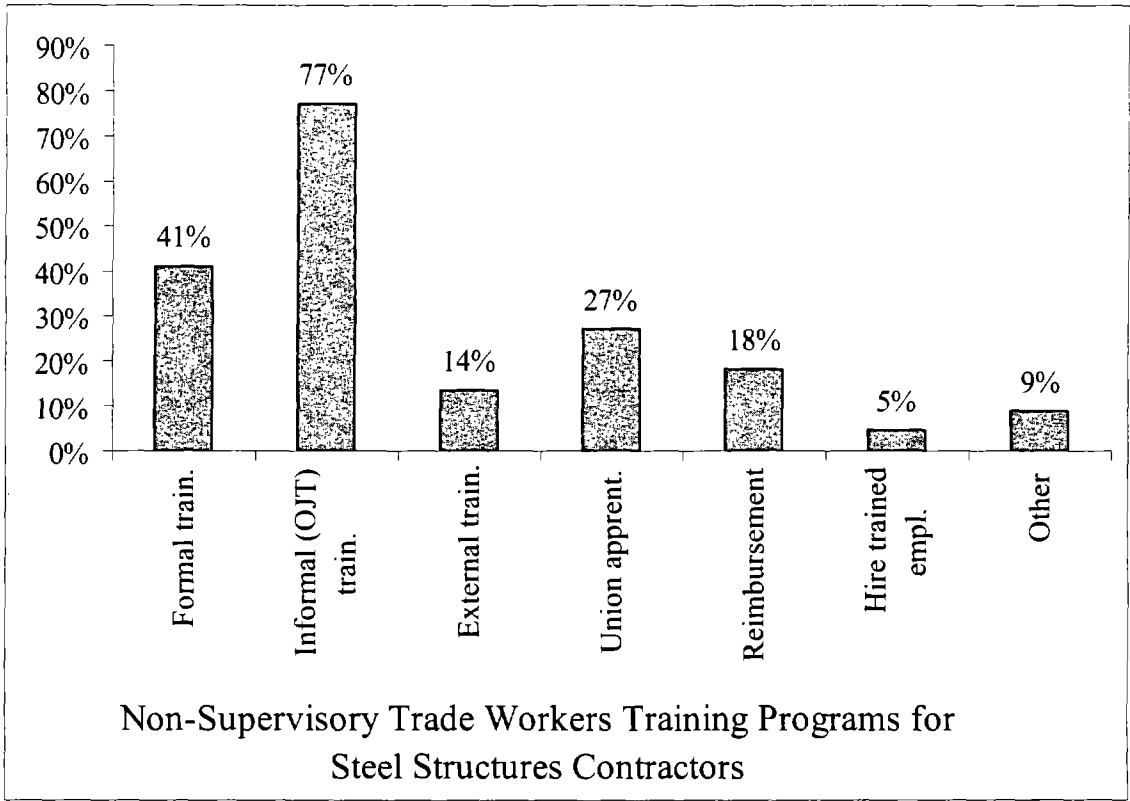


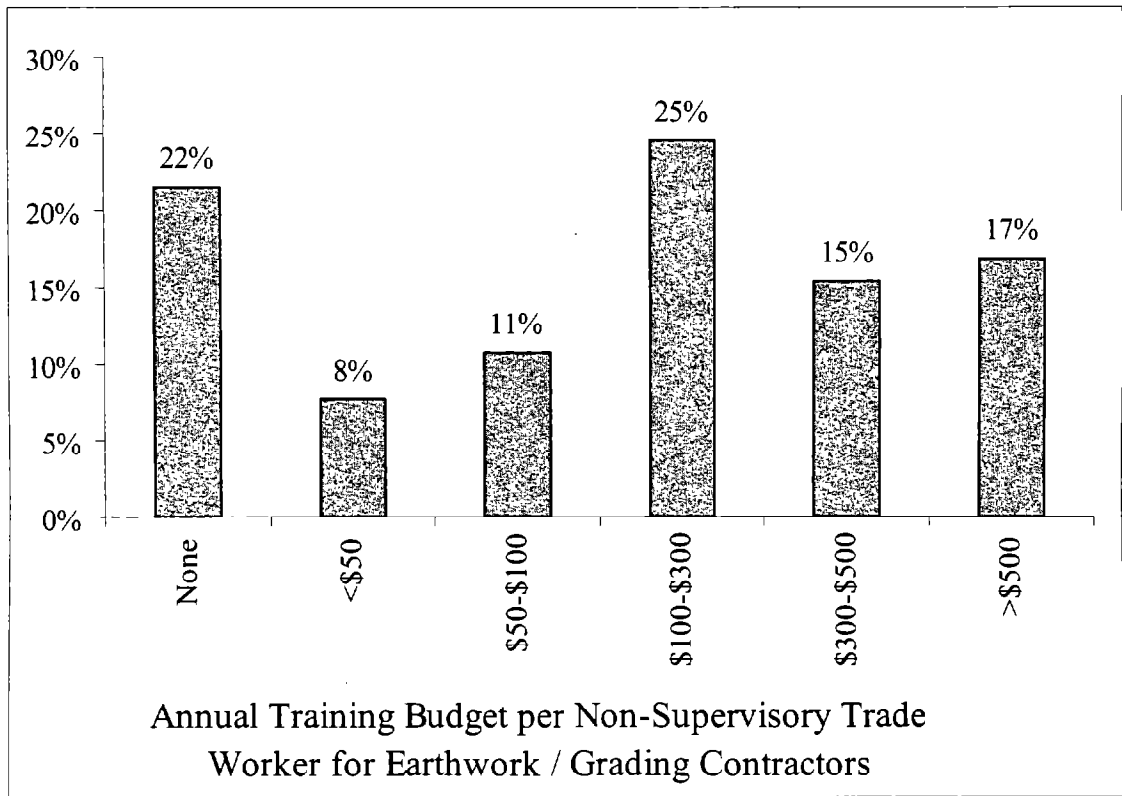
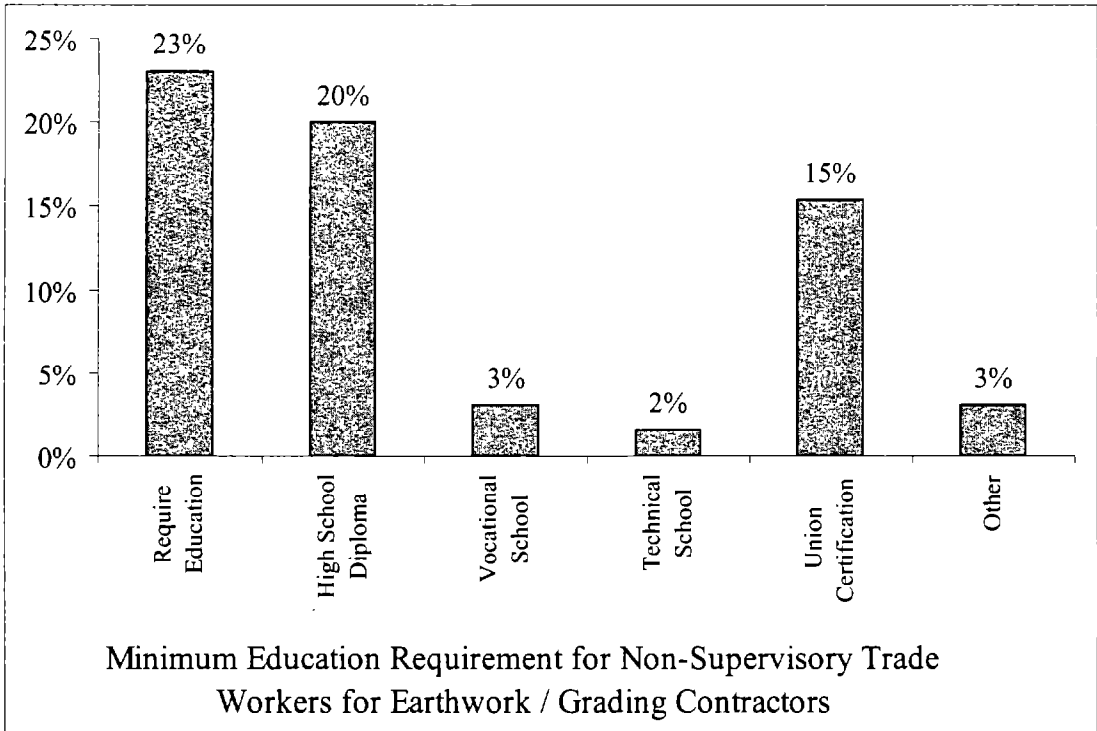


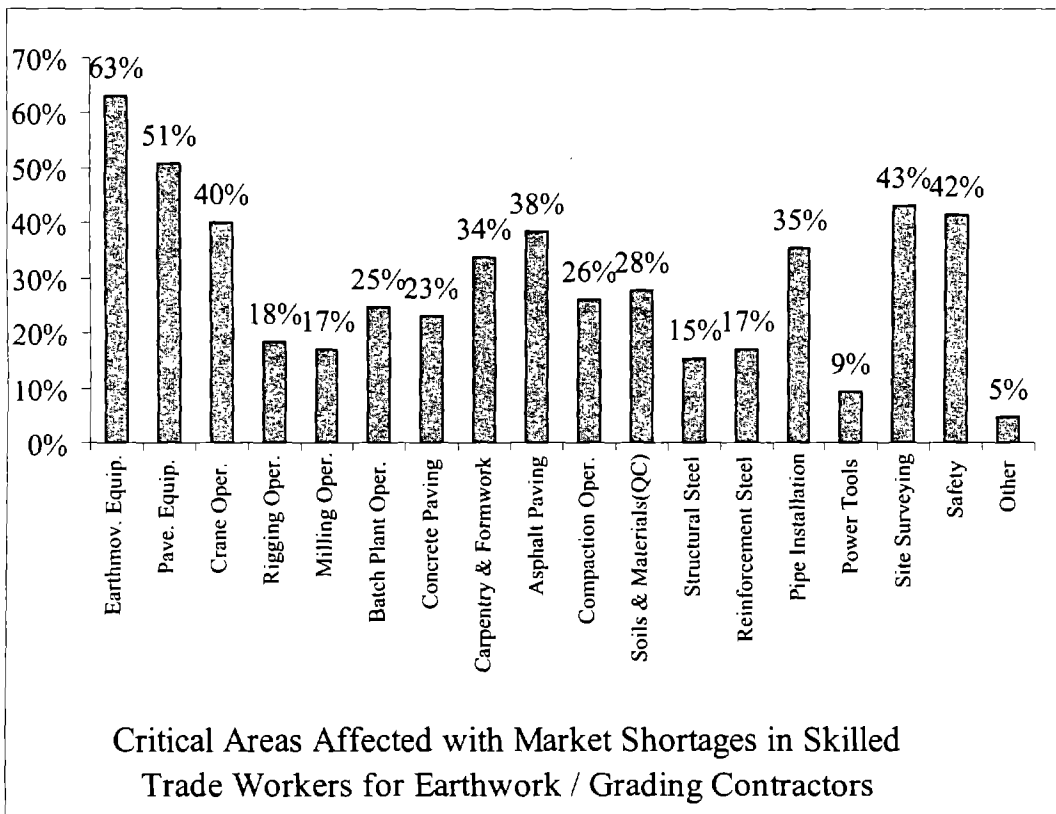
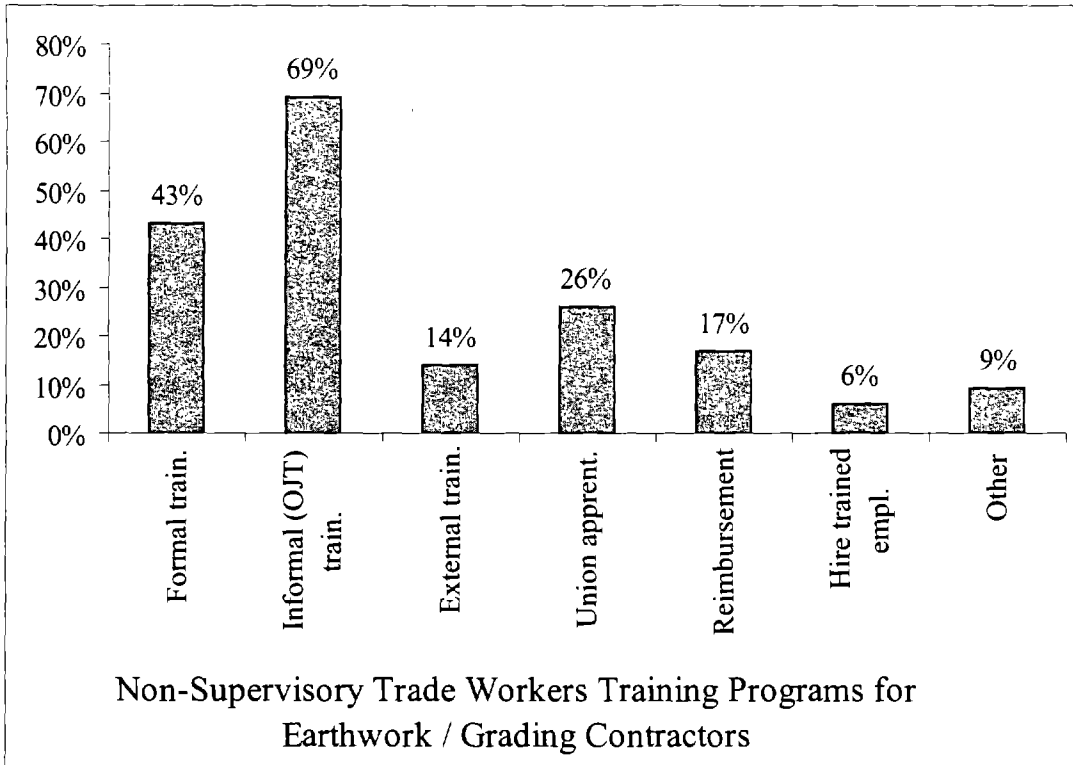










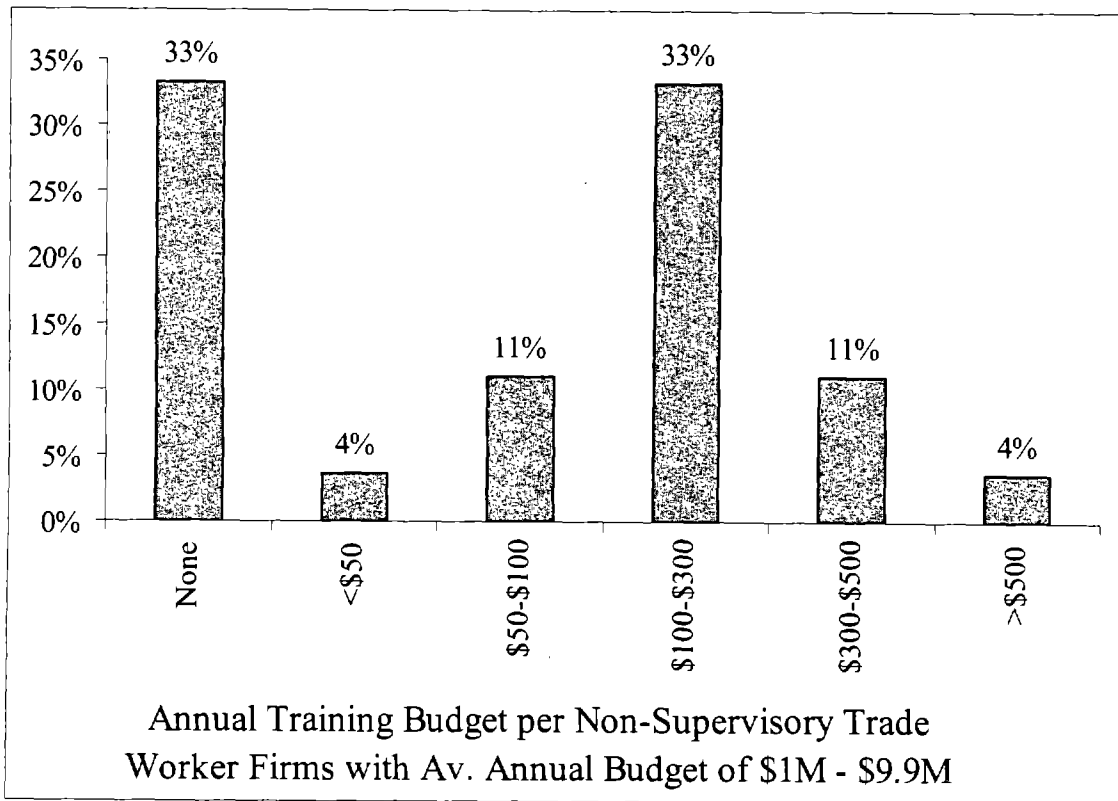
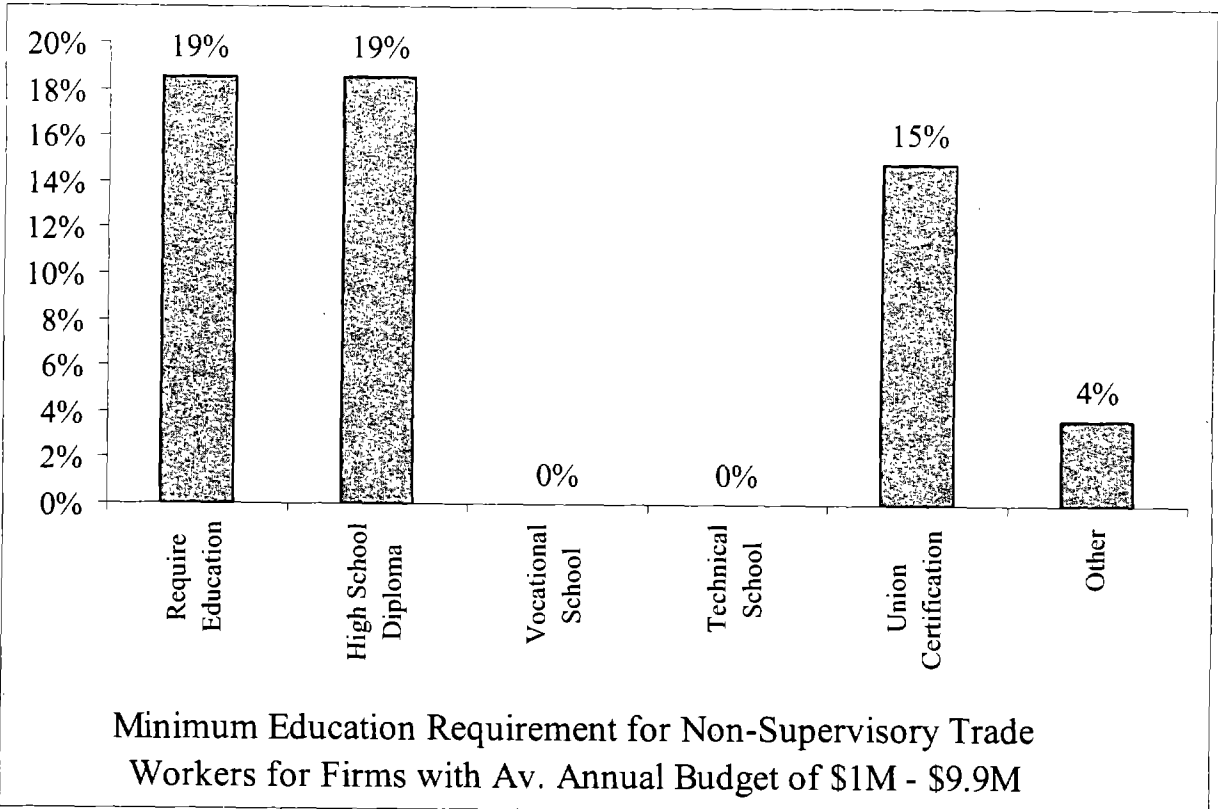


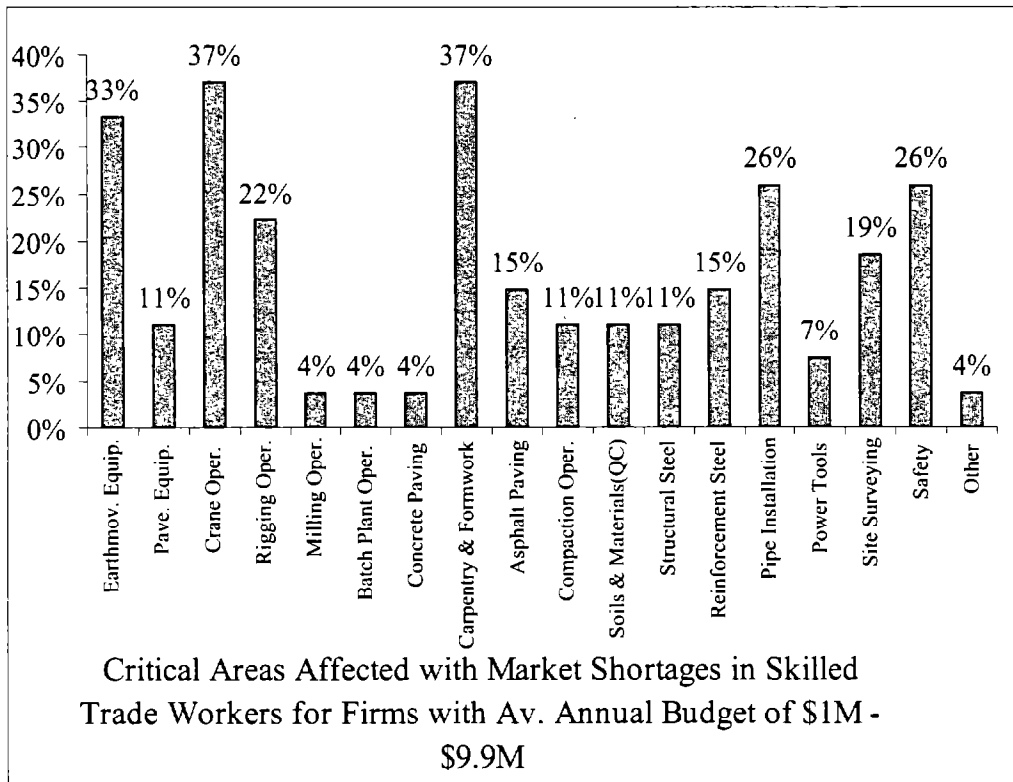
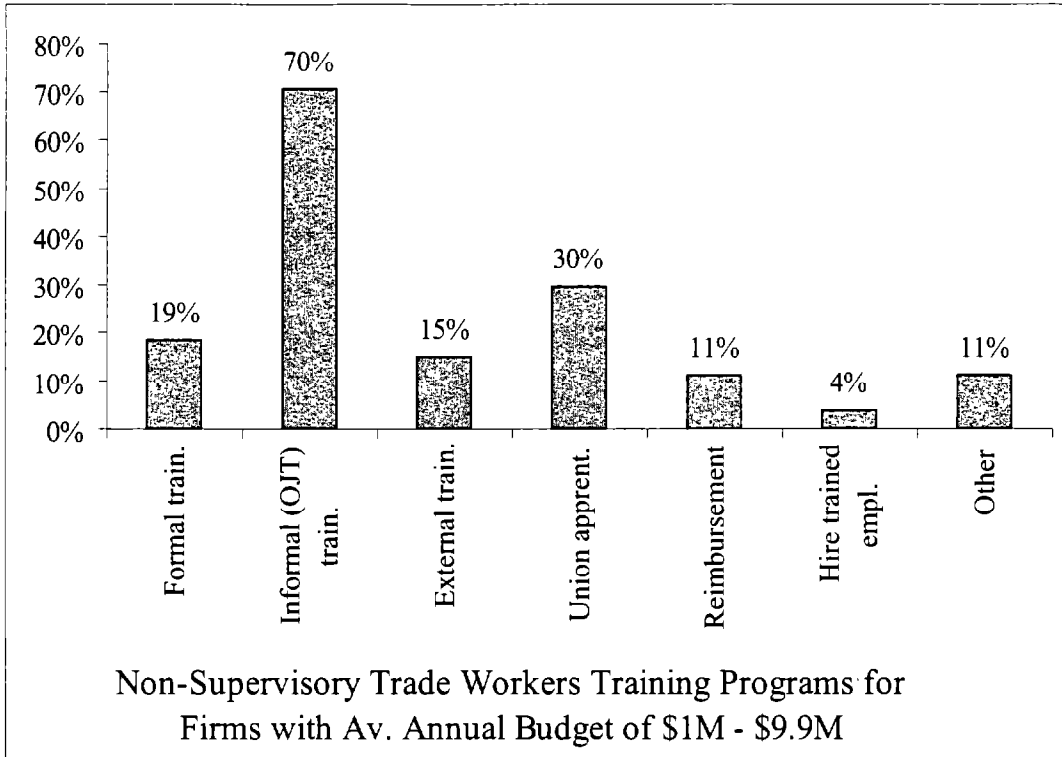


## **Appendix F**

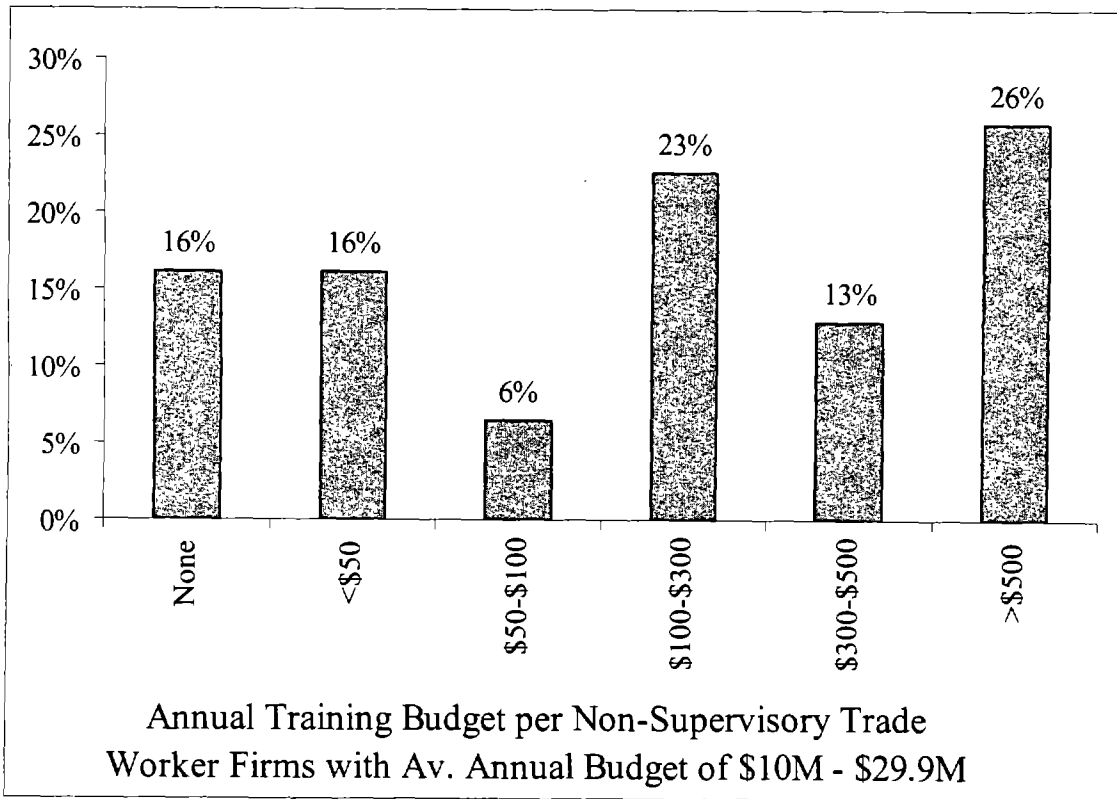
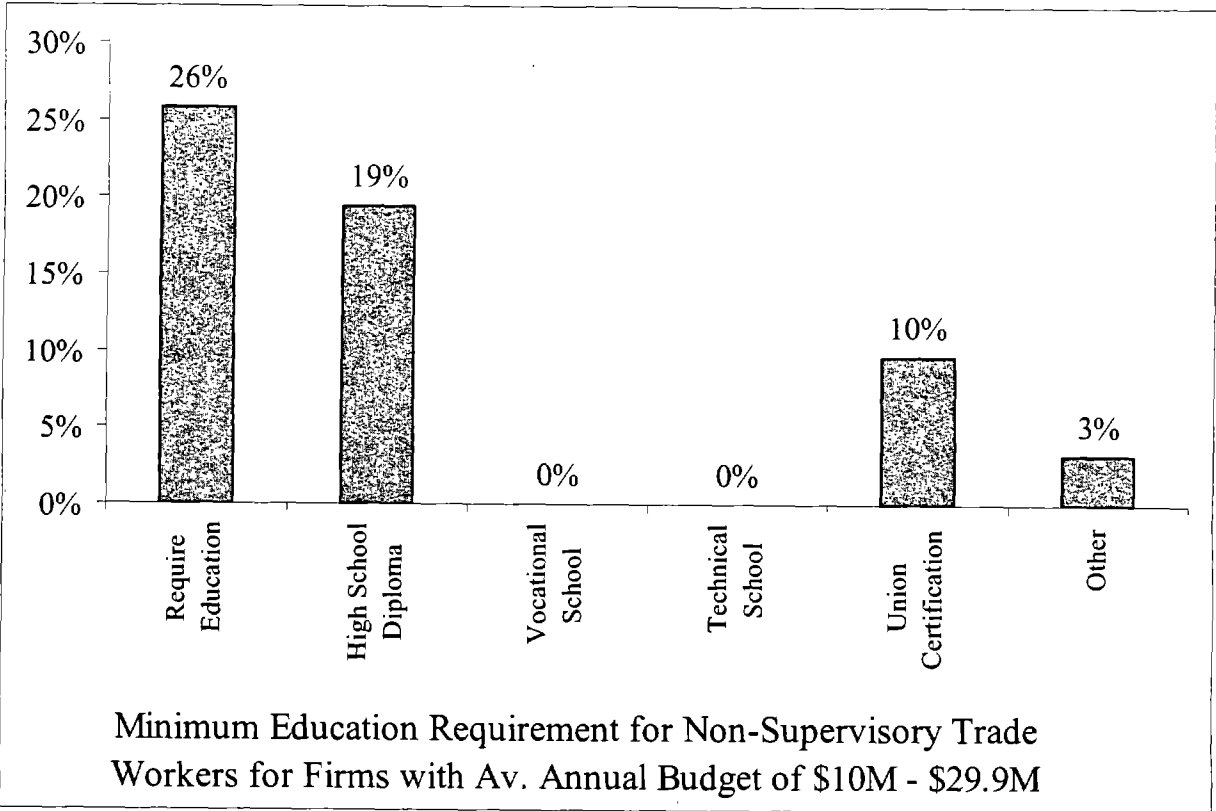
### **Analysis of Non-supervisory Skilled Workers Data by Company's Annual Volume of Work**

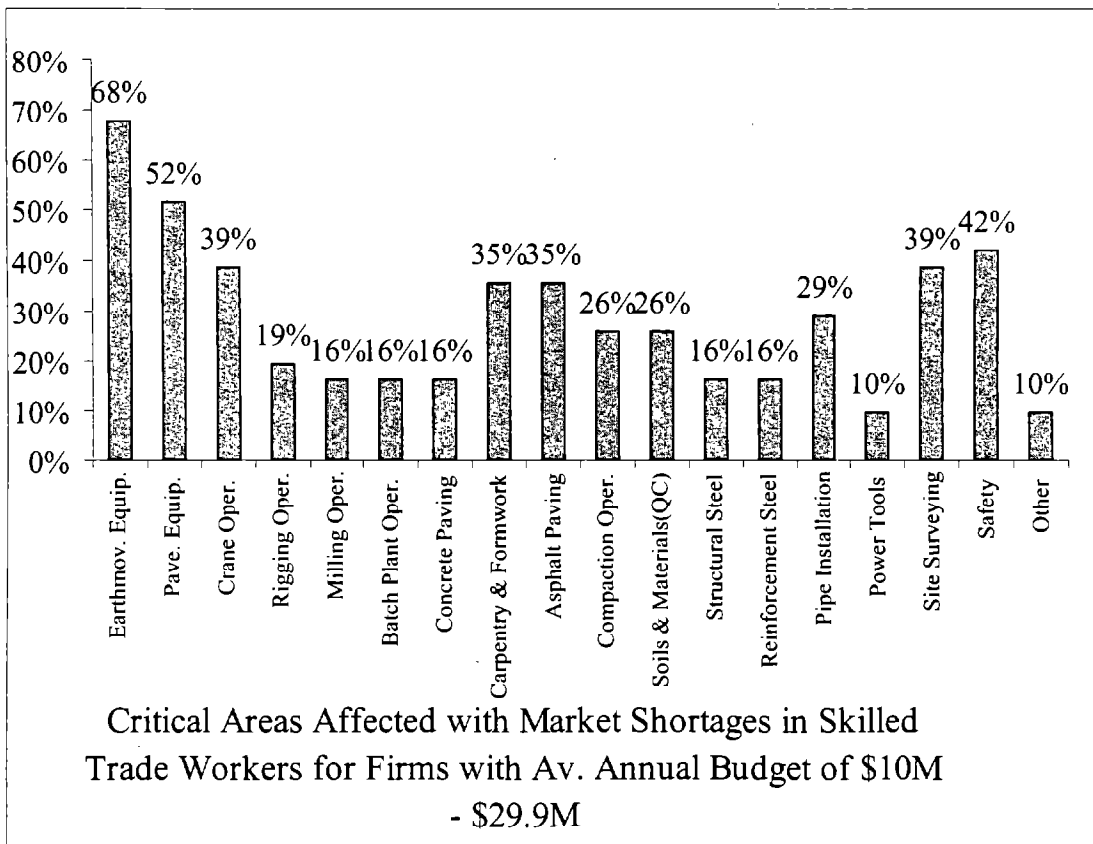
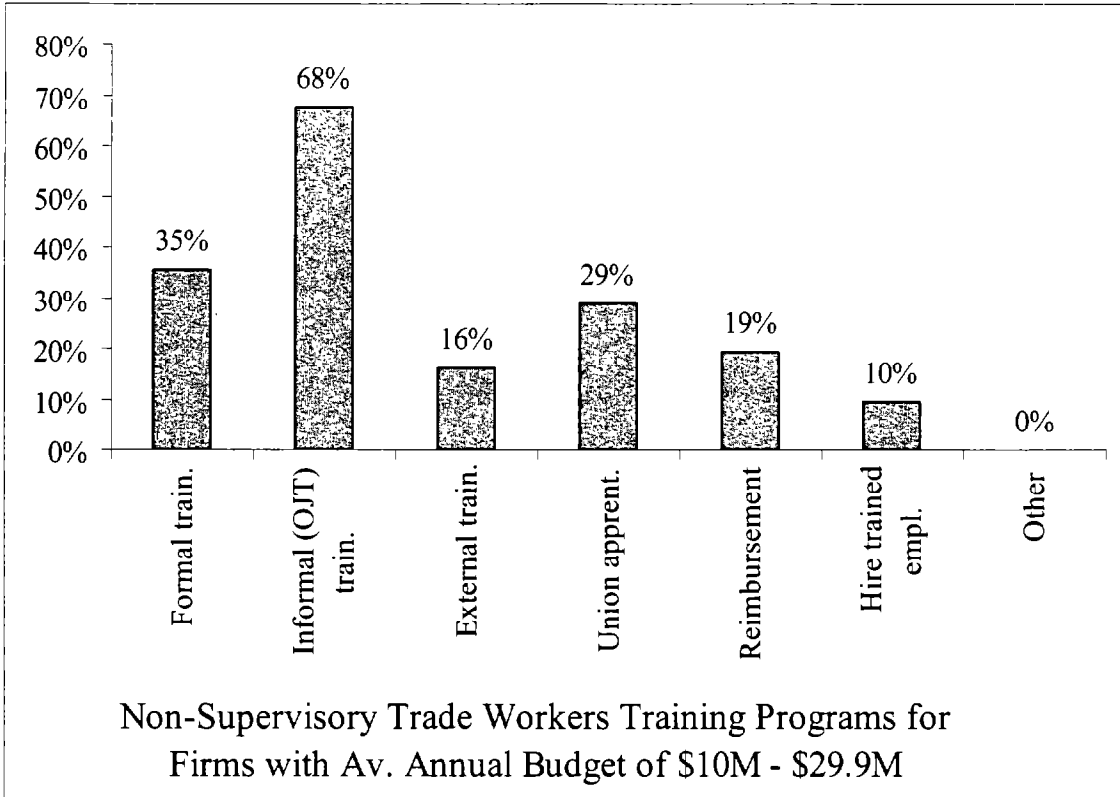


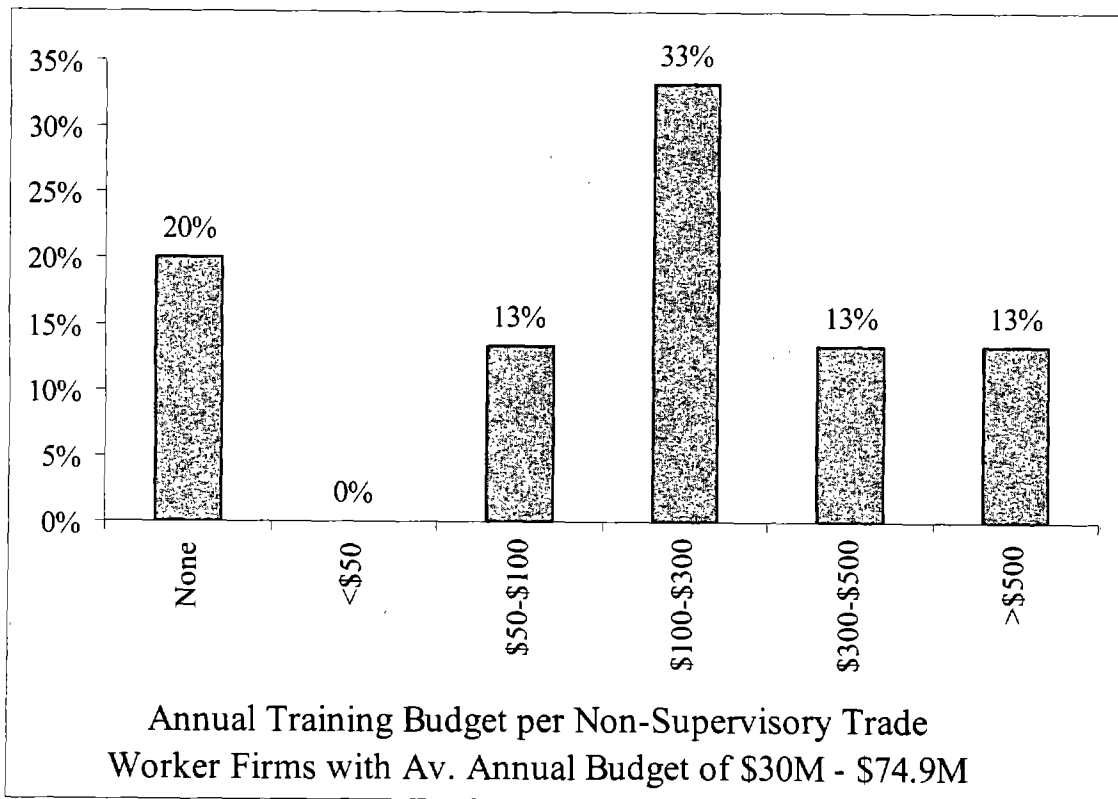
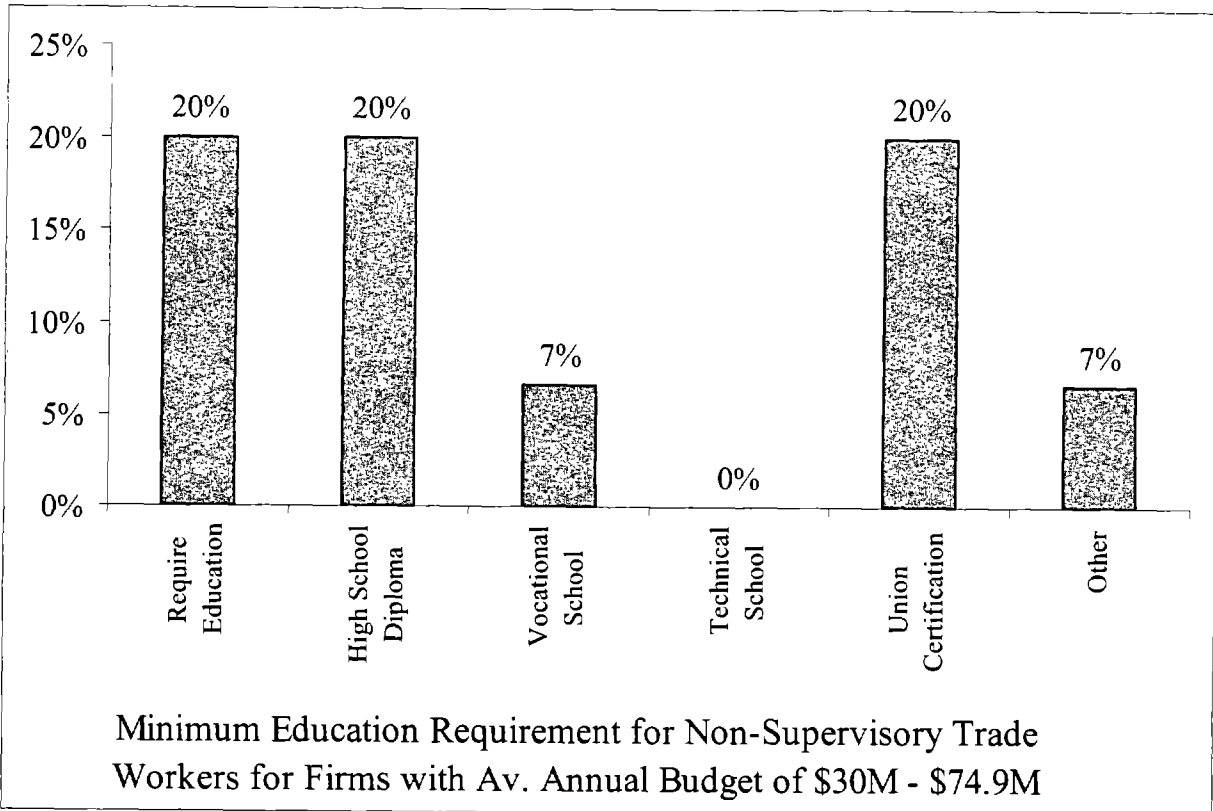


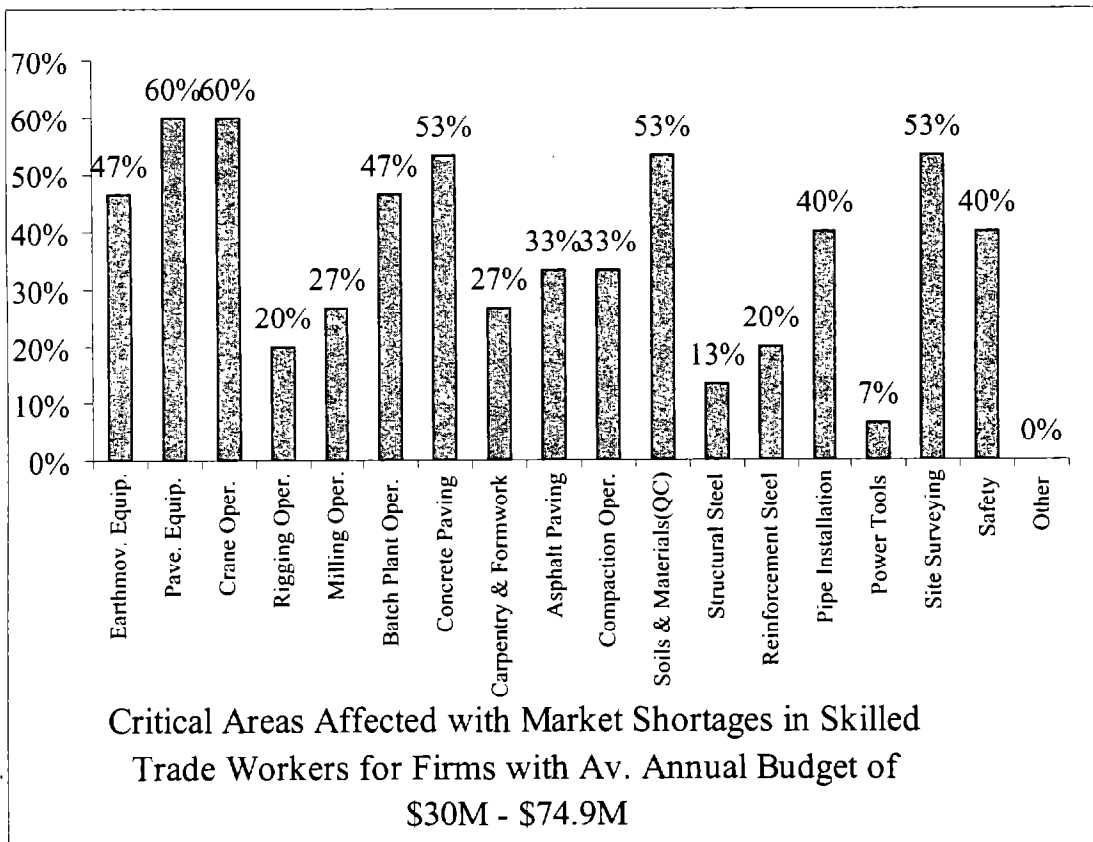
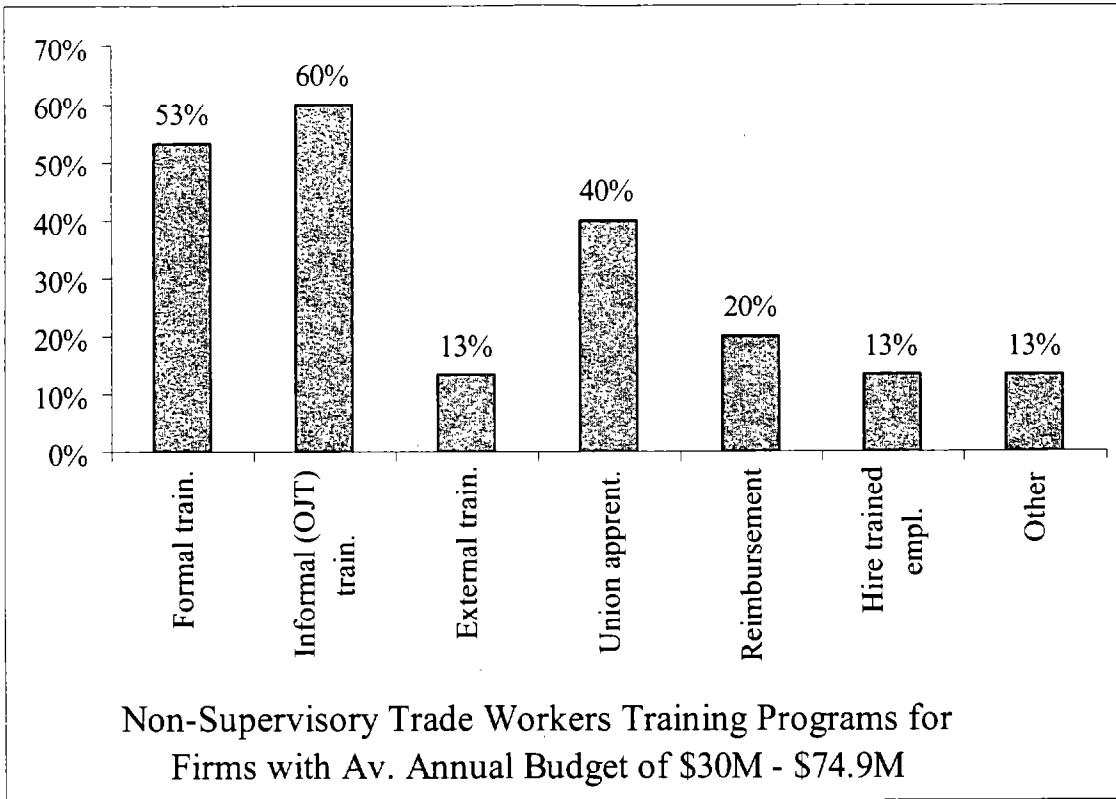


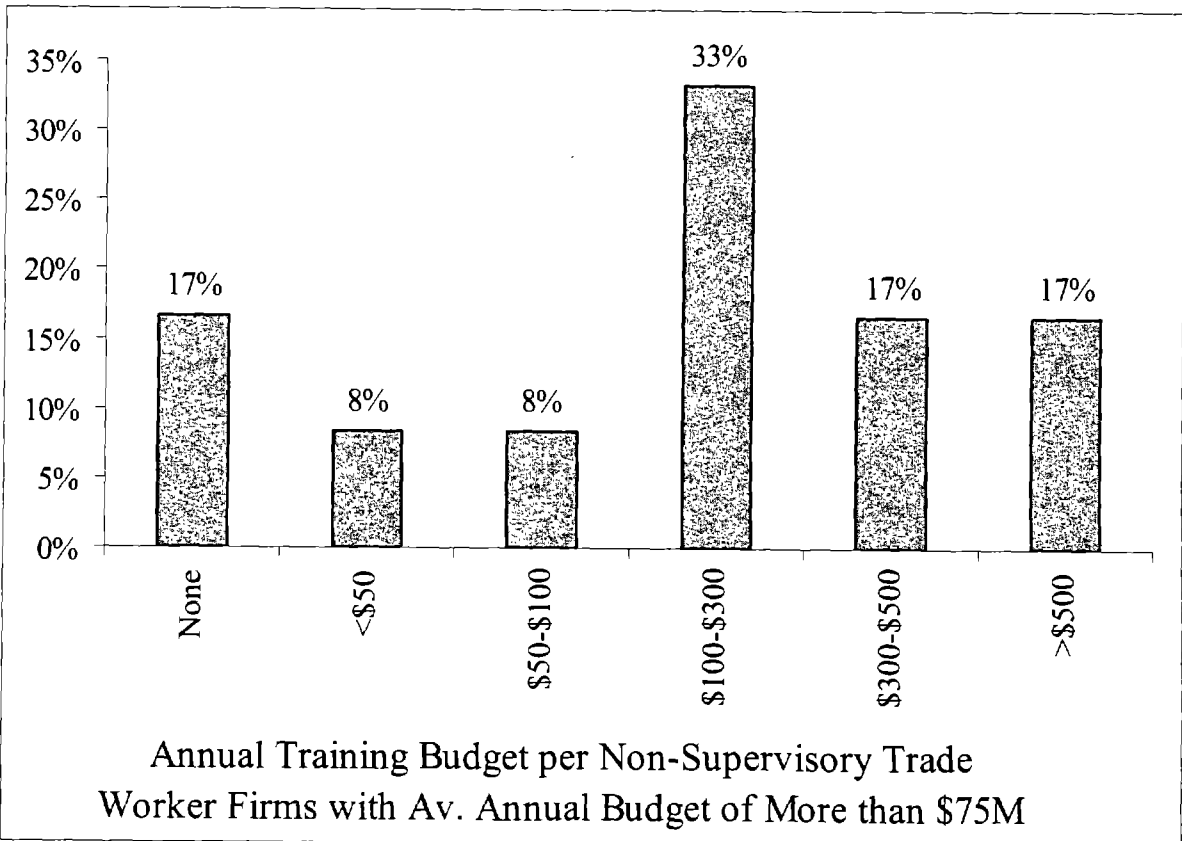
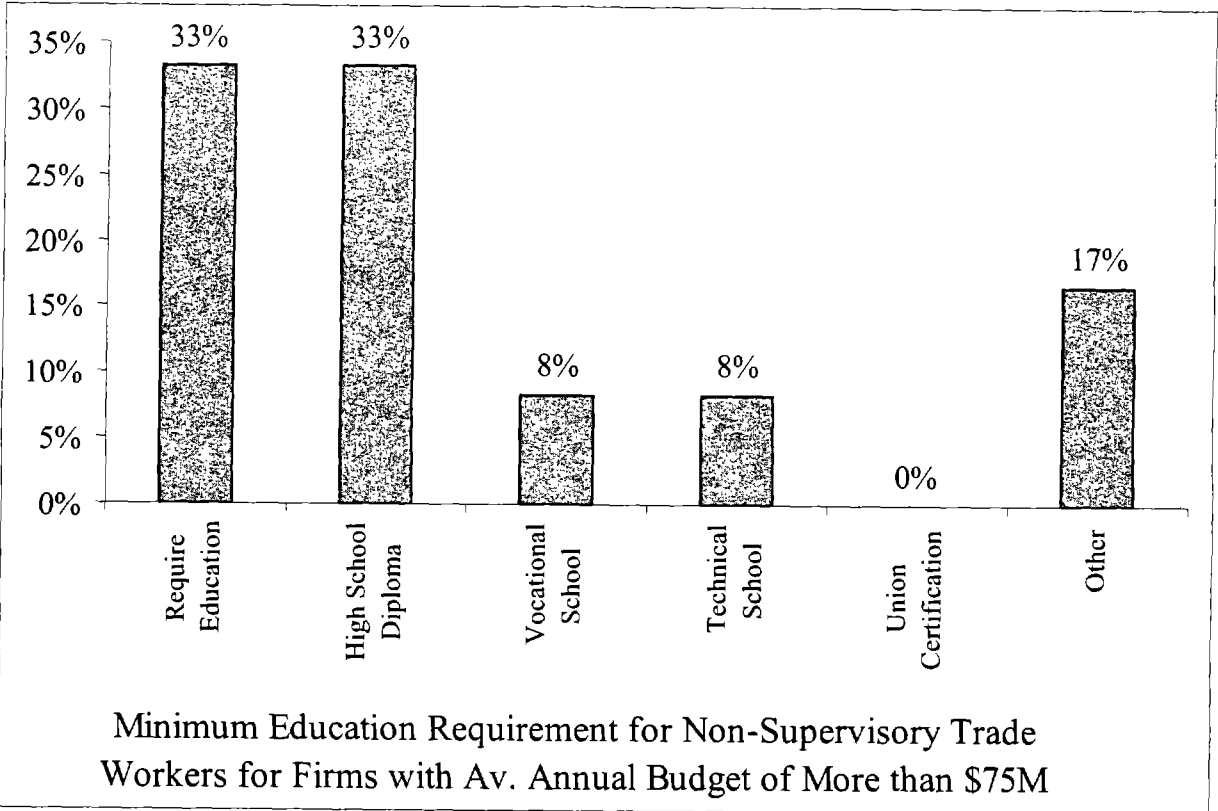


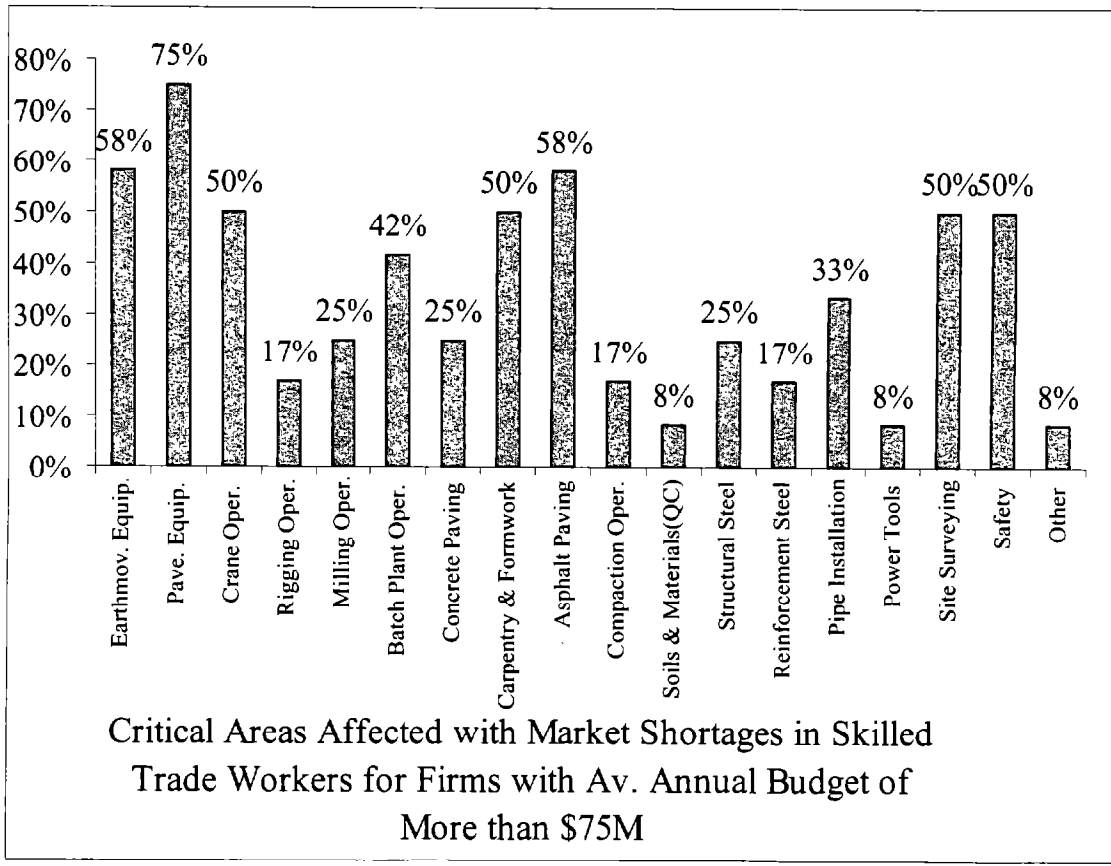
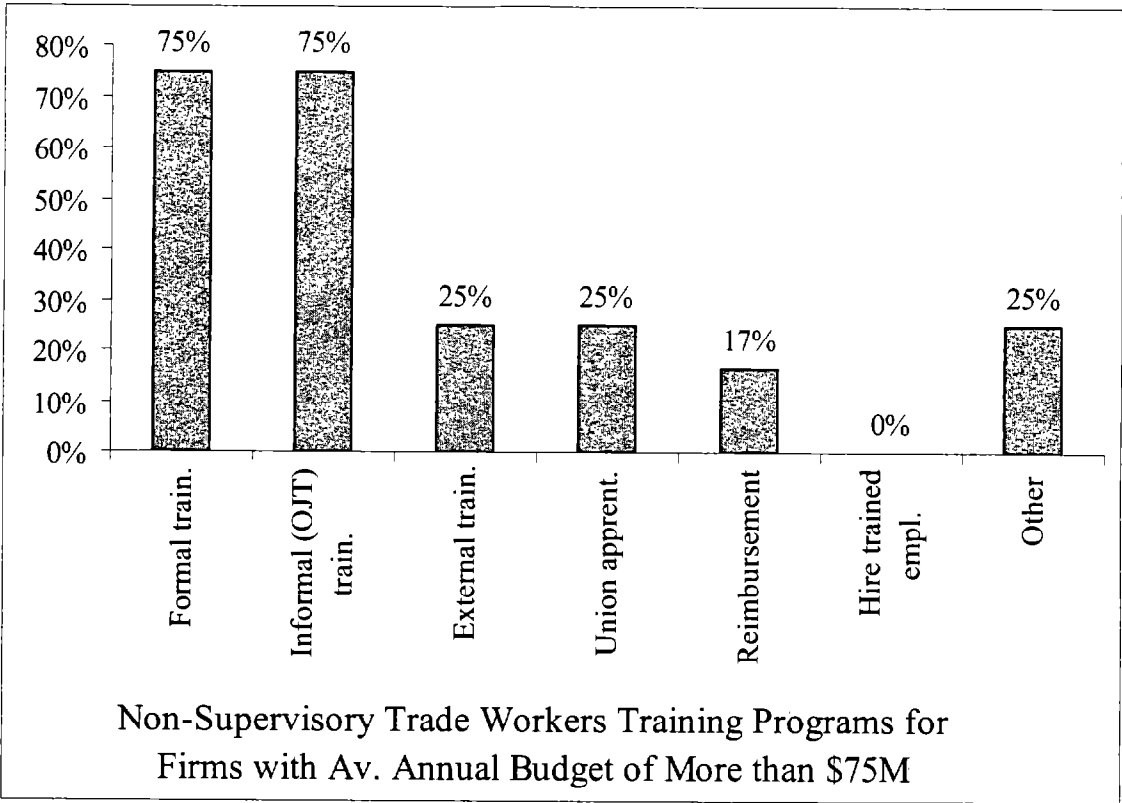












## **Appendix G**

### **Analysis of Non-supervisory Skilled Workers Data by Company's Number of Full Time Skilled Workers**





