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Developing effective integration between American supervisors and Hispanic craft workers in construction

Augusto Rogelio Canales Fernández
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Developing effective integration between American supervisors and Hispanic craft workers
in construction

by

Augusto Rogelio Canales Fernández

A dissertation submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of
DOCTOR OF PHILOSOPHY

Major: Civil Engineering (Construction Engineering and Management)

Program of Study Committee:
Edward Jaselskis, Co-Major Professor
Charles Jahren, Co-Major Professor
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Iowa State University

Ames, Iowa

2004

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~~Co-major Professor~~

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For the Major Program

DEDICATION

To my wife
María Elena
En lo próspero y en lo adverso

To my sons
Augusto, Alan, Aldo and Andres

To my parents
Aníbal and Elida
Margarito and Olaya

A mi Dios porque es bueno y porque para siempre es Su misericordia. Amén

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Ames, Iowa
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Augusto R. Canales

ABSTRACT

Hispanics are a large and growing part of the United States workforce. The U.S. Census Bureau showed Hispanics as the nation's largest ethnic or racial minority group in 2000. In addition, Hispanics are projected to make up 25% of the population of the United States by 2050. This has created several challenges for American construction companies.

This study addresses the situation by investigating training needs for Hispanic construction craft workers as well as American supervisors in the State of Iowa and developing four construction-focused training courses that can be part of an effective training program to facilitate integration among them. The research methodology consisted of assessing the needs and interests of the participants, developing and delivering the training courses, and finally evaluating the ESL course effectiveness. Two independent surveys were conducted in order to evaluate current craft workers' and American supervisors' conditions and interests within the construction industry. Ninety seven Hispanic workers and 38 American supervisors were interviewed as part of this project. The results confirm that communication, mainly because of the language barrier, is the main concern for both the Hispanic workers and the English-speaking employees involved in construction projects. As a consequence of this problem, American supervisors communicate through a "Link-person" with their Hispanic workers. This fact makes them extremely dependant on this person. As a part of this research, the training courses were designed to help both American construction companies and their Hispanic labor force overcome the barriers that keep them from integrating into a work team and succeeding safely and productively. The English/Spanish as a Second Language Survival Course was developed to facilitate basic communication between Hispanic workers and their American supervisors using construction-focused terminology. The ESL course was delivered four times and 24 participants attended. The SSL was delivered once and 2 participants attended. The training course Stepping Up to Supervisor (SUTS) for Hispanic Construction Workers was developed to provide an effective tool to help companies promote the Hispanic craft workers whose willingness and skills meet the requirements to advance to a supervisory position in an American construction company. The SUTS course was delivered twice with 7 participants attending. The course Concrete

Pavements: Construction basics is a course best suited for concrete road contractors. It is a helpful tool to train American supervisors to overcome the communication barrier with their Hispanic workers. This course remains to be delivered.

Participants of the ESL courses were interviewed two or more months after taking the course in order to evaluate their perceptions as they relate to the usefulness of the course. Feedback from a follow-up evaluation of the construction focused ESL course strongly suggests that the course has been useful in terms of increased confidence and improved ability to communicate. The follow-up evaluation consisted of developing a questionnaire and interviewing the same participants of the ESL course to determine their perceptions. Conclusions were obtained by comparing the sample's means by using a paired t-test.

CHAPTER 1. INTRODUCTION

1.1. Background

Hispanics are a large and growing part of the United States workforce. The U.S. Census Bureau showed Hispanics as the nation's largest ethnic or racial minority group in 2000. Hispanics are projected to make up 25% of the population of the United States by 2050 (U.S. Census Bureau 2004).

Mexico has been the traditional source of Hispanic immigrant labor in the United States. However, in the past decade, trends started to change with immigrants coming from Central America and, more recently, from countries such as Ecuador, Argentina, Colombia, and Peru due to the deterioration of South American economies.

Population trends indicate that the number of Hispanic workers in construction will continue to grow. This fact creates the need to develop strategies to blend cultures in the workplace.

Integration is based mainly on developing an understanding of the communication process and the role of language barriers to communication and identification of the consequences of the lack of communication between the Hispanic worker and his supervisor. Despite the complex nature of blending the cultures, it is still possible to develop productive relationships with Hispanic workers.

This dissertation presents a recommended strategy that can help define the procedure to integrate Hispanic workers into the American workforce with the clear expectation that the results of this effort will assist the contractor in benefiting from the reduction of accident rates, increased productivity, better quality of work, as well as other intangible factors such as less conflicts and increased morale.

1.2. Problem Statement

Because of the increasing numbers of Hispanic construction workers, as well as disproportionate number of fatalities among Hispanic construction workers, construction companies need to overcome new challenges. The Iowa Department of Transportation (Iowa DOT) has already started taking actions, working with the Department of Civil, Construction

and Environmental Engineering (CCEE) at Iowa State University to investigate training needs for Hispanics.

The Iowa State University research team performed a detailed assessment of the current conditions of the Hispanic population in the United States with emphasis on construction craft workers in Iowa. Surveys were also conducted on American supervisors to investigate how their needs and interests match with the Hispanic workforce they lead. There are several reasons why Hispanics are experiencing greater accident rates. The risk inconsistency is generally blamed on language barriers, educational levels, and the preponderance of Hispanics working under unsafe conditions.

As part of this research, training tools were designed to overcome obstacles found on the jobsite due to language barriers and the resulting lack of adequate communication. These training tools include two easy-to-use training courses focused on Hispanic construction workers: *English as a Second Language (ESL) Survival Course* and *Stepping Up to Supervisor for Hispanic Construction Workers*. These courses will help construction companies to create a more skilled and better-prepared Hispanic labor force. They will help to make sure that craft workers are aware of and understand risks involved in the workplace. These courses will also help to establish effective communication between the company and its Hispanic workers. In order to create integration, two other training tools were designed and developed targeting the American supervisors: *Spanish as a Second Language (SSL) Survival Course* and *Concrete Pavements: Construction Basics*.

This dissertation presents the results of the Hispanic workforce project to provide American construction companies with more information and tools for decreasing the rising accident statistics and improving productivity and quality of work, in other words, to facilitate *integration*.

1.3. Project Objectives

The purpose of this research is to develop planning guidelines and strategies to help contractors achieve integration between their Hispanic workers and their American supervisors in the most efficient and cost effective way. Previous research dealt mainly with communication between parties in the broader sense and did not address Hispanic workers at

all. Important factors were not considered and their relationship with culture and language barriers was not established. This study identifies key factors for integration based on surveys performed on Hispanic construction workers and American supervisors.

This analysis focuses on the determination of systematic planning of training activities directed towards blending Hispanic workers with American supervisors in the workplace with the purpose of developing a relationship that will lead to lower accident rates, increased performance, and better quality of work.

This dissertation focuses on integration between the American supervisor and his Hispanic crew specifically at the job site level. It is not concerned with integration at other levels of the organization.

Measuring the results of integration is not a simple task, and the benefits of a good integration can take long periods of time to obtain.

Measuring success of the approach is a long-term endeavor and involves the contractor determining the usefulness of the courses. At least four factors can be pursued and measured by the contractor, as follows:

- The rate of accidents
- Productivity of specific tasks
- Worker turnover
- Availability of the same workers from season to season

In addition, the contractor can benefit from encouraging Hispanic crew leaders to serve as the link persons, who act as communicators between the supervisor and the crewmembers. Integration will also bring increased morale and fewer conflicts.

The objective of this project is to provide effective tools for American construction companies interested in training and/or promoting the Hispanic employees whose skills meet companies' expectations for higher positions, such as supervisor. This research also provides a tool for Hispanic craft workers who would like to learn to speak construction-related English. In addition, American supervisors can benefit from using construction-related Spanish as a communication tool to help them fulfill their job responsibility.

In order for this project to provide successful solutions, it was necessary to assess the needs and interests of the Hispanic workers and American supervisors involved in

construction in Iowa. Data collected through surveys represent the foundation for the development of valuable training courses.

The gathered information, evaluated results, and developed basic ESL, SSL, and management training courses will be useful in helping both construction companies and their Hispanic workers to interact in a safer and more productive manner. If the training is implemented effectively, labor productivity is likely to increase and work site accidents are likely to decrease.

1.4. Definition of Terms

The term “Hispanic” is used in this report to conform with standard labor and census terminology. It is used as another word for “Latino.” The word “Latino” did not appear in the U.S. Census until 2000. People who identify their origin as Mexican, Puerto Rican, Cuban, or Central or South American are considered Hispanic (Guzman 2001). Hispanics may be immigrants or U.S. citizens.

The term “integration” refers to the act of bringing people together as a work team with the ability to communicate and perform as a unit, putting their efforts towards a common goal.

This dissertation is primarily concerned with Hispanics in the construction industry whose primary language is Spanish and who do not yet have a firm command of English, as well as with American supervisors who do not have a firm command of Spanish in construction-related terminology.

1.5. Economic Justification

This research took into consideration the employment statistics for construction companies with payroll by state in 2002, the latest Economic Census in the United States (U.S. Census Bureau 2002). The number of construction establishments in the United States in 2002 was 697,514, with 6,953,011 construction workers. The payroll for all construction workers was \$235.81 billion dollars. The payroll for Hispanic construction workers accounted for 20.3% of the total, or \$47.87 billion dollars nationally. In Iowa, 8,441 companies were reported, with 60,956 construction workers. The payroll for all construction

employees in Iowa, including office personnel, was \$2.34 billion dollars; the payroll for construction workers in Iowa was \$1.75 billion dollars.

It is clear that the percentage of payrolls dedicated to construction workers is significant and that Hispanics represent a large percentage of people working in construction. Construction companies stand to benefit from giving serious consideration to the implications on worker conditions as well as company productivity.

1.6. Dissertation Outline

Chapter 1 introduces the topic, exposes an existing problem, discusses the objectives of this project, and defines the goals of this research project.

Chapter 2 presents the literature review, starting with the general overview on the Hispanic and U.S. population before continuing with more detailed information on Hispanics influencing the construction industry in the United States. This chapter also presents a summary of available training material for Hispanic construction workers and American supervisors. It concludes with a general overview of the models researchers have developed to understand cultures: a) Hall's High-Context and Low-Context cultural framework; b) Geert Hofstede's definition of culture, dimensions, and implications with a particular focus on Hispanic and American cultures; and c) Trompenaars's dimensions of culture.

Chapter 3 contains the methodology used for gathering necessary data, analyzing the results, and drawing reliable conclusions and recommendations with which to develop and provide tools as a solution to the stated problem.

Chapter 4 provides the procedure, systematic approach, and cultural aspects considered in the development of the training courses for Hispanic workers and for American supervisors. It also provides the description and contents of the courses. The courses for Hispanic workers are *English as a Second Language Survival Course* and *Stepping Up to Supervisor Course for Hispanic Construction Workers*. For American Supervisors, the courses are *Spanish as a Second Language Survival Course* and *Concrete Pavements: Construction Basics*. The ESL Survival Course consists of four main parts: (1) general, (2) resources, (3) safety, and (4) various. At the end of the course, trainees receive an evaluation form for the course. The SUTS Course is organized into: (1) how to work by yourself, (2)

how to work with an individual, (3) how to work with a group, and (4) key points. An evaluation form is provided at the end of the course to make sure that the objectives of the course have been attained by the trainees. On the American side of the issue, the SSL Survival Course consists also of four main parts: (1) general, (2) resources, (3) safety, and (4) various. At the end of the course, trainees receive an evaluation form for the course. The Concrete Pavements: Construction Basics course consists of a logical sequence of general principles, site preparation, slip-form paving operations, jointing, special weather considerations, and testing and troubleshooting tables. Special emphasis is placed on materials and joint treatment.

Chapter 5 provides the results of the surveys to determine the effectiveness of the courses.

In chapter 6, transferability of the model to other ethnic groups and its application to other types of construction than concrete roads is explained.

Finally, a summary, conclusions, and recommendations are provided in Chapter 7.

CHAPTER 2. LITERATURE REVIEW

2.1. Background

From 1990 to 2000, the population of Hispanics in the United States grew by more than 50%, according to the U.S. Census Bureau. This study compiles and analyzes the information necessary to study factors and trends of the Hispanic population involved in the U.S. construction industry. Several organizations' websites have been reviewed in order to obtain current information. These organizations include the U.S. Census Bureau, the U.S. Department of Labor, the Bureau of Labor Statistics (BLS), the Occupational Safety and Health Administration (OSHA), and the National Institute for Occupation Safety and Health (NIOSH).

As the number of Hispanics working in construction increases, the fatality rate is rising disproportionately. John Henshaw, the assistant secretary of labor for the Occupational Safety and Health Administration (OSHA), determined that in 2000 Hispanics accounted for an inconsistent number of workplace fatalities—13.8%, compared with their proportion of employment—10.7% (Henshaw 2002). The construction industry accounts for about 7% of all employment and 20% of work site fatalities, with Hispanics comprising 18.8% of construction employment. In the year 2000, approximately 14.7 million Hispanics were employed in the United States, representing 10.9% of the U.S. workforce. The increase in the Hispanic portion of the labor force has been rapid, particularly in construction, which has the largest share of Hispanic workers than any other industry, second to agriculture. From 1980 to 2000, the proportion of Hispanic workers employed in the United States grew by 120%, while, in construction, it increased by 150%. The number of Hispanics employed in construction grew by a factor of 4.11 from 1980 to 2000.

Hispanic workers are more likely to reside in the South and in the West and less likely to live in the northeastern United States. As it relates to construction, 47% of Hispanic workers reside in the South, 39% in the West, 6% in the Midwest, and 8% in the Northeast. Data for Iowa shows 2.1 % of the Hispanic construction workers residing only in this state.

All data provided here was taken from the Current Population Survey, the U.S. Census Bureau, and The Construction Chart book.

Because of the high presence of Hispanics in the southern states, Hispanics in those areas have lately found themselves with fewer job opportunities and more difficulties integrating and have therefore moved north toward the less Hispanic-populated states, such as the states in the Midwest.

Integration of Hispanic workers into the American workforce is heavily affected by the complex nature of blending cultures. A multitude of factors can affect worker integration from the day he or she begins working on the jobsite through the process of becoming a foreman or supervisor.

2.2. Overview and Trends of the Hispanic Population in the United States

As a consequence of their growing numbers, Hispanics are significantly influencing the construction sector in the United States. A look at the information available on trends within the Hispanic population is necessary to gain insight into what has been occurring and what will occur in the construction industry. A compilation of the Current Population Survey (CPS) shows that in 2000, 35.3 million (or 12.5%) of the 281.4 million residents in the United States considered themselves Hispanic or Latino.

The Hispanic population growth in the United States from 1990 to 2000 was 57.9%, whereas the total U.S. population grew only 13.2% in the same time period. Besides this notable growth rate, there have also been changes within the Hispanic population distribution within this time frame. Mexicans increased 52.9% from 13.5 million to 20.6 million, Puerto Ricans increased 24.9%, Cubans increased 18.9%, and Hispanics from other origins increased 96.9% from 5.1 million to 10.0 million, as depicted in Figure 2.1 (Guzman 2001). At the beginning of 2003, Hispanics became the nation's largest minority, accounting for 13.6% of the total U.S. population.

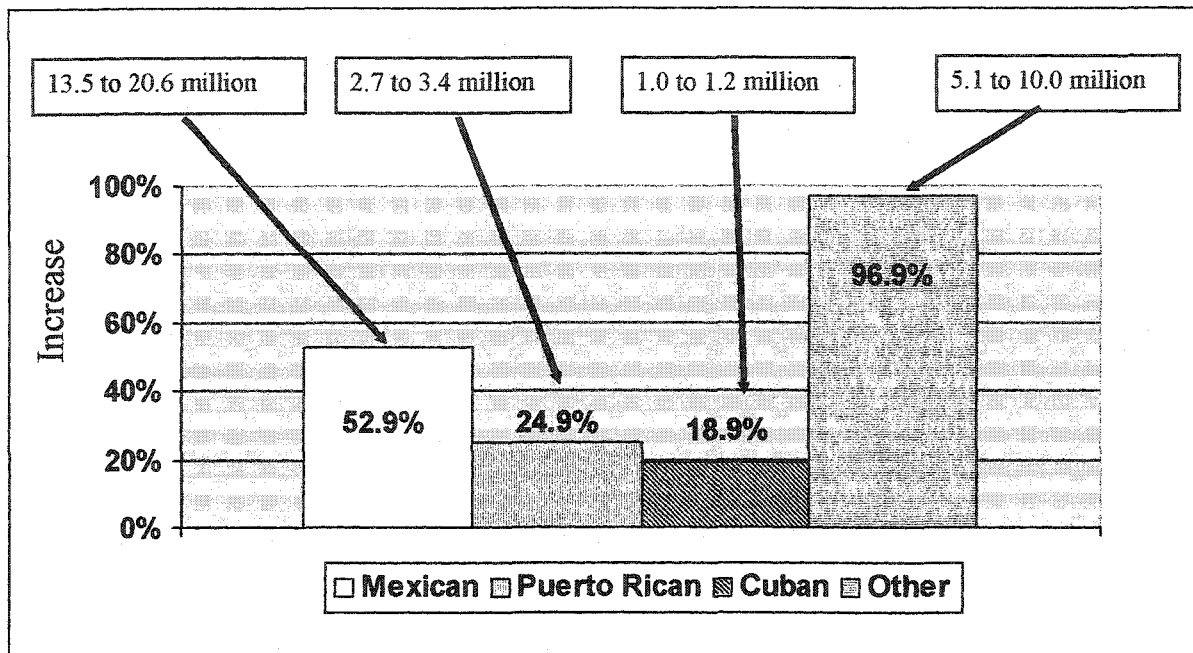


Figure 2.1. Hispanic population growth from 1990 to 2000 by group

Table 2.1 shows where the majority of the Hispanic population was concentrated and how fast these population centers grew from 1990 to 2000. More than three quarters of Hispanics in the United States lived in the West or South (primarily California and Texas). In 2000, 43.5% of Hispanics lived in the West and 32.8% lived in the South. The Northeast and Midwest accounted for 14.9% and 8.9%, respectively (Guzman 2001).

Table 2.1. United States, top-three states, & Iowa by Hispanic population, 1990 & 2000 (US Census Bureau 2000)

Area	1990			2000		
	Total population	Number	Percent	Total population	Number	Percent
United States	248,709,873	22,354,059	9.0%	281,421,906	35,305,818	12.5%
California	29,760,021	7,687,938	25.8%	33,871,648	10,966,556	32.4%
Texas	16,986,510	4,339,905	25.5%	20,851,820	6,669,666	32.0%
New York	17,990,455	2,214,026	12.3%	18,976,457	2,867,583	15.1%
Iowa	2,776,755	32,647	1.2%	2,926,324	82,473	2.8%

According to the U.S. Census Bureau projections, Hispanics will represent 25% of the U.S. population by 2050. In Iowa, the Hispanic population in 2000 made up 2.8% (or

82,473) of the total population (2,926,324). Of the Hispanics, 74.2% were Mexicans, 3.3% were Puerto Ricans, 0.9% were Cubans, and 21.7% were other Hispanics (including Central and South Americans).

Figure 2.2 shows the difference between population projections and the actual population of Hispanics in Iowa. According to the population projections (U.S. Census Bureau 2000), there will be 96,000 Hispanics in Iowa by the end of 2025. This group has shown such a significant growth rate that the U.S. Census Bureau had projected this number to be about 54,000 by the end of 2000, but in reality, the 2000 Census reported 82,000 Hispanics (a 52% increase) in the state of Iowa.

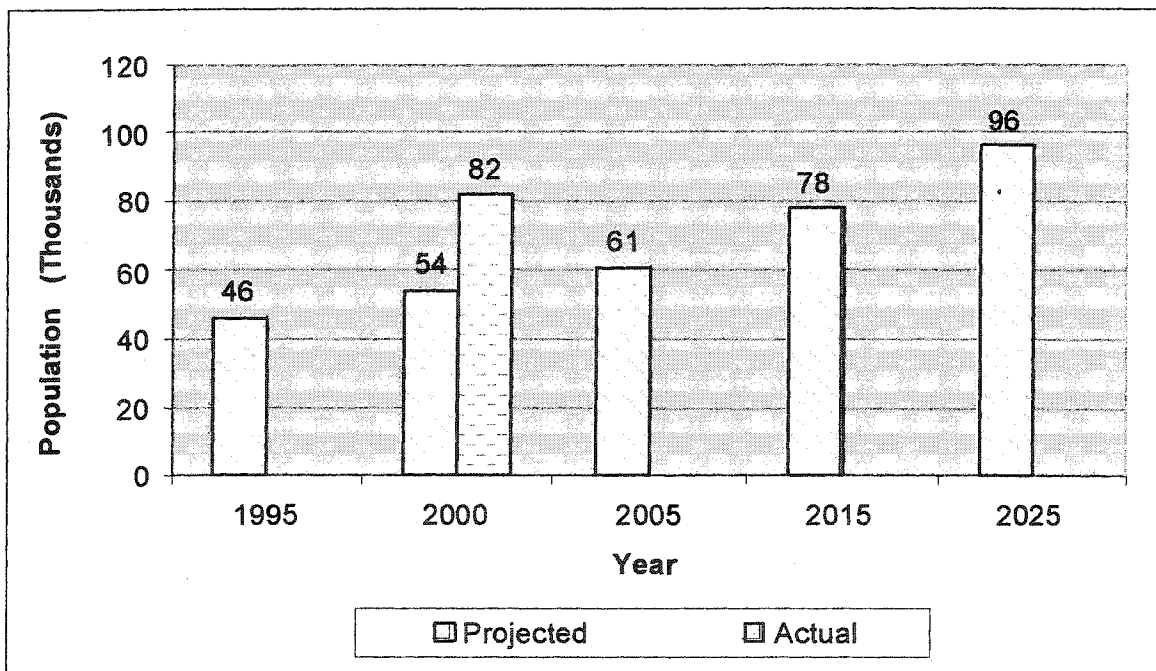


Figure 2.2. Hispanic population in Iowa: 2000 actual vs. 1995-2025 projections

2.3. Hispanics and the U.S. Labor Force

Hispanics living and working in the United States are the most exposed victims of environmental and occupational health problems and a disproportionate number of workplace fatalities was reported in 2000. The 2000 BLS report on fatalities showed that 815 Hispanic or Latino workers died as a result of job-related injuries. This appears to be largely due to the fact that Hispanics are employed in the more dangerous industries. For instance, the construction industry accounts for only about 7% of all employment but has a

disproportionately large percentage of workplace fatalities. As depicted in Figure 2.3, nearly 20% of Hispanic fatalities were due to falls and contact with equipment, events more common in construction work sites than in other employment areas (Henshaw 2002).

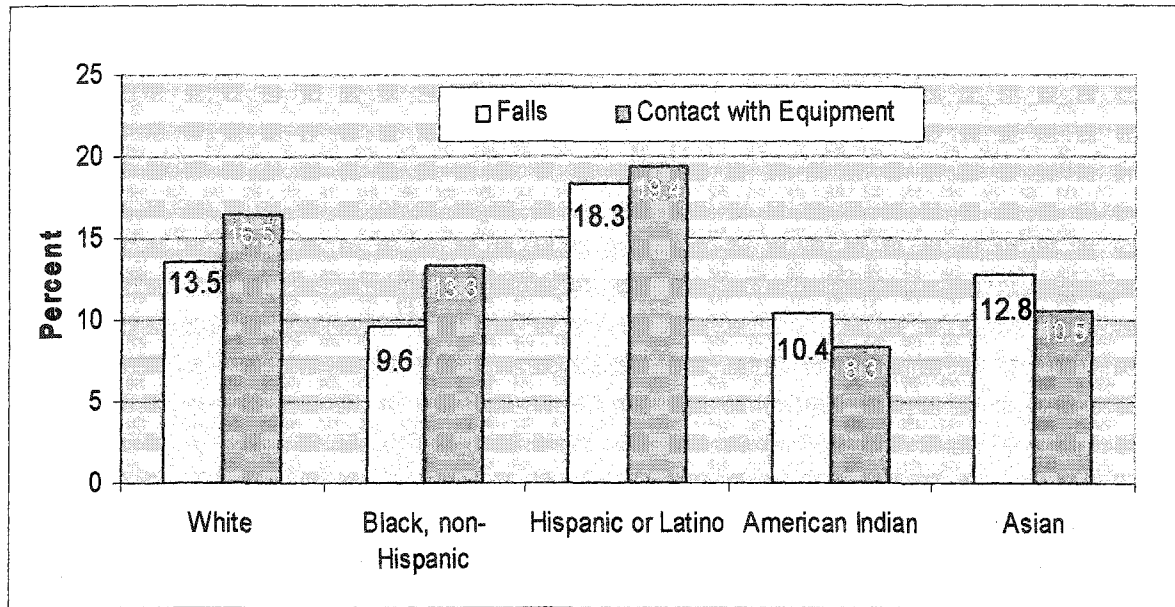


Figure 2.3. Fatal injuries by event of exposure and ethnic group (2001 data)

Recently, organizations have begun to not only reach out to a broader group of job seekers, but also provide effective training for new employees who, for whatever reason, lack the necessary skills for the work site. The idea is to ensure that, regardless of their racial or ethnic background, construction workers have the skills they need. Because they come from other cultures and might not speak English proficiently, immigrants might require more extensive training than other workers.

An effective training approach is therefore required to provide Hispanics not only with the right equipment and explanation of safety procedures, but also with a culturally meaningful explanation and conception of why safety is important. It must also illustrate how coming from a different culture can play an important role in safety issues.

The importance of workers' knowledge, skills, and capabilities is of primary importance among those construction companies which have come to the conclusion that it is not only about having enough workers to finish the work on time and under budget, but also

about having the right people with the necessary skills to accomplish a complete and competitive goal.

The construction industry is facing a combination of various issues that may affect its goal achievement. The presence of workers from different cultures on the jobsite has created a growing gap between workers' skills and capabilities and the job requirements. This gap must be closed through training programs that lead to employment development.

Employers must prepare to meet the challenges represented by this knowledge gap. Providing a safe environment must be a primary goal because it is critical to low employee turnover and high productivity.

The *Construction Industry Digest 2002*, provided by OSHA (1998) includes a chapter called "Safety and Health Management Systems" that contains four main sections: (1) Management Commitment and Employee Involvement, (2) Work Site Analysis, (3) Hazard Prevention and Control, and (4) Safety and Health Training. The fourth factor is an especially essential component of an effective safety program. Through such programs, companies are able to identify the safety and health responsibilities of both management and employees at the site. Training depends on the size and complexity of the work site, potential hazards, and worker characteristics.

One of the main objectives of a company's management is to train supervisors to understand the key role they play in the work site safety and to enable them to carry out their safety and health responsibilities effectively (OSHA 1998).

2.4. Summary of Available Training Material for Hispanic Construction Workers and American Supervisors

It is clear that training programs must be developed and offered based on current and future needs. Available material focused on the Hispanic population of the United States is becoming more and more popular and is requested more often. More than 10 million Hispanic Americans speak little or no English. Organizations such as OSHA have special concerns for non-English speaking workers. In October 2001, this agency formed a task force to inspect the issue of rising Hispanic fatalities and what employers should do to address the problem (OSHA 2001).

According to the OSHA Trade News Release (2003), more than \$2.2 million in new funding is allocated for outreach to Spanish and other non-English-speaking workers in President Bush's Fiscal Year 2004 budget for OSHA. This is the first time OSHA's budget will include additional funding for Hispanic outreach (OSHA 2003).

The American Society for Training and Development (ASTD) is the world's leading association for workplace learning and performance. Ongoing ASTD initiatives, such as its state of the industry report, show that training expenditures dropped from 2.0% of payroll in 2000 to 1.9% of payroll in 2001 (Thompson et al. 2002). Training expenditures per employee rose 8% to \$761, with 78% receiving training and an average of 23.7 hours (Thompson et al. 2002).

OSHA is forming alliances with Hispanic leadership and community-based organizations and offering an ever-increasing number of publications and fact sheets in Spanish. OSHA will continue to expand ongoing Hispanic outreach projects such as the community-based effort to disseminate safety and health information among immigrants in New York and New Jersey, the Construction Accident Reduction Emphasis (CARE) program in Florida, an alliance with a Latino community group in Georgia to encourage workers to report hazards, safety and health courses and small business training taught in Spanish in the Southwest, and bilingual compliance assistance specialists and inspectors available to assist Spanish-speaking workers and employers in several local offices (OSHA).

In addition, a new website written in Spanish is helping OSHA reach out to non-English speaking workers and employers. The web page initially is featuring basic documents such as worker and employer rights and responsibilities, resource materials, and other information of special interest to Spanish-speaking audiences. In addition, OSHA's new program, Alliances, enables organizations committed to workplace safety and health to collaborate with OSHA to prevent injuries and illnesses of Hispanics in the workplace.

The mission of the National Institute for Occupational Safety and Health is to prevent work-related illness, injury, and death. NIOSH conducts a wide range of research, training, and technical assistance programs to identify and reduce hazardous working conditions. Recognizing the vital importance of education in the occupational safety and health (OS&H)

field, NIOSH supports academic programs that are designed to enhance the knowledge of the professional and paraprofessional workforce in this field.

NIOSH in Spanish, another source of available material, includes Spanish-language versions of several NIOSH workplace safety and health documents relevant to industries and occupations in which large numbers of Spanish-speaking workers are employed. It also describes in Spanish how workers and employers can contact NIOSH and access basic services such as health hazard evaluations.

2.5. Training Programs

2.5.1 English as a Second Language (ESL)

The levels of English spoken at the work site vary depending on the diversity of the workers and supervisors. In construction, speaking the language is not strictly required, which may be an advantage for those who do not speak English at the beginning. However, not knowing the language represents an adverse safety issue.

As a first search for ESL materials, several journals were reviewed in order to understand to what extent this topic has been researched in the past. The following keywords were used in searching the journals:

- Communication
- Language barriers
- Cross-cultural aspects
- Hispanics

Journals published by the American Society of Civil Engineers (ASCE) contained little information on ESL topics. An article titled “Differences in nonverbal communication styles between cultures: The Latino-Anglo perspective” appeared in *the Journal of Leadership and Management in Engineering* in 2001 (Cruz 2001). This article focuses on the importance of studying one's own culture as a way of becoming aware of cultural differences. The awareness of these differences can be extremely important to anyone who wants to be effective in a diverse work environment (Cruz 2001). *The Journal of Management in Engineering* published an article in 2002 titled “Perception of construction professionals concerning important skills of effective project leaders” (Odusami 2002). In this article,

contractors ranked communication as the most important skill required in construction. *The Journal of Professional Issues in Engineering Education and Practice* published an article in 2002 titled "Developing cross-cultural communication skills." This article discusses how engineers have traditionally focused on hard-skill knowledge acquisition, but the increasingly multicultural work practices of professional engineers now demand better soft-skill proficiency, such as foreign language ability, communication confidence, and cross-cultural experience (Gilleard and Gilleard 2002).

The researchers' second step of reviewing ESL material included a search of other organizations on the internet. The search criteria included finding information about basic topics necessary for Hispanic construction workers whose communication skills are minimal, course durations, and availability of such courses in Iowa. Several websites contained information on ESL courses, with different levels and different topics. Some of these were construction related and others were focused on general topics.

2.5.2 Supervisory Training Program

The work expectations of the supervisor have been changing to meet the needs that characterize most workplaces and practices with the new skills required to lead effectively in the rapidly changing workplace. The supervisor's role has changed for several reasons. For instance, technological advancements and cultural diversity issues have become more important to construction companies.

The Associated General Contractors of America (AGC), through one of its subsidiaries the Iowa Association for Construction Training (IACT), provides a Supervisory Training Program (STP) for construction foremen and superintendents. STP is published by Wil McKnight Associates (2001) and courses are offered by AGC chapters, other construction organizations, and companies nationwide. For example, the IACT offers training programs using the Stepping Up to Supervisor materials, which consist of three parts: a Spanish-version book, an English-version book, and a Workshop Leader's Guide in English.

Some of the topics taught in these programs include the following: meeting the challenge of stepping up to a supervisory position, fitting your basic fundamentals into your

style, dealing with special situations, as well as using sample forms, checklists, and reference information (McKnight 2001).

All these materials are aimed to meet the needs of the construction industry. The STP focuses on the teaching the supervisor the skills that he or she must have to be an effective manager of people, time, equipment and materials. AGC has also created a wide variety of innovative and effective programs to support training programs for craft workers. Information on AGC's craft training programs and services is available through the AGC's training and educational services and also through the National Center for Construction Education and Research.

2.5.3 Spanish as a Second Language (SSL)

The levels of Spanish spoken at the work site vary depending on the diversity of the workers and supervisors. In construction, not knowing how to speak Spanish for an American supervisor is not a problem unless he does not have a bilingual person he can rely on to give instructions to workers. However, if the facilitator is not present and there is a high number of Hispanics without English speaking capabilities, then communication can be a real problem.

During the first search for SSL materials, several journals were reviewed in order to understand to what extent this topic has been researched in the past. The following keywords were used in searching the journals:

- Communication
- Language barriers
- Cross-cultural aspects
- Hispanics
- Spanish as a second language

Journals published by the American Society of Civil Engineers (ASCE) contained little or no information of any research study made on using Spanish as a second language to help American supervisors communicate with their workers. However, other journals were searched and papers found like "Teaching Spanish as a Foreign Language in Belgrade, Yugoslavia: a Need to Overcome the Old Ways," "Phonetics in Second Language Acquisition: An Acoustic Study of Fluency in Adult Learners of Spanish," "Is Talk Cheap? The Role of Conversation in the Acquisition of Language." Many of these papers discuss using techniques of pedagogy and applied linguistics for learning Spanish as a second language. Aspects like how to improve oral communication skills, vocabulary acquisition, pronunciation, and how to measure fluency are addressed. Several journals were searched: *Hispania*, *Hispanic American Historical Review*, *Hispanic Review*, *Industrial and Labor Relations Review*, *Journal of Business*, *Journal of Latin American Studies*, *Latin American Research Review*, *Journal of International Business Studies*, *Journal of Occupational Behavior*, *Journal of Business of the University of Chicago*, *Journal of Organizational Behavior*, and *University Journal of Business*. Nothing relevant and practical as it relates to our research focus was found.

The second step of reviewing SSL materials included a search of other organizations on the Internet. The search criteria included finding information about basic topics necessary for American supervisors whose communication skills are minimal in Spanish. Interestingly enough, a web site for the Continuing Education division of Washburn University in Topeka, Kansas, offers a number of Spanish courses. It appears to be that they specialize in this type of training targeted to non-Spanish speaking people. They offer Spanish for childcare facilities, for the physician's office, for office staff, for construction sites, for bank personnel, and for nurseries and landscaping.

The Spanish for construction sites, as it is addressed in the previous paragraph, is a 16-hour course that provides construction site supervisors with functional language skills for working with their Spanish-speaking employees. In addition to a special section devoted to pronunciation, the course includes work-specific language sections dealing with routine construction commands and terms such as measurements and fractions. The course fee

includes a bound manual and accompanying audio cassettes/CDs. No prior knowledge of Spanish is required.

In addition, they also offer a course called "The new Hispanic workforce: Challenges and benefits." They say that organizations that successfully recruit and retain new Hispanic employees are much more competitive in the marketplace. This two-day course prepares employers to understand the challenges involved in hiring new Hispanic employees and to develop effective strategies for integrating them into the workforce. It does not say that the target is the construction industry, but they mention the word integration.

2.5.4 Other Training Efforts in the Nation

Transportation Construction Training (TCT) is a program sponsored exclusively by the AGC Heavy/Highway Chapters in Arkansas, Louisiana, New Mexico, and Texas. This is a pilot on-the-job training program presented to the executive committee in 2002. This program is the result of numerous recommendations, considerations, and/or suggestions received from forums held around the country. It has the purpose of enhancing the effectiveness of FHWA 7-2-2 program. The primary objective of this pilot program as implemented in the five states is to assimilate women, minorities, and others into construction crafts on a reasonable, productive basis as rapidly as possible. The suggested hours for competency on this program is 520 hours minimum, 1040 standard, and 2080 hour maximum and the ability to pass a competency based skills evaluation. Instructional hours will include a core curriculum utilizing the system in NCCER (National Center for Construction Education and Research) curriculum materials or the equivalent. This includes subjects such as introduction to craft skills, responsibilities of the employee, communications, success in employment, and basic safety.

This program contains 75 separate courses on different subjects, 11 of which are courses related to concrete. They offer a course called Concrete Finisher (paving). The Department of Labor (DOL) describes it as follows:

A concrete finisher finishes the exposed surfaces of fresh concrete paving to the final grade and contour with the use of straight edges and steel trowels. Forms and finishes edges and joints. Also finishes concrete curbs and gutters. Performs other related duties (U.S. Department of Labor 1991).

In a different line of training/research efforts that involves Hispanic workers, The Electrical Contracting Foundation commissioned a study entitled "Technology Transfer to Mexican Electrical Contracting Firms: A Feasibility Study" and has announced the publication (Rojas et al. 2001) *New Business Opportunities for U.S. and Mexican Electrical Contractors*. The document was prepared by Dr. Eddy Rojas of the University of Washington, Adriana Mejia of the University at Buffalo, and Victor Espinola, Mexican Advisor for AMERIC – the NECA Chapter in Mexico City.

This study, documented in English and Spanish, seeks to open up Mexican/American electrical opportunities for contractors on both sides of the border. The Mexican electrical market offers unique business opportunities for US contractors and manufacturers through collaboration and strategic alliances with their Mexican counterparts. In general, profit margins would be better for both US and Mexican contractors if they work as a team. Big opportunities may await those who are willing and able to learn and adapt. The study has recommended creation of the Electrical Technology Institute (ETI) to address the situation and open up opportunities for both Mexican and American contractors. ETI would offer technical courses for Mexican electricians and managers as well as cultural courses for U.S. companies.

The basic concept behind their study is that through training the objectives can be achieved. Bottom line is the fact that at the jobsite level, there is interaction between Mexican (Hispanic) worker and an American supervisor, although this interaction happens in Mexican territory. There is still the need to integrate/blend both populations.

The work plan of ETI for the year 2002 and future years is addressed and includes the challenges, opportunities, and the goals. Among the challenges, they cite scarcity of qualified craftsmen in Mexico and lack of understanding of US technologies. The opportunities are to overcome barriers identified in two following groups: problems with technical and managerial training and problems with information sources.

With regard to the goals of the project, the publication includes the following:

1. Develop awareness among US and Mexican contractors about the opportunities for cooperation and partnerships in Mexican projects.

2. Identify the set of skills required by both Mexican managers and craftsmen to effectively interact with their US counterparts.
3. Study different methods for providing training such as focus groups and practical sessions in Mexico and/or the establishment of practical training programs in the US for a selected group of participants from Mexico.
4. Develop strategies for providing training to Mexican electrician and managers.
5. Study the use of different media to deliver training information.
6. Determine the sources of information for the training programs.
7. Develop the schedule of activities required to fully implement the training program

The mission of the Electrical Technology Institute will be achieved through the following functions:

- Course development
- Course administration
- Certificate and award programs
- Internship program
- Export promotion

ETI will offer technical courses for Mexican electricians and managers as well as cultural courses for US companies. With regard to the course development, NECA has already developed educational materials for its Electrical Project Supervision (EPS) seminar series and its Project Manager Seminar series. These materials will be the foundation for the Manager's program. They will be translated into Spanish and adapted for the Mexican market.

The Electrical Contracting Foundation effort is quite interesting and specific for the purposes of entering the Mexican electrical market. However, it contains conceptually similar aspects to the Hispanic workforce project, in particular to the blending of the cultures at the jobsite and using appropriate training for doing so.

In summary, it appears that extensive programs and training efforts across the nation have been made to accommodate training of minorities, Hispanic workers in construction among them, which has been very helpful. However, a focus on integration *per se* seems to

be missing. The focus of this work is developing the training program through the design and development of four courses suited to create integration between the American supervisor and the Hispanic craft worker. They are not intended to develop an outstanding proficiency in speaking either language. They are supposed to teach to communicate good enough to get the job done under a safe environment with the best quality and productivity possible.

2.6. Models of Culture

As part of the literature research, an effort was put into trying to understand culture, its definition, dimensions, and implications. Researchers have developed several models to understand national and organizational cultures (Nahavandi 2003). This section briefly reviews three different models.

2.6.1 Hall's High-Context and Low-Context Cultural Framework

One of the simplest cultural models focuses on differentiating communication styles within cultures in two groups: high context and low context (Hall 1976).

People (leaders, supervisors) of high context culture rely heavily on the context to establish communication with others. They rely on the use of non-verbal clues, situational factors, and personal relationships to communicate and understand the world around them. Leaders from low context culture focus on explicit, specific verbal and written messages to understand people and situations (Munier 1993).

For example, Saudi Arabia, Italy, France, Vietnam, Korea, and China are all high context cultures, where subtle body posture, tone of voice, detailed rituals, and a person's title and status convey strong messages that determine behavior. Communication does not always have to be explicit and specific. Trust is viewed as more important than written communication or legal contracts. In low context cultures, such as Germany, Scandinavia, Switzerland, the United States, Great Britain, and Canada, people pay attention to the verbal message. What is said or written is more important than non-verbal messages or the situation. People are, therefore, specific and clear in their communication with others (Nahavandi 2003).

The difference between high and low context can explain many cross-cultural communication problems and lack of integration that people face when they interact with others in work settings.

2.6.2 Hofstede's Research on Cultures

The work of Geert Hofstede on studying cultures was reviewed. He originally conducted more than 100,000 surveys of IBM employees in 40 different countries, supplemented later by another scale based on Confucian dynamism (Nahavandi 1997).

Hofstede's terminology for describing national cultures consists of 5 different criteria, which he called "dimensions" because they occur in nearly all possible combinations. They are largely independent of each other. These five criteria are described in the following table:

• Individualism vs Collectivism	The extent to which individuals or a closely-knit social structure such as extended family (Collectivism) are the basis for social system. Individualism leads to reliance on self and to a focus on individual achievement.
• Large or small power Distance	The extent to which people accept unequal distribution of power. In higher power-distance cultures, a wider gap exists between the powerful and the powerless.
• Strong or weak Uncertainty avoidance	The extent to which the culture tolerates ambiguity and uncertainty. High uncertainty avoidance leads to low tolerance uncertainty and to search for absolute truths.
• Masculinity versus Femininity	The extent to which assertiveness and independence from others are valued. High masculinity leads to a high sex-role differentiation and to a focus on independence, ambition, and material goods.
• Time orientation	The extent to which people focus on past, present, or future. Present orientation leads to a focus on short-term performance.

For our present study, it is important to summarize information that can be obtained from Hofstede's research as it relates to Mexico and the U.S.A. This is done in the following section.

Comparison of Cultural Dimensions between Mexico and the United States according to Hofstede's research

People developing training courses for Hispanic workers and for American supervisors must take into consideration cultural differences between both countries. In addition, as the U.S. construction labor force becomes more diverse, successful leaders will owe some of their success to the experience of working in multicultural environments. The goal of this comparison is to help trainers respond to possible challenges posed by training a more diverse workforce. Some of the skills that American supervisors can develop include the capability to demonstrate respect and understanding, to communicate effectively, and to work collaboratively with people from a Hispanic background. Special effort must be made to help all employees learn new skills to overcome the group differences. This will increase worker effectiveness and help avoid the risk of creating threatening stereotypes.

In Hofstede's model, there are five main dimensions for describing cultural differences: (1) large or small power distance, (2) individualism versus collectivism, (3) masculinity versus femininity, and (4) strong or weak uncertainty avoidance, and (5) time orientation (Hofstede 1983). The fundamental issues identified by Hofstede are expressed here for four dimensions, and a graphical comparison between the U.S. and Mexican societies is shown in Figures 2.4–2.7. These numbers were extracted from a study done by Hofstede that compared aspects of national character across countries, assigning an index value from 1 to 100. For the development of the courses, Mexico has been used as the country to be compared with the United States.

Power distance refers to the way how society deals with the fact that people are unequal. In organizations, the level of power is related to the degree of centralization of authority and the degree of autocratic leadership. Hofstede established some relationship among these four dimensions, such as *power distance* and *collectivism* (1983). Collectivist countries always show large power distances, but individualist countries do not always show small power distances. Poor countries tend to be collectivist with larger power distances, and many Hispanic construction workers are from these poorer countries.

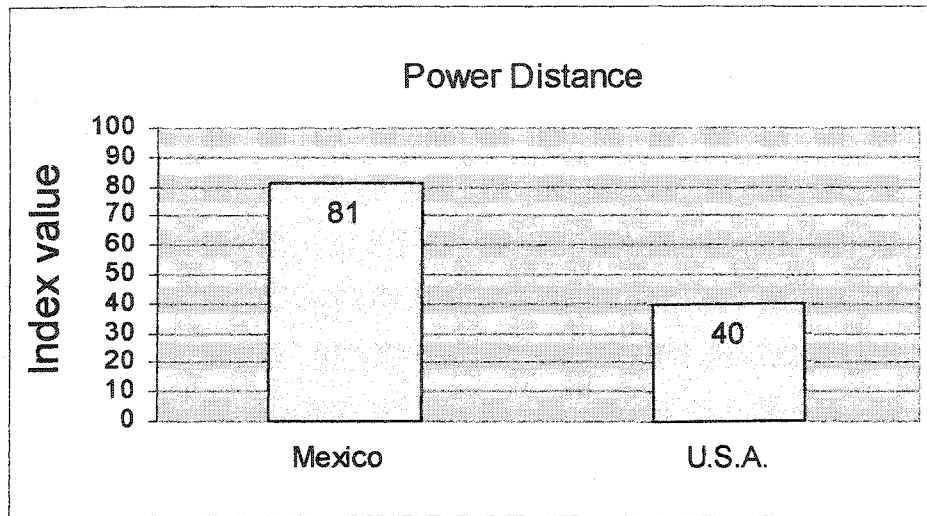


Figure 2.4. Comparison between Mexico and United States according to power distance

Individualism versus collectivism involves the relationship between an individual and his or her fellow individuals. There are two categories: (1) societies in which ties between individuals are very loose, that is, everybody looks after his or her own self interests (individualistic); and (2) societies in which the ties between individuals are very tight, that is, everybody looks after his or her group's interests (collectivistic). Hispanic societies fall in the second category, where friendships prevail over tasks, and loyalty is very valuable among group members and between bosses and subordinates.

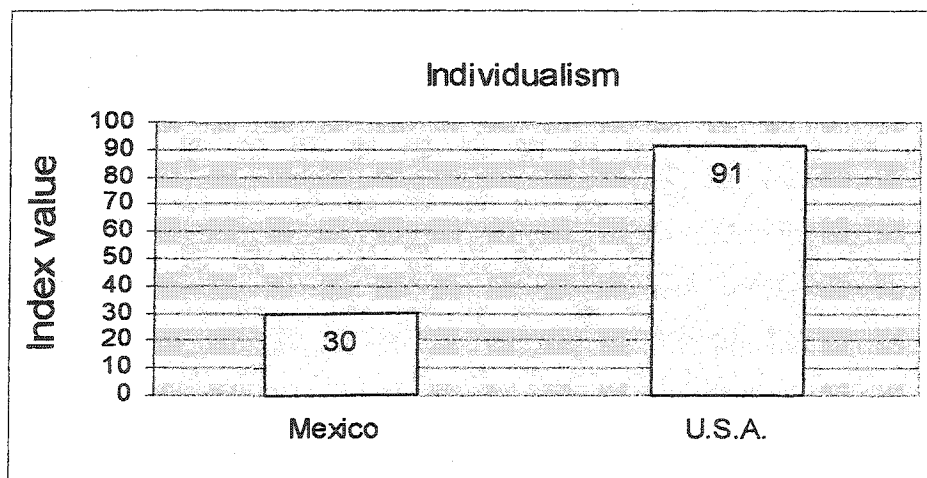


Figure 2.5. Comparison between Mexico and United States according to individualism

Masculinity versus femininity is related to the division of roles between the sexes in society. Human societies have associated certain roles to men only or to women only. This is part of a socialization process, rather than biological sex role. Latin countries such as Venezuela and Mexico are considered to be quite masculine biased. Figure 2.6 shows how the masculinity of Mexican society compares to the masculinity of American society.

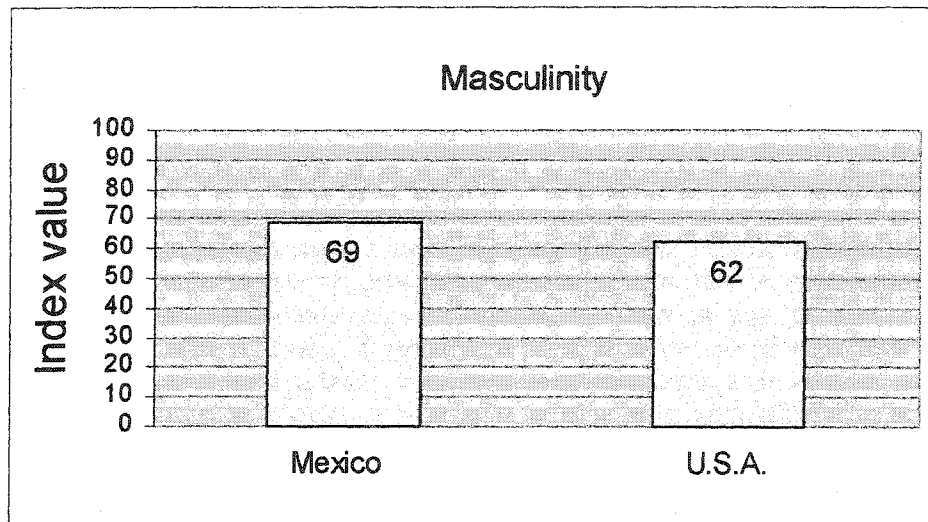


Figure 2.6. Comparison between Mexico and United States according to masculinity

Uncertainty avoidance indicates to what extent a culture can program a member to sense or feel about changing, unknown, or surprising situations. The two ends of this dimension are related to how strong or weak members accept or avoid uncertainties. Groups with weak uncertainty avoidance tend to accept the fact that future is unknown and therefore accept each day as it comes. On the other hand, other societies tend to reduce uncertainty in the future by creating security and avoiding risk. In this dimension, there exists a clear correlation between power distance and uncertainty avoidance. According to Hofstede, Hispanic societies show strong uncertainty avoidance with a large power distance, whereas in American society and other countries with large populations with Anglo-European roots, an opposite correlation was found, that is, small power distance and weak uncertainty avoidance. Figure 2.7 compares uncertainty avoidance scores between the United States and Mexico.

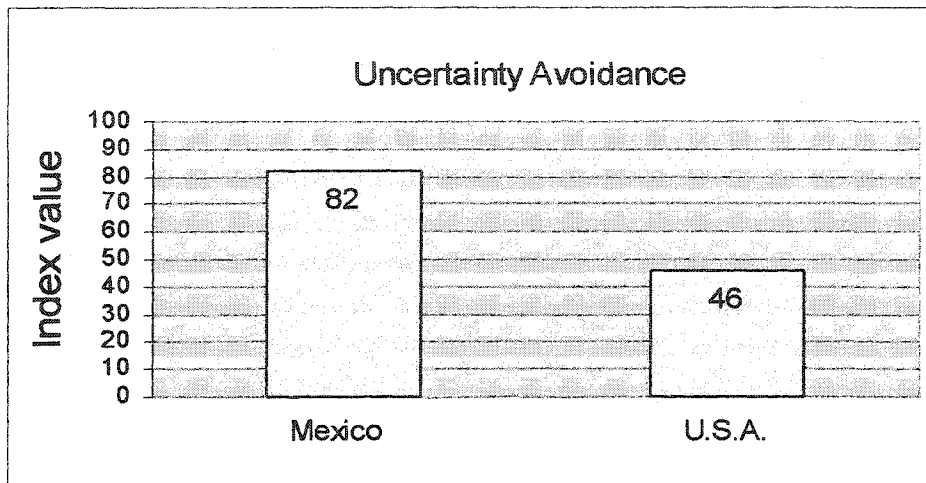


Figure 2.7. Comparison between Mexico and United States according to uncertainty avoidance

Table 2.2 describes some examples of national cultural values that will help trainers better understand the impact of cultural differences on the jobsite. According to the Hofstede's findings on both the Mexican and American cultures (1983), it is concluded that in the workplace, Mexicans, as subordinates, expect to be told what to do, see hierarchy as an existential inequality, and consider their boss as a benevolent autocrat. Also, because of their collectivism, they see relationships more important than tasks.

Table 2.2. Comparison of management styles between Mexican and American cultures according to Hofstede (MGT 503)

Aspect	Mexican	American
Work/leisure	Works to live. Leisure considered essential for full life. Money is for enjoying life.	Lives to work. Leisure seen as a reward for hard work. Money often end in itself.
Direction/delegation	Traditional managers. Autocratic. Younger managers starting to delegate responsibilities. Subordinates accustomed to being assigned tasks, not authority.	Managers delegate responsibilities and authority. Executives seek responsibilities and accepts accountability.
Theory vs. practice	Basically theoretical mind. Practical implementation often difficult.	Basically pragmatic mind. Action-oriented and problem solving approaches.
Control	Not fully accepted, sensitive to being checked on.	Universally accepted and practiced.
Staffing	Family and friends favored because of trustworthiness. Promotions based on loyalty to superior.	Relatives usually barred. Favoritism not acceptable. Promotion based on performance.
Loyalty	Mostly loyal to superior. Beginnings of self-loyalty.	Mainly self-loyalty. Performance motivated by ambition.
Competition	Avoids personal competition. Favors harmony at work.	Enjoys proving oneself in competitive situations.
Time	Deadlines flexible.	Deadlines and commitments are firm.
Planning	Short-term due to uncertain environments.	Long-term due to stable environments.

2.6.3 Trompenaars's Dimensions of Culture

In a similar line of research for understanding cultures, Fons Trompenaars and his colleagues provide a complex model that is useful for understanding national culture and its effect on organizational cultures (Hampden-Turner, A. Trompenaars, F. Trompenaars, and Lewis 2000; A. Trompenaars and Hampden-Turner 2001; A. Trompenaars, Hampden-Turner, and F. Trompenaars 1997). They developed a model based on 15,000 people surveyed in organizations in 47 cultures that suggest that, although understanding national culture requires many different dimensions, cross-cultural organizational cultures can be classified more efficiently based on two dimensions (Trompenaars 1994). These dimensions are 1) egalitarian-hierarchical and 2) orientation to the person or to the task. When combined, they yield four general organizational cultures: a) incubator, b) guided missile, c) family, and d) Eiffel Tower. These cultures are depicted in Figure 2.8.

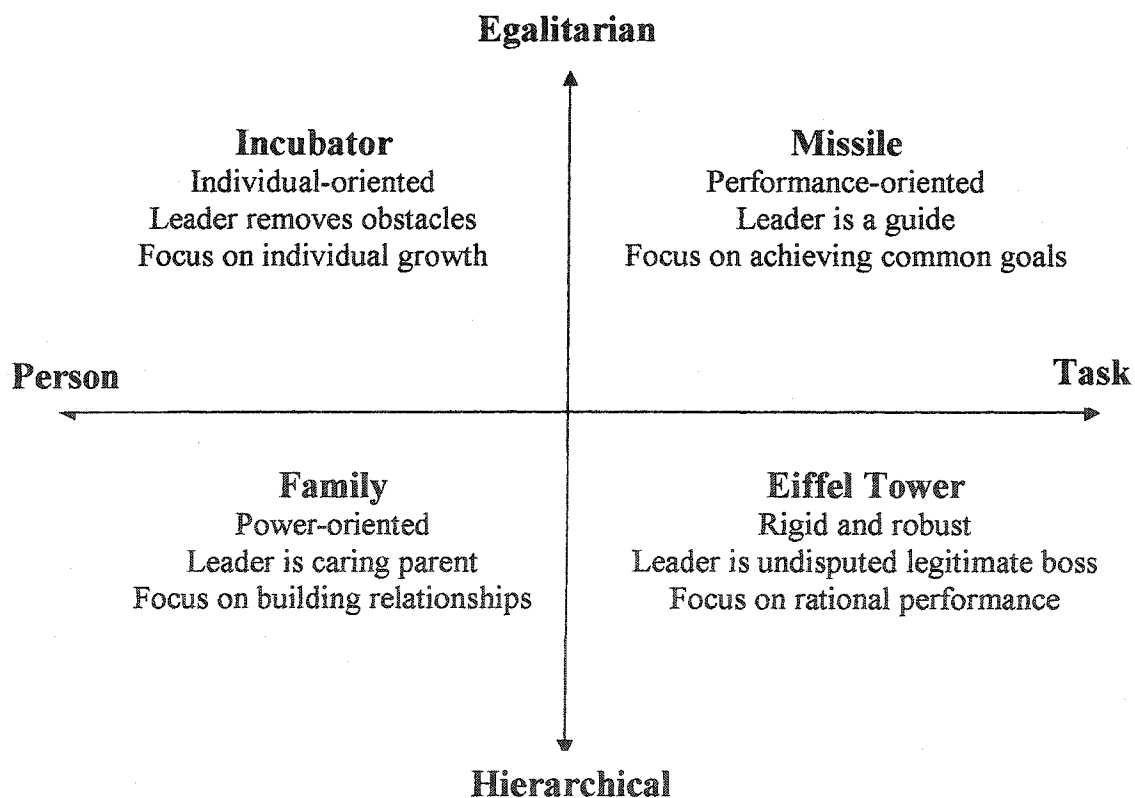


Figure 2.8. Trompenaars' cross-cultural organizational cultures

Incubator cultures are egalitarian and focus on taking care of individual needs. These are typically individualistic cultures in which professionals are given considerable latitude to do their jobs (e.g., start-up high-technology firms in the U.S. and Great Britain) (Trompenaars 1994). Leaders in such organizations emerge from the group rather than from outside. Therefore, leadership is based on competence and expertise.

The guided missile is also an egalitarian culture, but the focus is on task completion rather than on individual needs. As a result, this type of organization is impersonal and directed towards accomplishing the job. Basic attributes is that leadership is based on expertise, people work in teams, follower participation is expected, and performance is the primary criterion for effectiveness.

The family and Eiffel Tower cultures are both hierarchical. The Eiffel Tower is focused on the task and the family takes care of individuals. The leader's role in a family culture is that of a powerful father figure who is responsible for the welfare of all members. Trompenaars suggests that family cultures are found in Greece, Italy, Singapore, South Korea, and Japan. The Eiffel Tower culture is both hierarchical and task oriented. The focus is on performance through order and obedience to legal and legitimate authority. The leader is the undisputed head of the organization and has full responsibility for all that occurs (Nahavandi 2003).

Due to the fact that communication plays an important role for integrating cultures, next section describes basic concepts about communication, its definition, goals, and process.

2.7. Communication

What is so important about communication? There is a very simple answer to this question: without communication, hardly anything gets done. Communication is the lifeblood of every relationship. When it comes down to the jobsite and transactions between American supervisors and Hispanic crew members in construction, information must be conveyed, received, understood, and acted upon in a manner that would produce expected results.

When there is a breakdown in this process, productivity, quality, and safety of workers are compromised. This section provides an overview of the fundamentals of the communication process, how it works, and the reasons why it breaks down. Some of the

major barriers to communication are identified and methods of dealing with them are discussed.

2.7.1 Definition of Communication

Communication is the process of transferring meaning (Gibson and Hodgetts 1990). In a jobsite setting, this process accounts for the difference of getting the task done or failure to do so. It is of utmost importance to be able to communicate what has to be done, when it has to be done, and how it has to be done that eventually will make the job advance to further stages of development.

Another similar definition is that communication is the transmission and reception of ideas, feelings, values, and attitudes verbally or non-verbally which produce a response. This leads to understanding and establishing the major goals of communication.

2.7.2 Goals of Communication

Literature suggests (Gibson and Hodgetts 1990) that there are multiple goals that have to be achieved during the communication process. However, projecting this suggestion into the construction industry and in a jobsite setting, the following has to be attained:

- a. High productivity rates
- b. High quality of work
- c. Safe worksite

All of the above are core objectives within the timeframe as determined in the schedule of work and subject to a given budget. In addition, it can be expected that good communication would yield increased morale, less conflicts, and decreased turnover, while maintaining favorable relations among all parties.

2.7.3 Communication process

A standard model of communication, adopted from Gibson and Hodgetts (1990), is shown in Figure 2.9. Interpersonal communications involve at least two persons, a sender or source and a receiver. The process starts when the sender creates and sends a message for transmission over a communication medium or channel to the receiver who

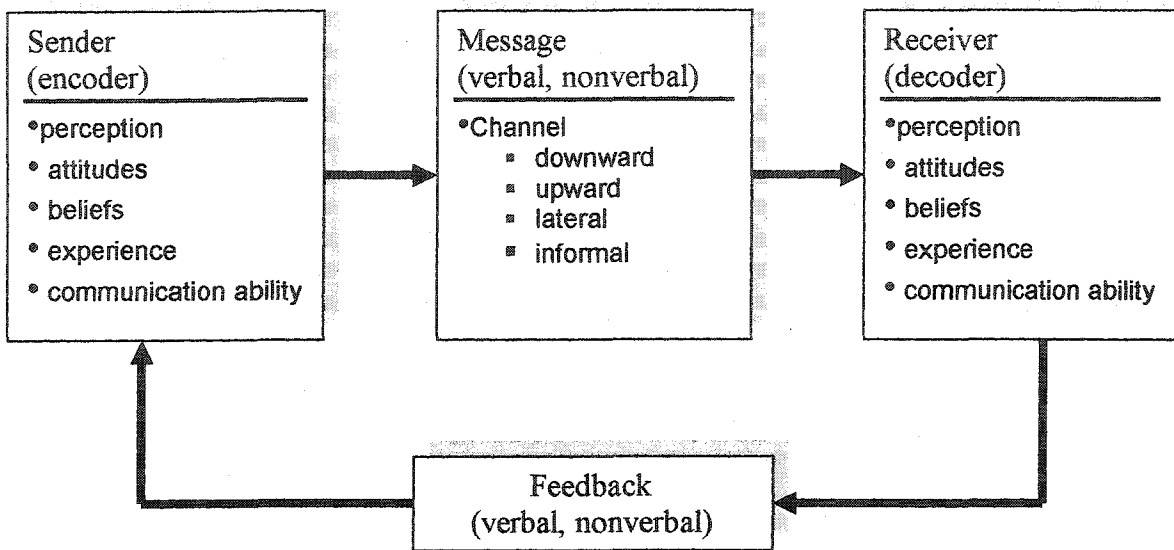


Figure 2.9. The communication process

interprets or perceives the messages according to his attitudes, beliefs, experience, and communication ability. Then through feedback, the receiver conveys information to the sender about his thoughts and reactions, and the process continues. Throughout the communications process, an important concern is noise which acts as interference and distorts to effective communications.

This simple model of communications illustrates the need of effective speaking and listening skills and of adequate feedback. It also helps trace the origin of any barrier that might hinder effective communications

2.7.4 Communication Barriers

There is a great number of communication barriers, which can be classified into three broad categories (Sigband 1976):

- a. Physical or environmental
 - Noisy workplace
 - Interruptions / distractions
 - Privacy at communicating
 - Poor organization
 - Poor listening

- The competition for attention
- b. Cultural
 - Language
 - Norms, values, and beliefs
 - Ethnocentrism
 - Work related values and habits
 - Personal behavior
 - Appearance
 - Prejudice
 - Differences in perceptions
- c. Psychosocial
 - Personality
 - Attitudes
 - Experience
 - Communication ability
 - Lack of fundamental knowledge
 - Lack of interest

For purposes of analysis, problems or defects at communicating in all three categories must be traced to the objects of communications, that is, to the sender, the receiver, the channel, and the feedback.

Suggested solutions to eliminate the communication barriers

A number of steps can be taken to deal with the communication barriers. There is a great number of solutions that can be applied to any of the objects in the process of communication, such as eliminating distractions, providing relevant feedback, having a receptive attitude, being specific, etc. The specific step will depend on the particular situation. However, in construction projects where cultural diversity is present, sensitivity to cross-cultural or cross-national differences in communication norms is critical to advance the project. Communication skills' training is a key action that contractors can take to improve the capabilities of supervisors and workers as well. This training includes mainly the following:

- a. Learning each other's language to use as communication tool
- b. Understanding cultural differences

A common problem in cross-cultural communication is ethnocentrism, which is the tendency to regard one's own culture and its values and norms as superior to other cultures. This attitude should be avoided, if not eliminated totally, in order to facilitate smooth relationships among all parties.

CHAPTER 3. RESEARCH METHODOLOGY

3.1. Introduction

In general, the research methodology for this project involves assessing the needs and interests of American supervisors as well as Hispanic craft workers who meet together on the construction jobsite to achieve common goals. After this, the process involved designing, developing, and delivering four training courses and assessing the effectiveness of the training. The courses were considered to be a minimum requirement and essential for developing integration.

The Hispanic Research Project is comprised of two phases. Phase I is called “The development of an Effective Construction Training Program for Hispanic Supervisors and Craft Workers,” and Phase II is called “The development of an Effective Construction Training Program for American supervisors.” The research scope also included the evaluation of the effectiveness of the ESL courses. Figure 3.1 shows schematically the phases of the Hispanic Research Project, it is expected that by merging the efforts of phase I and phase II of the project will lead to *integration*.

This research focuses on the Hispanic craft workers in construction with emphasis on Hispanics working for American construction companies in Iowa.

The methodology used for this research project on Hispanic construction workers and American supervisors is shown in Figure 3.2. It consists of four parts: (1) a literature review on the construction industry and Hispanics in the state of Iowa; (2) questionnaire design, data collection, and data analysis; (3) developing and delivering the training courses: *ESL/SSL Survival Courses*, *Stepping Up to Supervisor for Hispanic Construction Workers*, and *Concrete Pavement: Construction Basics*; and (4) effectiveness evaluation and results and conclusions and recommendations.

The literature review on the construction industry and Hispanics in the state of Iowa is presented in Chapter 2.

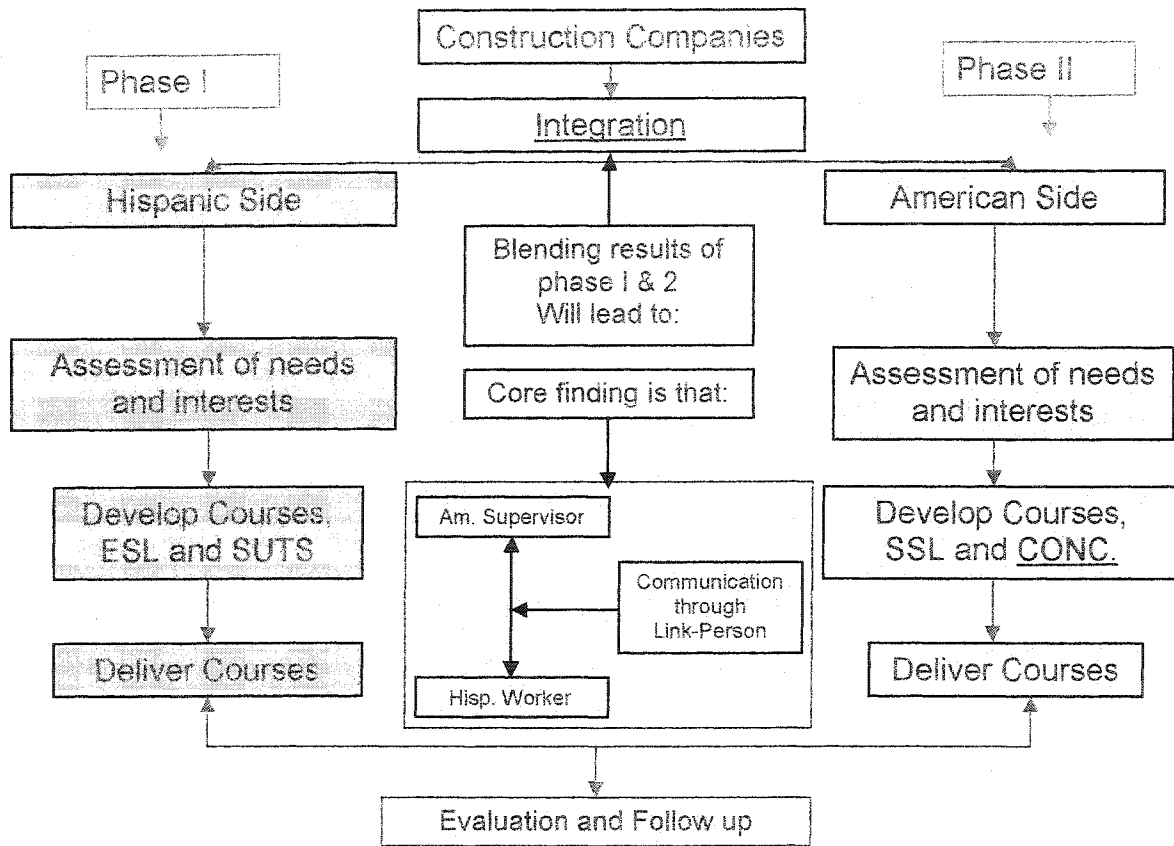


Figure 3.1. Schematic representation of the Hispanic research project phases

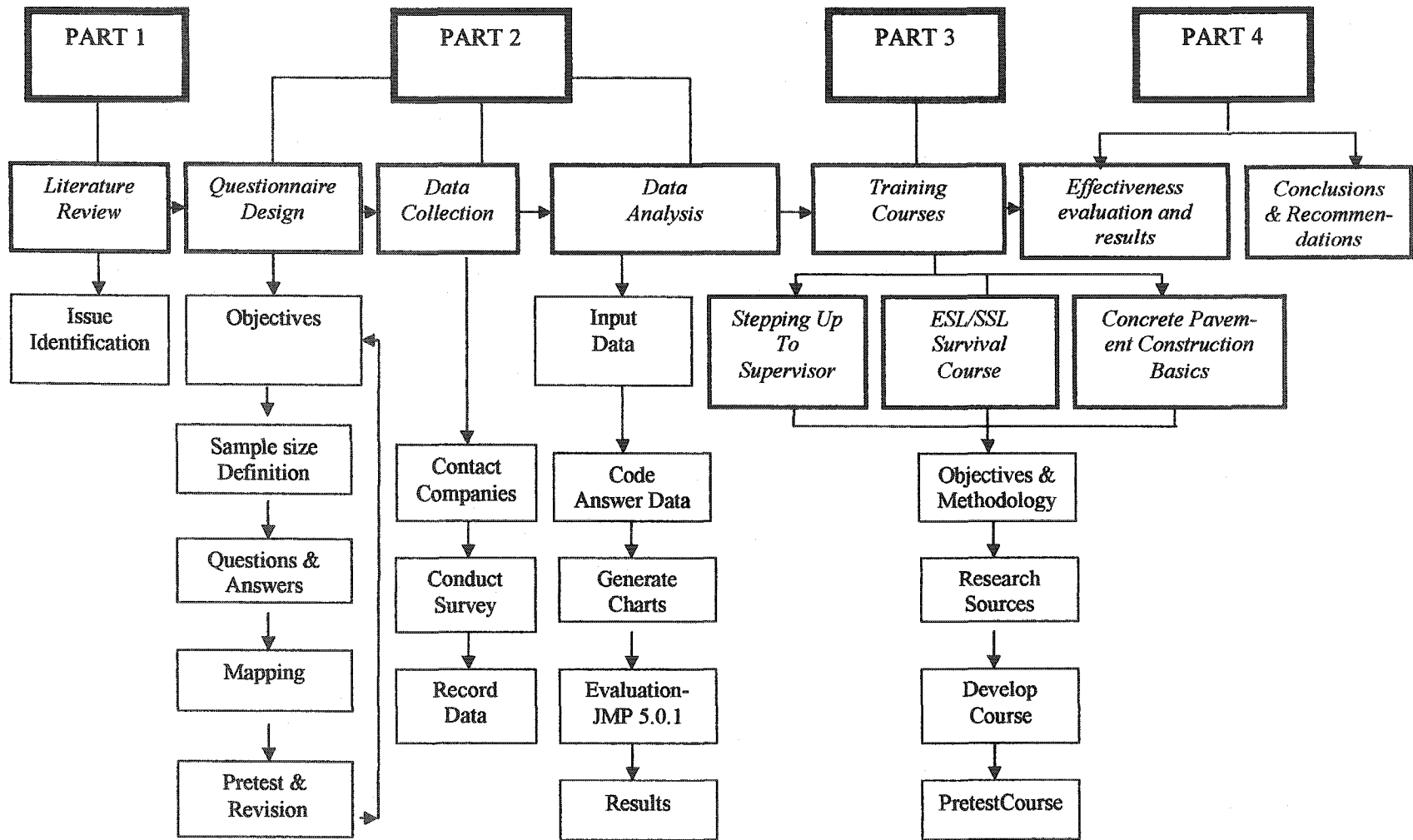


Figure 3.2. Research methodology

3.2. Questionnaire Design, Data Collection, and Data Analysis and Evaluation

A face-to-face survey was deemed the most efficient and reliable way to collect data from American Supervisors and Hispanic construction craft workers. Thus, after the literature review, Part 1, which was conducted on construction companies and Hispanics in the state of Iowa, the research process continued with Part 2. This part consisted of three stages: (1) questionnaire design, (2) data collection, and (3) data analysis and evaluation.

Two questionnaires were designed: one for Hispanic craft workers and another for American supervisors. The goal of the questionnaires was to provide data necessary to bridge the gap between American supervisors and Hispanic construction workers by identifying the problems created by blending the two cultures into the workplace. After identifying the problems, suitable and effective training courses could be designed and developed to create integration between American supervisors and Hispanic construction workers. The purpose of those courses would be that both can become a team and be active and productively engaged participants in the refinement and accomplishment of American construction companies' goal of working under a safe environment.

The following fifteen objectives were defined for the design of the questionnaire for Hispanic Craft Workers:

1. Determine general and specific types of training programs currently offered to Hispanic workers by construction companies in the United States.
2. Determine the level of adequacy of Hispanic workforce training with regard to courses taken, course duration, and degree of difficulty.
3. Identify how Hispanics feel about the usefulness of the courses.
4. Identify Hispanic and American cultural differences and their implications for the workplace.
5. Determine patterns of needs, interests, and areas of training for Hispanic construction workers according to the current level of skills and working conditions.
6. Prioritize those areas of improvement for the implementation of ESL and technical training courses for Hispanic construction workers.

7. Determine the factors and problems (e.g. language barrier, experience) that adversely affect the performance, quality, and safety conditions of Hispanic construction workers.
8. Determine the level of interest, as expressed by Hispanic workers, in relation to improving and learning new skills such as construction equipment operation.
9. Prioritize the type of equipment they would prefer to learn to operate.
10. Determine the level of satisfaction of Hispanic workers related to their opportunities to learn new skills, safety conditions, and type of tasks they perform.
11. Verify the need to have key employees on the work site to overcome the language barrier.
12. Determine accident rates and types of accidents incurred by Hispanics in construction.
13. Gather background, personal, and demographic information on Hispanic construction workers.
14. Obtain mobility index (idea of how long they stay in a particular job) of Hispanic workers.
15. Identify personal expectations and goals towards the future of Hispanics.

The following fifteen objectives were defined for the design of the questionnaire for American Supervisors:

1. Determine the types of training programs currently offered by construction companies to American supervisors.
2. Determine the level of adequacy of American supervisors' training as it relates to working with the Hispanic workforce.
3. Identify the value of training programs to American supervisors.
4. Identify Hispanic and American cultural differences and their implications for the workplace.
5. Determine patterns of needs, interests, and areas of opportunity for American supervisors to develop their relationships with Hispanic workers.

6. Prioritize those areas of improvement for the implementation of ESL/SSL and technical training courses for Hispanic construction workers and for American supervisors.
7. Determine the factors and problems (e.g. language barrier, lack of experience) that adversely affect the performance, quality, and safety conditions of Hispanic construction workers.
8. Determine the level of interest expressed by American Supervisors in having Hispanic workers learn to operate construction equipment.
9. Prioritize the type of equipment American supervisors would prefer Hispanic workers learn to operate.
10. Determine the level of satisfaction expressed by American Supervisors when dealing with Hispanic workers as it relates to their willingness to learn new skills, to comply with safety rules and regulations, and to do the type of tasks they are asked to do.
11. Establish by documenting the need to have key employees on the job site to overcome the language barrier.
12. Determine accident rates and types of accidents incurred by Hispanics in construction as expressed by American supervisors.
13. Gather background, personal, and demographic information on American supervisors.
14. Obtain turnover rates of American supervisors.
15. Identify personal expectations and goals of American supervisors related to maintaining and developing their relationship with Hispanic workers.

Having defined the objectives of the questionnaires, the sample size for each population (Hispanic craft workers and American supervisors) was defined by using the literature review summarized in Chapter 2. It was determined that a preliminary estimate of one hundred and fifty respondents on the Hispanic side and 30 on the American side were necessary to obtain enough data to draw and evaluate significant conclusions and generate recommendations. Several factors influenced the sample size, such as how quickly the surveys had to be conducted on the jobsite, what type of survey to do, and what is the availability of workers as well as the willingness of the project supervisors at the time of the

interview. More specifically, the sample size was calculated according to the number of American supervisors and Hispanics involved in the construction industry in Iowa, obtained from statistics provided by the BLS and U.S. Census Bureau.

Hence, a convenience sample was decided upon according to the literature review on how to conduct surveys (Fink 1998). One factor was the respondents' willingness and availability to complete the survey.

The questionnaire for Hispanic craft workers was developed before the one for American supervisors, which came later after acquiring the feedback from the first one. The process for the questionnaire for Hispanics was such that once the factors of sample size were taken into account, quantitative and qualitative measurements were determined as well as the order and survey length. This step was mainly based on the specific objectives of the survey. Initially, the questionnaire consisted of 20 questions arranged in four categories of information, as follows: (1) ESL background, (2) management course information, (3) safety aspects, and (4) personal information.

This first draft of the questionnaire was pre-tested on three different work sites and had nine respondents. Corrections and modifications were made by several experts, including the survey director and associate of the Center for Survey Statistics and Methodology and other Iowa State University faculty.

Finally, the questionnaire was completed. It consisted of thirty-five questions with the same four categories established before the pre-test. Appendix A contains the questionnaire in its final format and with its main objective, which was used as introductory information before the surveys took place. A similar procedure was followed to develop the questionnaire for American Supervisors. This questionnaire in its final format is also included in Appendix A.

3.2.1 Data Collection for Hispanic Craft Workers

Data collection, the second stage of Part 2, was carried out by using face-to-face interviews with construction workers on the jobsites. Several construction companies in Iowa were willing to collaborate and ten of them were contacted prior to conducting the interviews. Research team members, called project contacts, explained the nature of the survey and requested permission in advance to enter the jobsite.

A variety of project types were selected. Most of the construction projects chosen as data sources were located in the Des Moines area, Ames, Burlington, Council Bluffs, and cities in which the presence of Hispanic workers was sufficient to conduct the survey. All of the workers were working on Iowa DOT projects. Of the 150 surveys initially planned, 97 were actually conducted. However, the decision to stop at 97 interviews was made based on the fact that similar answers were being obtained, as seen from the comparisons of the results at 20, 40, 60, 80, and 97 interviews illustrated in Figure 3.3.

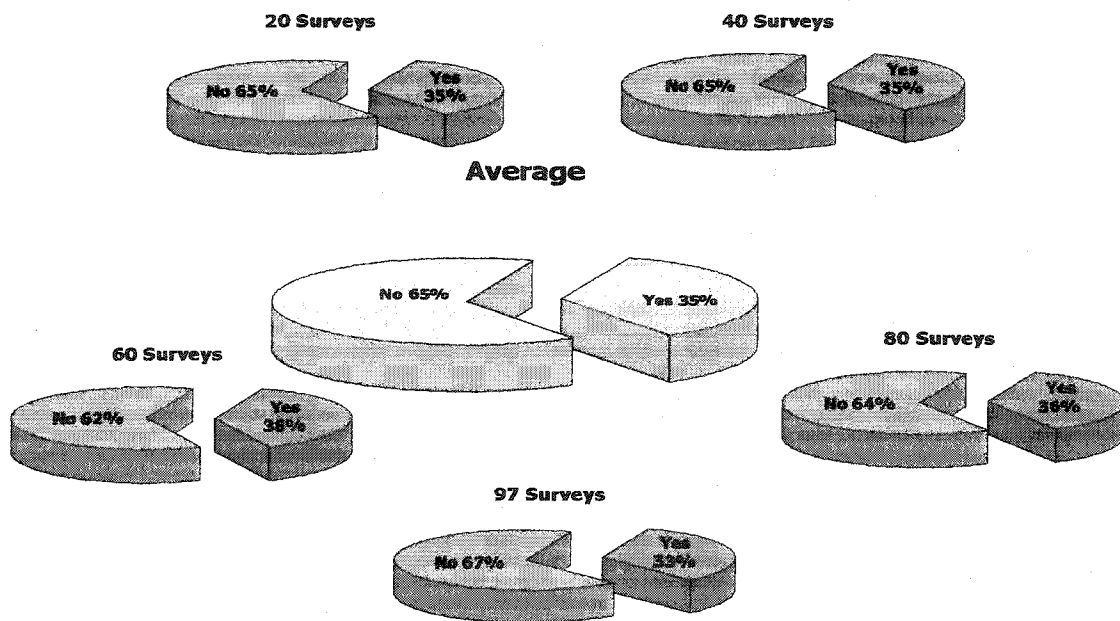


Figure 3.3. Comparison of results for question 1, “Have you ever taken a course to help you learn English?”

Further support for the decision to stop at 97 interviews is contained in Table 1 of Appendix B, which shows the answers to questions 1, 2, 7, 10, 11, 13, 14, 15, 19 and 33 also as obtained for sample sizes of 20, 40, 60, 80, and 97 interviews. The mode is used to show that answer # 7 in the scale (1-7) is a typical mode as a measure of central tendency.

A comparison of the mean and the median gives an indication of the skewness of the data. Table 2 in the Appendix B shows that for question 10 a, b, and c, the data yield a leftward skewness, which supports the most favorable answer.

To conduct this survey, the author and a Master's degree student in Construction Engineering with bilingual skills in Spanish and English were used as surveyors.

As a last stage of the Part 2, data analysis and evaluation were completed and used for the selection and development of two effective and unique training courses. In this part, factors such as the length of the questionnaire, the number of completed surveys, and the data analysis software to be used had to be considered. Each objective in the questionnaire was achieved by asking the adequate question. Appendix A contains a complete mapping of objectives in relation to the corresponding questions.

Microsoft Excel was used to store respondents' information. Thus, survey responses were input, coded, and kept confidential in a customized database. Totals and respective percentages were calculated, and charts were generated for each of the 35 questions.

Data analysis continued with the evaluation of the generated charts. Variability and similarities were extracted from the bar charts obtained for each question. Establishment of relationships indicated patterns that, in turn, would lead to significant conclusions for research project recommendations.

Given the number of respondents, the data were exported to statistical software called Jump 5.0.1. Making use of both bar charts and statistical results, questions were selected according to the research objectives.

3.2.2 Data collection for American Supervisors

On the other hand, data collection for American Supervisors, as the second stage of Part 2, was carried out in a somewhat different manner. Seventeen supervisors were interviewed personally on the jobsite or elsewhere, and the rest of the questionnaires were filled out by supervisors on their own. American supervisors did not experience any difficulty filling out the questionnaire. This was not the case with Hispanic workers, who in general required that some questions be explained to them. A total of 15 construction companies in Iowa were willing to collaborate.

Of the 30 surveys initially planned, 38 were actually obtained. At the time of writing this report, other filled-out questionnaires are expected to come and would be integrated in the database.

As a last stage of Part 2, data analysis and evaluation were completed and used for the selection and development of two additional effective and unique training courses using the same procedure as for Hispanic workers.

CHAPTER 4. TRAINING COURSE DEVELOPMENT, DESCRIPTION, AND CONTENT

4.1. Introduction

The challenges of the American-Hispanic cultural blending in the workplace require close review of training approaches by organizations. The large numbers of Hispanics present in the U.S. construction labor force create substantial issues for developing training material. Communication barriers, involving culture and language issues, are a growing problem at the typical jobsite.

Providing a continuous learning environment for employees is one of the best methods for ensuring the achievement of company production goals. This is particularly important in the construction industry, in which contractors should not let its diverse workforce fall short of benefiting from the implementation of proper training programs.

Based on available data and the results and recommendations obtained from the surveys conducted from May 2003 to March 2004, the research team developed the four training courses mentioned in Chapter 3. Two of the courses are intended for both Hispanic construction craft workers who need to develop language skills focused on construction and those with the willingness and skills that meet the requirements to advance to a supervisory position within an American construction company. The second two courses are intended for American supervisors who need to develop their Spanish speaking capabilities in order to facilitate communication with the Hispanic workforce and to improve their leadership. All four courses are intended to create integration between both parties when assembled together into a training program.

Some of the Outreach Training Program Guidelines from OSHA's outreach training program have been incorporated in the design of these courses.

4.2. Systematic Approach for Training Course Development

A systematic approach to diversity training is necessary for the development of the proposed courses. Goldstein (1993) forces training developers to consider why training is

needed, what should be covered in training, and how training outcomes should be measured. This approach was adapted and simplified for this research purpose, as shown in Figure 4.1.

Stage one was described in Chapters 2 and 3 of this dissertation. The courses included in this report—ESL/SSL Survival Course, Stepping Up to Supervisor Course for Hispanic Construction Workers, and Concrete Paving: Construction Basis—address a combination of current Hispanic workforce issues and other issues identified among survey findings from Hispanic craft workers in Iowa. The courses also address American supervisors working for construction companies. Therefore, the intent of these courses is to provide instructional material and content that is based on research findings to will facilitate integration between the Hispanic worker and his American supervisor by improving his or her English/Spanish skills related to the construction jobsite, but more specifically, to the construction of concrete roads.

Figure 4.1 indicates that once the needs assessment is complete, training course development can begin. For this process, the courses were structured around three main steps that play a critical role in the process of training individuals: (1) awareness, (2) skill building, and (3) action planning. Having structured the contents, a process of understanding these defined contents is the supplemental part of each of the four courses.

In the *ESL/SSL Survival Course*, participants are provided with a booklet containing all the material, and a presentation is given by the instructor according to the booklet. The presentation has four parts: (1) meaning in English/Spanish, (2) meaning in Spanish/English, (3) pronunciation of the word in English/Spanish, and (4) a photo of the word. Every word included in the booklet is presented to participants in these four ways. The teaching process has the following sequence: (1) the word is shown to participants and read to them by the instructor in English/Spanish; (2) participants repeat the word several times; (3) participants write the pronunciation of the word (phonetic sound); and (4) comments are discussed.

The *Stepping Up to Supervisor Course for Hispanic Construction Workers* contains three steps, as follows: (1) how to work with yourself, (2) how to work with an individual, and (3) how to work with a group.

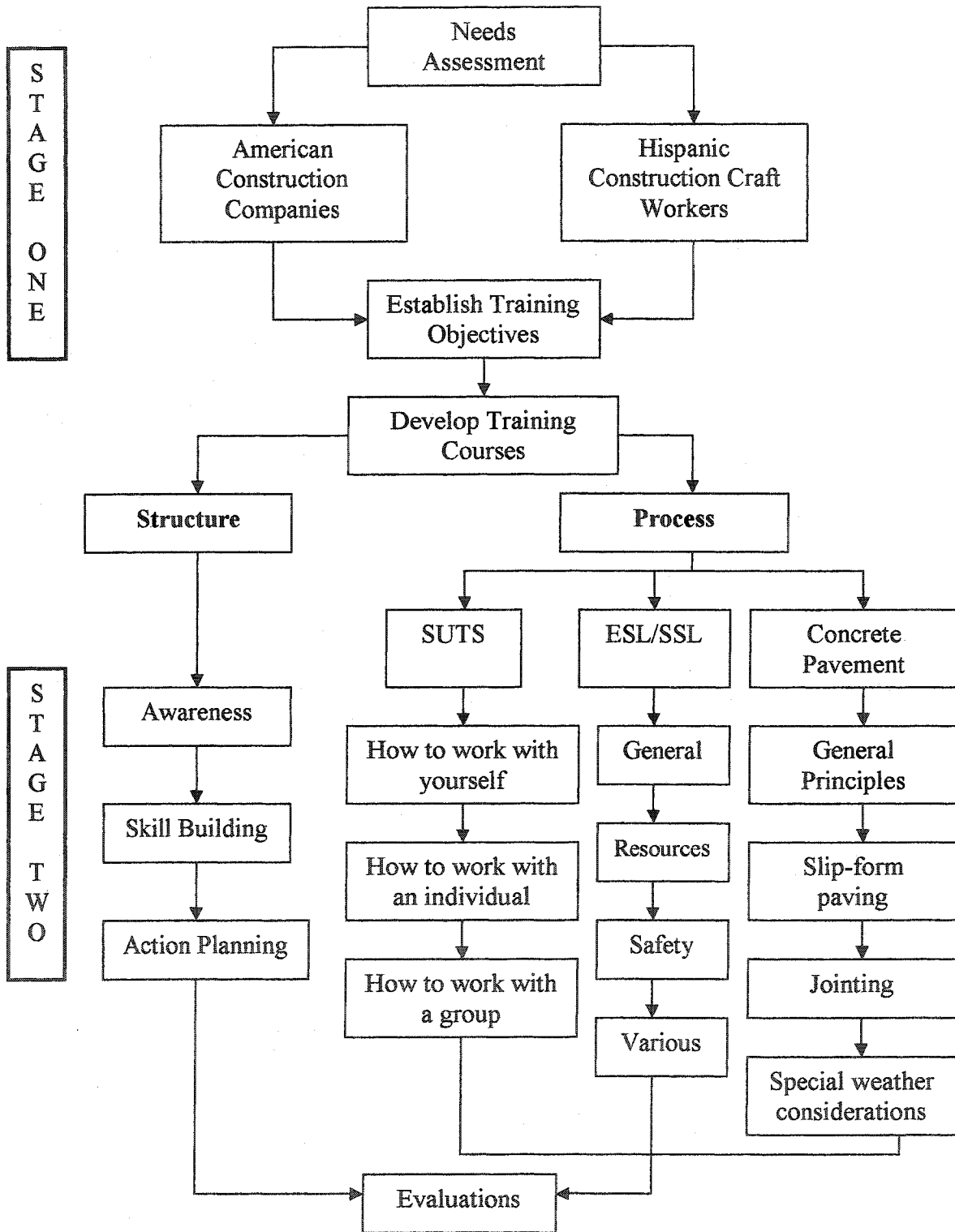


Figure 4.1. Approach of training course development

Each of these sequential steps is related to the structural components, but the goal is to follow an effective, combined path.

In addition, it is recommended for the first structural component, *awareness*, that bi-cultural training processes begin by informing participants of organizational facts, differences in the workplace, projected demographic changes, risks involved on the jobsite, and accident rates among others. This should lead to increased participant's motivation, interest, and/or attention.

After being more aware of the actual working environment and possible changes, the attainment of knowledge and *skills building* for new adjustments, challenges, and behavioral changes can start (Kraiger 2002). It is very important to stress differences about cultural norms, attitudes, and values between American culture and Hispanic culture.

Since diversity is emphasized by these courses, these courses should be developed and delivered by not only a qualified trainer, but also by a person with a bi-cultural (Spanish-English) background.

During the *skills building* component, participants should also have opportunities to observe both appropriate and inappropriate behavior, have experience working with cultural issues and conflicts, and finally receive encouraging criticism to make needed adjustments. As an example, simulations of workplace situations are useful at this stage. Group discussions can be used where issues can be identified and improved. This identification of real-life scenarios becomes crucial in the case of Hispanics working in the United States. Some of these workers may have already faced situations where culture is the barrier, but others will not even understand what is going on due to the lack of language or to cultural differences.

These are the types of skills that must be delivered to Hispanic trainees and American supervisors as well. They need to understand why and how those situations may be encountered on the jobsite. The main goal is to create integration. Both parties can become one team working towards the achievement of a common goal, communicating at a basic level in either or both languages and using construction-related terminology.

The last structural component is called *action planning*. It concludes the preceding *skills building* and *awareness* stages. Without it, the training approach would be

unsatisfactory. This stage is the result of the training process; therefore, trainers are to make sure that it has been successfully attained. During this stage, problem-solving and process-improvement activities are discussed and should be developed when delivering the training course.

In addition, trainees (for the second course, prospective Hispanic supervisors) are required to develop an action plan after they have identified the challenges, changes, and issues involved in this transition. A plan must be developed that describes the new roles and responsibilities that advancing to supervisor entails.

The contents of these courses were chosen according to what Hispanic construction craft workers need to know with regard to stepping up to a supervisory position within an American construction company. More specifically, these contents were given a Heavy/Highway type of emphasis because the majority of the survey findings were obtained from this field of the construction sector.

The Concrete Pavements: Construction basics is an even more targeted course, as it relates specifically to the construction of concrete pavements. It covers a full spectrum, including the site preparation, slip-form paving operations, jointing, special weather considerations, and testing and troubleshooting. It contains a deep coverage of materials, transport, stringline, grade finish, placing, finishing, curing, safety, tools, equipment, joint layout, sawing, and sealing. American supervisors can choose among any or all of these sub-topics to be trained not only on the technical side, but also to have the added value of the language dimension in order to be able to communicate with his/her Hispanic crews without the absolute need of having the link-person present on the jobsite all the time.

4.3. Basis to Select the Type of Training Course

4.3.1 For Hispanic Craft workers

The selection of the courses to be developed for Hispanic workers was based on the results obtained from the surveys. Out of the fifteen questionnaire objectives defined in Part 2, four objectives (1, 2, 6, and 8) were used as the basis for developing the *ESL Survival Course* and five objectives (1, 5, 7, 10, and 15) were used as the basis for developing the *Stepping Up to Supervisor Course for Hispanic Construction Workers (SUTS)*. Table 4.1

contains the corresponding questions for selecting each course in order to narrow down the answers to the specific training needs of Hispanic workers on the jobsite. The graphs developed out of the questions are included in Appendix C along with the coding manual.

Table 4.1. Objectives and questionnaire used for training course selection

Objective no.	Objective	Questions	
		SUTS	ESL
1	Determine general and specific types of training programs currently offered by construction companies in the United States to Hispanic workers.	19c	19c
2	Determine the level of adequacy of Hispanic workforce training as it relates to courses taken, course duration, and degree of difficulty.		1a, 1b, 4, 5
5	Establish patterns of needs, interests, and areas of training for Hispanic construction workers according to their current level of skills, working conditions, and safety environment.	7, 8, 9, 13, 19d	
6	Prioritize those areas of improvement for the implementation of ESL and technical training courses for Hispanic construction workers.		10a, b, c, d, e, f, 33
7	Determine all factors (e.g., language barriers) that adversely affect the performance, quality, and safety conditions of Hispanic construction workers.	23a, b, 24a, b	
8	Determine the level of interest as expressed by Hispanic workers in relation to improving and learning new skills such as construction equipment operation.		11
10	Determine the level of satisfaction of Hispanic workers as it relates to their opportunities to learn new skills, safety conditions, and type of tasks they perform.	17a	
15	Identify personal expectations and goals toward the future of Hispanics.	32, 35	
SUTS: Stepping up to Supervisor		ESL: English as a Second Language	

The results of the survey reflect the needs of Hispanic workers to take ESL courses that are short enough and construction-focused. 65% of the workers said they had not taken courses to help them learn the language, 57% expressed that duration (too long a course) was a concern since their courses were more than 40 hours. Learning construction-focused terminology was “very important” according to 55% and “important” to 28% of the workers.

The format, the duration, and the contents of training courses are all important aspects of a well-designed training course, regardless of the target audience. In the case of Hispanic workers, 79% expressed the desire and need to be trained in both English and Spanish. Many of those surveyed expressed that if they are trained in English, they have trouble learning, and if they are taught in Spanish, they do not learn English. Therefore, they prefer to be trained in both languages. Training in both languages forces the courses to be taught by a bilingual instructor with construction experience to explain concepts not only related to the language but also to the work. Therefore, efforts in developing the *ESL Survival Course* were made to accommodate these specific needs of the Hispanic workers.

A construction craft worker who will become a supervisor is expected to be fluent in English since this is one of the initial requirements for advancement opportunities within an American construction company. The analysis of data and training-related charts led to four influencing factors to obtain advancement positions: (1) a lack of adequate training, (2) the existence of the required construction experience, (3) the desire for advancement opportunities, and (4) the desire for taking training courses to develop skills.

It is vital to note the importance that advancement opportunities hold for a Hispanic construction worker. 77% of workers answered that it was very important and 10% said it was important to have advancement opportunities. If this is so, training to help Hispanic construction workers achieve advancement should become a priority.

Experience is an important factor when supervisors decide to promote a construction craft worker to a supervisory position. The construction experience Hispanic craft workers had prior to coming to the United States shows that, of these workers, 40% had between one and three years of experience in their native countries and only 15% had more than seven years of experience. These workers had experience in such areas as carpentry, masonry, and concrete among others.

In terms of construction experience in the United States, 58% of Hispanics have already had more than four years of experience working for American companies. Carpentry was the most common trade found among Hispanics, with 61%, followed by concrete work with 20% and construction labor with 15% of the total.

Finally, it was also necessary to measure the desire of these workers to grow and step up to a supervisory position. When workers were asked whether or not they would like to take a course to be promoted to supervisor, a significant 86% of them answered positively. Within the context of this research, a supervisory position is understood as a leadership position such as foreman, crew leader, or supervisor, depending upon the company's needs and the worker's capabilities. All of these were fundamental considerations to develop both the ESL and the SUTS courses for Hispanic craft workers.

4.3.2 For American Supervisors

The role of the American Supervisor is determinant. They are the leaders: they have to make the decisions with regard to what has to be done on the jobsite, they plan and schedule the work, they assign material resources, they define the best construction procedures, and most important of all, they select, assign, train, and manage the workforce to do the job from the onset of construction through completion. American supervisors have to deal directly with any problems that arise related to their workforce. Therefore, their opinion expressed in the questionnaires is very important and relevant to the issue of managing Hispanic workforce. The graphs developed out of the questions are included in Appendix C along with the coding manual.

Their needs and interests combined with those of Hispanic workers were analyzed and evaluated to help select the appropriate training courses that would best benefit the integration with their workers. The following are findings that were derived from the surveys of American supervisors:

1. The main problem they have is Communication (to be able to transmit instructions and get adequate responses). More than 60% of supervisors and more than 55% Hispanic workers affirmed the fact, as shown in Figure 4.2.
2. 73% of supervisors communicate through a "Link-person" with their crew members.
3. 85% of supervisors use English to speak to their workers and 15% use English and Spanish combined.
4. 80% of supervisors would like to take a course to learn Spanish.

5. 33% of supervisors have taken Spanish in High School, 22% in College, and 6% in both. Supervisors indicated that they have forgotten most of what they learned. 39% have taken additional Spanish courses as they felt the need to facilitate their job.
6. When asked what solutions they propose to solve the language barrier, 47% said ESL/SSL courses should be delivered, 18% said their HWF should take ESL, and 16% said they should take SSL courses.
7. With regard to the interest in taking a technical course related to their trade, 90% of workers and 92% of supervisors said yes, as shown in Figure 4.3.
8. With regard to what technical course to take, the interest is concentrated in concrete, equipment, and carpentry courses, as shown in Figure 4.4.
9. When asked what course to take that would benefit communication, 65% said concrete finishing, 12% said carpentry/formwork, and 6% said equipment operation, as shown in Figure 4.5.
10. With regard to taking a course to help step up to supervisor, 55% of American supervisors said they would like to send their workers to such course, and 86% of the workers expressed the interest in taking a course.

Based on these findings, two additional training courses were decided upon and developed: a) Spanish as a second language: Survival course and b) Concrete Pavements: Construction basics. 63% of the American supervisors said that a course on concrete finishing would benefit their communication with their Hispanic workers. The SSL course is very similar to the version for Hispanic workers, and the course on concrete was developed based on the curriculum of the Center for Portland Cement Concrete Pavement Technology at Iowa State University.

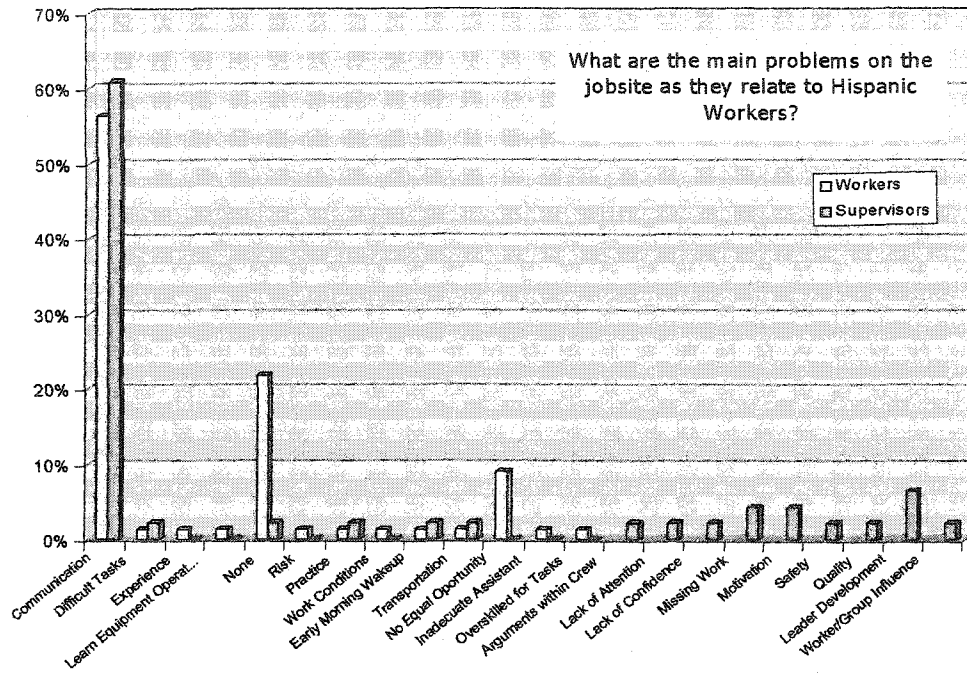


Figure 4.2. Main problem in the jobsite as related to American supervisors and Hispanic craft workers

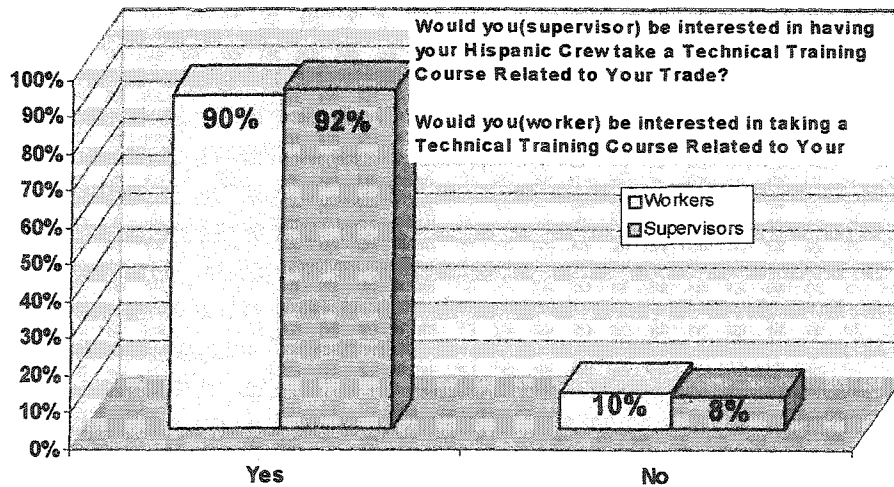


Figure 4.3. Common interest to take a technical course related to the trade

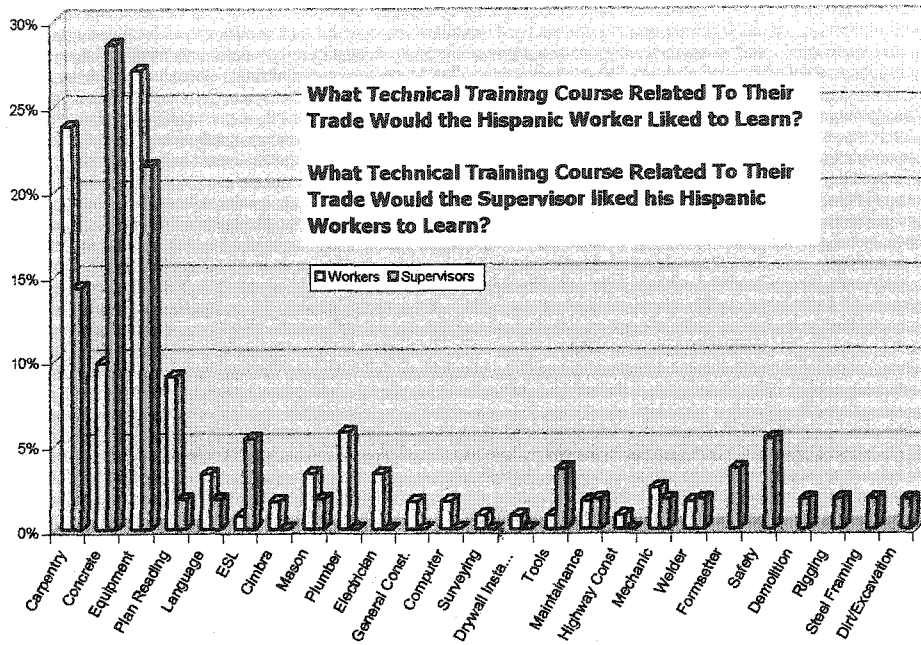


Figure 4.4. Type of technical course as expressed by American supervisors and Hispanic craft workers

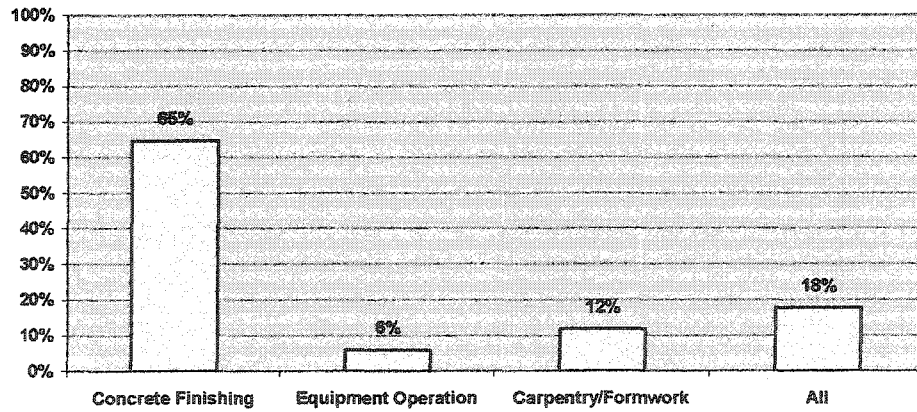


Figure 4.5. Preference of American supervisors as it relates to technical course to take that would best benefit communication with Hispanic workers

4.4. Brief Description and Contents of Training Courses

4.4.1 English/Spanish as a Second Language Survival Course

The focus of these courses is on simplicity. They are not college courses, but instead, they are highly interactive, basic courses on only what-you-need-to-know, including construction-related vocabulary, tool names, equipment, and simple directive language phrases that will facilitate basic communication.

The development of the *ESL/SSL Survival Courses* was based on basic vocabulary used in construction. The level of these courses, as the name indicates, is for construction workers and American supervisors with a low level of second language knowledge. The survey findings related to ESL/SSL courses led developers to structuring the course such that it contains two types of instructional materials: a booklet and a visual presentation. The booklet provided to trainees consists of a list of words that are sorted alphabetically and organized by categories. These categories include general vocabulary (e.g., alphabet, vowels, numbers, and hand tools), resources (e.g., materials, workforce, and equipment), safety (e.g., safety equipment and safety signs), and other information (e.g., productivity, quality, and survival phrases). The visual presentation contains pictures of the word and its meanings in English and Spanish.

The following are the contents of the courses by topic and subtopic:

General

- Alphabet
- Vowels
- Numbers
- Hand tools

Safety

- Safety equipment
- Safety signs

Resources

- Materials
- Work force
- Equipment

Various

- Productivity
- Quality
- Miscellaneous

Examples of the material used during the course are provided in Figure 4.6. The full version of the ESL/SSL Survival Course is available at the Iowa State University Construction Engineering department. One difference in the booklet is that instead of saying “se oye como” in the ESL version, it should say “it sounds like” in the SSL version. Another important difference is in the safety subtopic. It contains real work situations where the American supervisor can learn to instruct his or her worker so that the risk of an accident can be minimized.



Agreggate	Agregado
Se oye como: _____	
	_____ _____ _____
Asphalt	Asfalto
Se oye como: _____	
	_____ _____ _____

Figure 4.6 Examples of ESL / SSL survival courses

After several trial runs of the *ESL/SSL Survival Course*, a methodology was implemented. A word is supposed to be read by the trainees after they have visualized the picture symbolizing the word’s meaning. Once this word has been visualized and read, trainees should repeat the word after the instructor has clearly pronounced it to them. This process may be repeated several times until trainees feel comfortable with the pronunciation and meanings of the word. Flashcards are used to facilitate learning and retain knowledge and pronunciation of the word. This course is designed to be taught in one 8 hour session.

Instructors are to discuss aspects of cultural dimensions or cultural differences that give Hispanic workers and American supervisors a sense of confidence that goes beyond just pronouncing the word correctly. By discussing the cultural dimensions as described by Hofstede (1983), participants get sensitized to the fact that we are all different, that cultural diversity exists, and that we are somehow located or belong/ behave in one or more of the Hofstede's dimensions. An example of this is the dimension of Power Distance in which the worker believes that his boss is an all-powerful person that he can not even dare to talk to. In such a setting, communication basically does not exist. In addition to providing "survival words," the course includes "survival phrases" which will facilitate communication between the Hispanic worker and the American supervisor.

4.4.2 Stepping Up to Supervisor Course for Hispanic Construction Workers

Becoming a supervisor or leader requires a different set of skills to move from actually doing the job to the role of delegating the work to others. The work expectations of the supervisor have been changing to meet the needs that characterize most workplaces. New skills are required to lead effectively in rapidly changing workplaces.

As a first stage of the training course development, an identification of job needs or problems is required. Therefore, survey findings were used in deciding what kind of material would be appropriate for Hispanic construction workers. As part of this identification, prospective supervisors must be alerted to the requirements of the position.

Strategic decisions were made when developing the action plan, methodology, and contents of the course. In addition to making use of existing references on this topic, the researcher adopted information on cultural differences between the American and Mexican cultures obtained from a research study in order to provide a more detailed idea of how the course contents were selectively oriented to both American and Hispanic cultures.

Finally, after performing a task analysis and identifying and collecting information, the design of the curriculum was carried out. A detailed course outline was prepared and evaluated. Several steps took place in this stage of Part 4, as follows: development of lesson plans and instructional materials, evaluation of training materials, consideration of learning styles typical of Hispanic culture, selection of visual materials, and suggestion of additional reading materials to be used as a post-training process.

The goal of this training course is to provide an effective tool to help the promoted (or to be promoted) Hispanic craft worker prepare for his/her new supervisory position, manage new responsibilities during the transitory period and after, and finally become a successful supervisor always looking for opportunities for improvement and working in a safe environment.

The following are the contents of the course by topic and subtopic:

- Introduction
 - It is different to be a supervisor
 - The supervisor's role
 - Facing the challenge
 - How to handle new responsibilities
 - Recommendations on how to be a successful supervisor

- Part I: How to work with yourself
 - Leadership
 - Attitude
 - Motivation
 - Productivity
 - How to deal with stress and anxiety
 - Decision making
 - Problem solving

- Part II: How to work with an individual
 - Factors influencing individuals
 - Giving workers your opinion about their performance
 - How to instruct your workers
 - How to evaluate your workers
 - Setting goals
 - Disciplinary measures
 - Terminations

- Part III: How to work with a group
 - Selecting and managing your crew
 - Taking advantage of your crew members' skills
 - Involving others in the decision making process
 - Dealing with complaints
 - Putting together an effective work team
 - Work site meetings
 - Crew performance

- Part IV: Key points
 - Weekly and daily schedules
 - Getting the resources you need
 - Assuring quality
 - Enforcing safety
 - Scheduling overtime
 - Supervising friends
 - Common mistakes

- Evaluating yourself

The complete course is provided in the Thesis written by Arbeláez (2003) and at the Iowa State University Construction Engineering Department.

The full course lecture is offered in Spanish with heavy emphasis in English terminology. The course material (workbooks) is delivered to the participant in both versions (English and Spanish).

4.4.3 Concrete Pavements: Construction Basics

Due to the fact that learning a second language (as an adult) is a lifelong endeavor, developing integration by training American supervisors calls for a very specialized effort on deciding what they should learn and how to use this knowledge as a communication tool on the jobsite to get the job done on time and within budget, when it comes to working with Hispanic workers. With this in mind, the technical curriculum of the Portland Cement Concrete Pavement Technology, housed at the Center for Transportation Research and Education, was taken and adopted as a basis to develop a systematic approach in selecting the most appropriate technical vocabulary for American supervisors to learn and to keep as a minimum knowledge of the Spanish language related to construction of concrete roads. The teach-learn concepts used on the ESL/SSL courses are also used here. A booklet and a visual presentation are provided to the American supervisors in order to get them acquainted with the terminology used in this type of activity.

There are 6 general topics and 12 subtopics on concrete paving in the course, as shown in Table 4.2. Out of these twelve, the sub-topics on materials, joints, and sawing and sealing were fully developed as part of the scope of this dissertation. All other topics are under development as of today as part of Phase II of the project conducted at the Iowa State University. They will also be available at the Iowa State University Construction Engineering department.

American supervisors can choose among any of these sub-topics to be trained not only on the technical side, but also to have the added value of the language dimension in order to be able to communicate with his/her Hispanic crews without the absolute need of having the link-person present on the jobsite all the time.

The following table includes the contents of the course by topic and sub-topic.

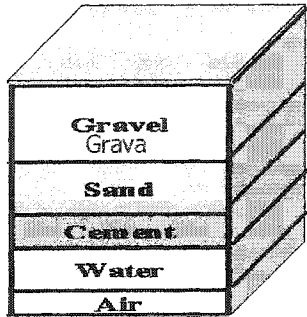
Table 4.2. Contents of the course Concrete Pavements: Construction Basics

Topics and sub-topics	Common Sub-topics
a. General Principles 1. Stringline and Dowel bars	a. Materials
b. Site preparation	b. Safety
c. Slip-form paving operations 1. Grade finish 2. Transport the mixture 3. Placing the concrete 4. Finishing the concrete 5. Curing	c. Tools
d. Jointing 1. Joints 2. Sawing and sealing	d. Equipment
e. Special weather considerations	
f. Tests and Troubleshooting	

Examples from the Concrete Pavement Course for American Supervisors are provided in Figures 4.7 and 4.8. The full English-Spanish version is provided in Appendix D.

All material contained in this course was reviewed by Mr. Jaime Reyes. Mr. Reyes was born in Monterrey, Mexico. He holds a Bachelor's and a Master's degree in Civil Engineering. He is a registered professional engineer in Arizona, Iowa, and Mexico and has been working for the Iowa DOT since 1970.

Materiales para Concreto Concrete Materials



- Agregado
- 60-70% Aggregate
 - 30-35% Rock Roca
 - 30-35% Sand Arena
 - 9-15% Cements Cemento
 - 15-16% Water Agua
 - 6- 8% Air Aire

Agregados Aggregates

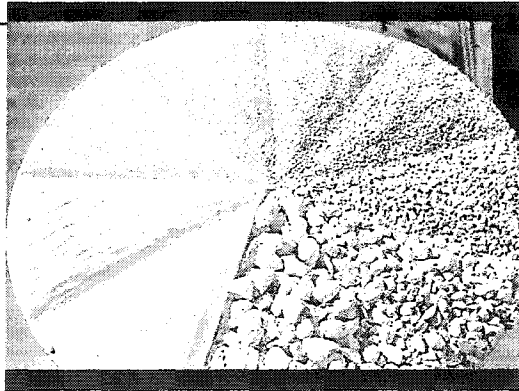


Figure 4.7. Examples of Concrete Pavements: Construction Basics

Principios Generales

Entender y adherirse a los siguientes principios de los pavimentos de concreto ayudará grandemente en la construcción y entrega de un pavimento duradero y muy bien construido:

- Todos en la obra de construcción, particularmente los mayordomos y supervisores, son responsables de ubicar y resolver los problemas como se vayan presentando.
- Las cargas (coladas) de concreto deben ser consistentes y mezcladas uniformemente.
- La causa primaria en la falla de los pavimentos es una sub-base inestable. La sub-base debe consistir de material uniforme y debe drenar libremente.
- Las dovelas son importantes para la transferencia de carga a través de las juntas. Deben ser alineadas cuidadosamente, de forma horizontal y vertical para prevenir el daño al pavimento en las juntas.
- Un cordel acotado controla el movimiento vertical y horizontal de la cimbra de la pavimentadora para asegurar un perfil de pavimento liso. Toda vez que el cordel ha sido colocado, no debe desajustarse.
- Sobre-acabado en el nuevo pavimento y/o agregar más agua a la superficie puede dañar seriamente la superficie del pavimento. Si el concreto no está suficientemente trabajable, las cuadrillas deben llamar al Gerente de Proyecto. Cambios en la mezcla o al equipo pavimentador puede reducir el problema.
- El curado adecuado es crítico para prevenir daño al pavimento debido a la pérdida de humedad en la superficie del mismo.
- Un sistema de juntas adecuadamente espaciadas y construidas es crítico para evitar las grietas al azar.
- Las juntas no son más que grietas controladas. Deben ser ranuradas durante el breve periodo de tiempo después que el pavimento ha ganado suficiente esfuerzo para prevenir desmoronamientos pero antes de que empiece a agrietarse al azar ("La ventana del corte").
- Las variaciones de clima y temperaturas diarias afectan el tiempo de fraguado y otras variables en el nuevo concreto. Las operaciones de construcción deben ajustarse apropiadamente.

General Principles

Understanding and adhering to the following concrete paving principles will go a long way toward delivering a well constructed, durable pavement:

- Everyone at the construction site, particularly foremen and supervisors, is responsible for recognizing and troubleshooting potential problems as they arise.
- Batches of concrete should be consistent and uniformly mixed.
- The primary cause of pavement failure is unstable subgrade. The subgrade should consist of uniform material and the subgrade system must drain well.
- Dowel bars are important for load transfer at lateral joints. They must be carefully aligned, horizontally and vertically, to prevent pavement damage at the joints.
- Stringlines control the slipform paver's horizontal and vertical movement and ensure a smooth pavement profile. Once stringlines are set, they should not be disturbed.
- Overfinishing the new pavement and/or adding water to the surface can seriously damage the pavement surface. If the concrete isn't sufficiently workable, crews should contact the project manager. Changes to the mixture or to paver equipment may reduce the problem.
- Proper curing is critical to preventing pavement damage from rapid moisture loss at the pavement surface.
- A well spaced and constructed system of joints is critical to preventing random cracking.
- Joints are simply controlled cracks. They must be sawed during the brief time after the pavement has gained enough strength to prevent raveling but before it begins to crack randomly (the "sawing window").
- Seasonal and daily weather variations affect setting time and other variables in new concrete. Construction operations should be adjusted appropriately.

Figure 4.8. Concrete Pavement: Construction Basics English-Spanish course

4.5. Concluding Remarks

It is clear from the literature review, the design of the questionnaire, the data collection, and the data analysis and evaluation, that courses for training Hispanic workers and American supervisors with the main objective of creating integration between them are not only necessary but mandatory. At this point, the research process has lead to reliable data from Hispanic construction craft and American supervisors, which leads the research team to the design, adaptation, and/or development of such courses as the *ESL/SSL Survival Course*, *Stepping Up to Supervisor Course for Hispanic Construction Workers*, and *Concrete Pavements: Construction Basics*.

CHAPTER 5. ESL TRAINING COURSE EFFECTIVENESS

There have been many studies on Second Language Acquisition (Cambridge University Press). Ample treatment has been given to how to approach measurements of changes in oral communication skills. The point of view can be theoretical or pragmatic. Such things as language proficiency, improving pronunciation, vocabulary acquisition, fluency, the flow of the language, intonation, rhythm, speed and accuracy, and the influence of face-to-face communication using a foreign language have received enough attention in the Linguistic and pedagogy fields.

The intent of this research is from the practical point of view. Therefore, three methods of measuring training course effectiveness can be cited:

- a. Fill out a questionnaire (course evaluation) on the course; this can be done after attending the course or some time later (follow-up).
- b. Take a test; this can be done after attending the course or some time later (follow-up).
- c. Define effectiveness indicators and take measurements in the field long enough to establish relationships.

For this research project, the first method was used to measure the effectiveness of the ESL courses. Two evaluations were given to the participants of the ESL Survival Courses that have been delivered to date. The first evaluation was made immediately at the end of the course. The follow up evaluation was given two months or more after the course was delivered. Both evaluations tried to measure three important aspects of the course: (1) the contents, (2) the usefulness, and (3) the instructor. For both evaluations, two questionnaires were developed and used to determine the participant's perceptions, in particular, to the usefulness of the course as it relates to the benefits they obtained from taking the course.

The results of the course evaluation shows that course contents were described as very basic by 69% of the participants and normal by 31%. With regard to the usefulness of the information they received, 50% said that all of it will be useful and the other 50% said that most of it will be useful in the future. Ninety one percent of worker's opinion is that

the course was definitely what they expected; 95% of workers said that it was worth the time attending the course. Eighty seven percent said their confidence increased, and 100% of workers would recommend the course to others. With regard to the workbooks, 95% said they were excellent and 100% said they were specific enough (construction focused). The activities during the course were excellent according to 96% of workers.

All of these results strongly indicate that the course contents, basic in nature and construction focused, will be useful and will help the worker to better overcome the communication barrier.

The course evaluation consists of 19 questions. The graphical results of this evaluation are included in Appendix E. An excel spreadsheet was used to generate the graphs.

The second evaluation, or preferably the follow-up evaluation, was performed on 20 out of 24 ESL participants two or more months after the course was delivered. The surveys were carried out during the months of June and July 2004. The general objective of the follow up questionnaire was to determine the effectiveness of the ESL Survival course and how it compares to the results of the course evaluation. The ultimate objective was to help Hispanic construction workers develop the ability to communicate with their supervisors in order to be active and productively engaged participants in the refinement and accomplishment of American construction companies' goals under a safe environment. Specific objectives of the follow-up evaluation were the following:

1. To determine if workers have found the ESL survival course to be useful.
2. To determine if workers have used the workbook that was given while taking the course.
3. To determine if workers remember the specific class activities.
4. To determine if workers have increased their confidence to communicate in English as it relates to their work environment.
5. To determine those areas of improvement for the implementation of the ESL survival course.
6. To gather background, personal, and demographic information on Hispanic construction workers.

The questionnaire was similar to the first one except that it was oriented toward what happened in the past. It consisted of 20 questions, the last seven of which were used to generate personal and background information. It also contained two open-ended questions. Seven questions could be compared directly (to the course evaluation), and this was done by means of the statistical tool called paired t-test (using JMP 5.1, Statistical software) in which the results of same sample are tested twice at different times: first, immediately after participants took the course (the course evaluation) and second, two or more months after they took the course (the follow-up). Full versions of the questionnaires are included in Appendix E.

For the follow-up evaluation, combined answers to questions 1, 2, 12, and 13 are given in Table 5.1.

Table 5.1. Combined answers to questions 1, 2, 12, and 13 of the follow-up questionnaire

a. Has the ESL survival course been useful? Can you explain?

Comment	Number of times comment was made	% of participants
• Construction focus	10	53
• Scaffolding	1	5
• Tools	10	53
○ Hammer	2	10
○ Shovel	2	10
○ Float	1	5
○ Level	1	5
○ Saw	1	5
• Improved communication	15	79
• Many things I learned I have put in practice	1	5
• Very well explained	2	10
• You see the words everyday in the jobsite	1	5
• Improved / better confidence	11	58
• Survival phrases	7	37
○ Please repeat	5	26
○ Look them in the eye	2	10
○ Write it down	1	5
○ Make sure you understand	2	10
• Materials	7	37
• I feel better	1	5

Table 5.1. (continued)

Comment	Number of times comment was made	% of participants
• It was encouraging	2	10
• I know more English	1	5
• I think the course made a big difference	1	5
• Safety signs	5	26
• I got my salary increase twice	1	5
• I got my salary increase	2	10
• I lost fear of speaking / I dare to speak	8	42
• Equipment	9	47
○ Skid loader	3	16
○ Roller	1	5
○ Backhoe	1	5
○ Jumping jack	1	5
• I was shy, not anymore	2	10
• I want the course once again	3	16
• The course helped me a lot	2	10
• I reduced dependency on the link-person	1	5
• Now I can ask questions	1	5
• Good to have bilingual instructor	1	5
• Writing / pronunciation	3	16
• I understand more words than before	3	16
• Square meters, cubic meters, numbers, colors, months	1	5
• Labor	Carpenter, finisher, electrician, asphalt, aggregates	5
• I keep the workbook	1	5
• Change attitude, more confidence to communicate	As observed by American supervisor	

b. Of the information you obtained, what was the most useful/ least useful?

Comment	Number of times comment was made
Most useful	Equipment(5), Tools(11), Write it down(1), Materials(3), survival phrases(4), do not be ashamed to communicate(1), I have lost fear(1), Please repeat(3), pronunciation, names of words, all(4),safety signs(1), Numbers(1)
Least useful	None(14), equipment(3), material (1), safety signs(1)

Analyses of the answers provided by the participants of the ESL survival course strongly suggest that the course has been useful. Then, when asked to explain why they think it has been so, participants gave different responses, as can be observed in Table 5.1. Ten of them said it was useful because it was construction focused, 15 said they have improved communication, 11 said they have improved their confidence, and 8 said they have lost their fear of speaking.

When asked about the most useful information/lessons taught, 11 participants said information about tools was useful, 10 said survival phrases were useful, 4 said everything was useful, 5 said information about equipment was useful, and 3 said information about materials was useful.

When asked about what has been the least useful information/lessons taught, 14 said everything was useful, 4 said information about equipment was the least useful, and 1 said information about materials was the least useful.

With regard to the answers that can be analyzed using the paired t-test, Table 5.2 depicts the results of questions 1, 4, 5, 6, 7, 9, and 10. When the p-value is greater than 0.05, the difference in mean answer provided is statistically insignificant for responses at the time of the course evaluation and follow up. It can be observed that out of the 7 questions, 4 had statistically insignificant mean difference having $p > 0.05$. It is reasonable to assume that participant perceptions regarding likelihood to recommend the course to others, worth of time they invested in it, appropriateness of workbook to improve their speaking capabilities, and also usefulness of class activities remains unchanged several months after completion of the training course. Of the 3 questions that have $p < 0.05$, the post-course mean values fall in the upper part of the answer scale of 1 to 7. This means that participants continue to regard the course as having been useful, since they improved their confidence in speaking (see Table 5.1) and believe the course is just what they were expecting to get. The follow up mean scores were significantly lower from a statistical perspective but less so from a practical standpoint.

The results of both questionnaires strongly suggest that the ESL survival course is an appropriate tool for improving the capabilities of the Hispanic workers to communicate better in the jobsite with their American supervisors, thus taking them a step further into

the integration process that will lead to reducing the accident rates in the long run and improving the productivity and quality of work.

Table 5.2. Results of t-test for the same sample of ESL participants

Question Number	No. of Participants	Mean		Prob > t	Results	Observations
		Course Evaluation	Follow up			
Q1. Has the ESL survival course been useful?	19	6.842	5.842	0.0010	< 0.05	2
Q4. The course was just what I was expecting to get.	19	6.947	6.474	0.0034	< 0.05	2
Q5. The course was worth the time I invested in it.	19	7	6.737	0.0562	> 0.05	1
Q6. I feel that my confidence has improved since taking the course	19	6.842	6.211	0.0239	< 0.05	2
Q7. I would recommend the course to others.	19	7	6.895	0.1628	> 0.05	1
Q9. I think the workbook was appropriate to improve my speaking capabilities	19	6.842	6.526	0.2301	> 0.05	1
Q10. I think the class activities were useful.	19	6.834	6.556	0.2878	> 0.05	1

1- No significant change; Evidence exist that the answer is the same

2- Statistically significant; Evidence exist that the answer is not the same

CHAPTER 6. TRANSFERABILITY OF RESEARCH FINDINGS

6.1. Development of Model for Other Ethnic Groups

Transferability is a term used in qualitative research to establish the degree to which aspects of research findings can apply to contexts other than the study from which the findings emerge. This has led to the development of a model that can be applied to any ethnic group that currently or in the future pose similar integration problems in construction as do Hispanic workers now. This is useful when other populations are represented with high percentage of workers within the construction industry.

Strong evidence exists that the research model for Hispanic workers can be transferred to groups like Bosnian construction workers. This ethnic group was chosen as an example for model transferability because it was evident at the time when performing the interviews that Bosnian workers have an important presence in the jobsites in Iowa. In addition to this, the issue of Bosnian workers was brought up several times in meetings and conversations with AGC of Iowa officials. Figure 6.1 depicts the flow of major actions to be undertaken in order to successfully transfer the research findings and obtain the benefits as that for Hispanic workers. It is very important to note that the final objective to keep in mind is that integration between the workers and the American supervisors needs to be achieved.

At the onset of the effort is the need to have an institution that will financially sponsor the research project and an entity (University) that will be willing and capable to undertake the transfer process. Then research activities can begin with the literature review, followed by the needs assessment, development of the training courses, delivering the courses, and evaluating the results, after which the definition and implementation of the training program can be established. The model transferability bases are the following:

1. Context
 - a. Social: work interaction between American supervisors and Bosnian workers
2. Setting: job site
3. Time: seasonal construction for Iowa
4. Type of work: construction
5. Main problem: lack of communication / cultural differences

6. Potential solution: adequate training program
7. Communication channel: link-person? Unknown
8. Demographics: TBD (to be determined)
9. Formal school education of Bosnians TBD (to be determined)
10. English courses taken: TBD (to be determined)
11. Interest to learn: TBD (to be determined) for both Bosnian workers and American supervisors

When transferring the model, it is very important in the literature review stage to determine the demographics and the trends of the target population. One important difference between Bosnian and Hispanic populations is the actual number of workers and the growth trend. Based on projections we expect that the Hispanic population will continue to grow to be one fourth of the population of the U.S. by the year 2050. This most likely will not be the case for Bosnians. However, it appears that currently the need exists in the State of Iowa to serve the needs of the Bosnian population in construction.

In a similar line of transferability, the model can be adopted and adapted to Hispanic construction workers that labor for different type of contractors such as electrical, housing and building. Any type of contractor who has a considerable number of Hispanic workers in his/her crews can have the courses transferred to meet their specific needs for developing integration through custom tailoring the training courses.

Model for Bosnians Construction workers

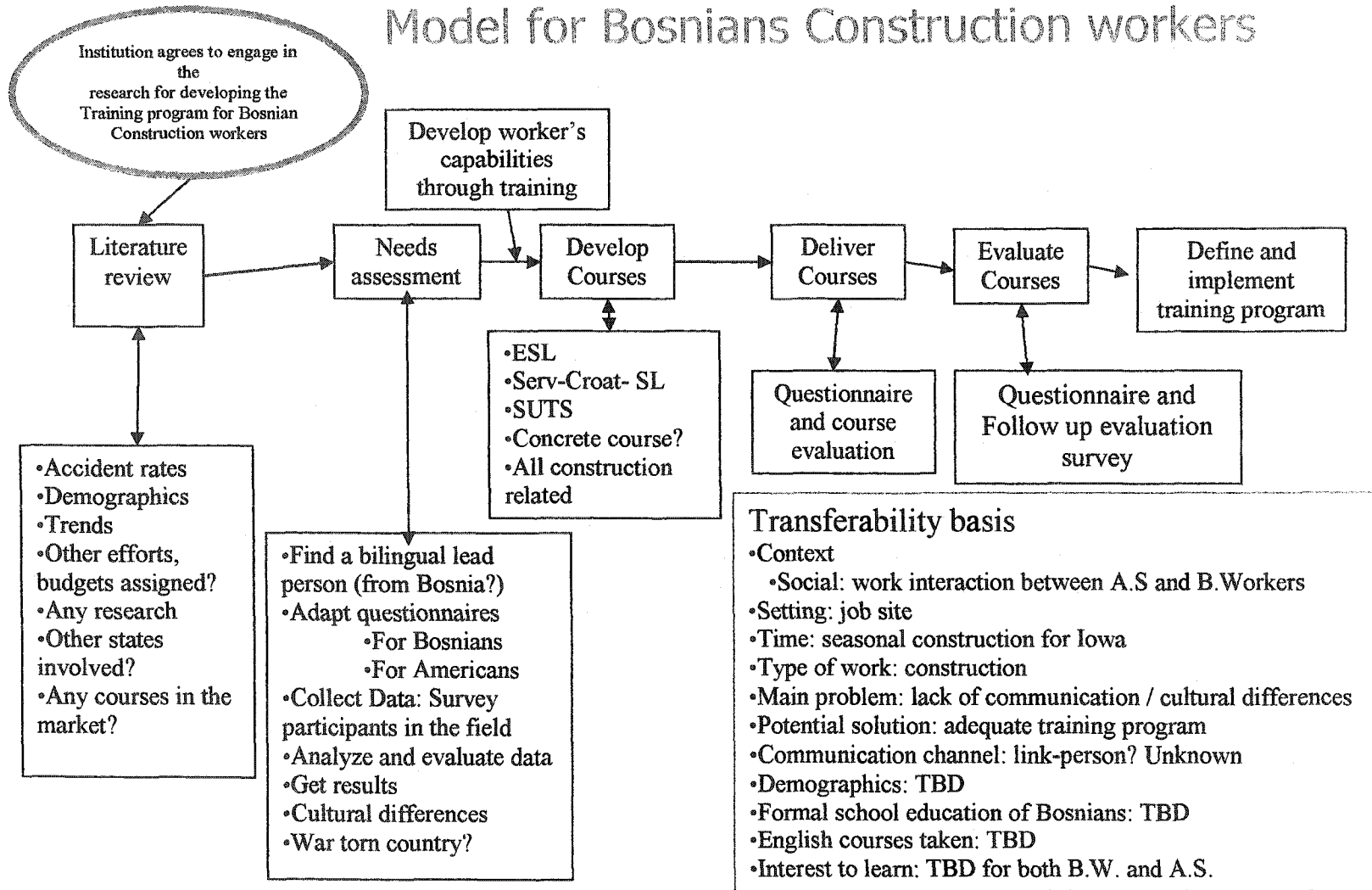


Figure 6.1. Transferability model for Bosnians construction workers

CHAPTER 7. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

7.1. Summary

As part of an introductory literature search, a summary of information related to the Hispanic population such as its influence in the U.S. construction labor force and work site accident rates was included. This population has become the nation's largest minority group in the United States and is expected to grow at a rate of 10 million every 10 years. Hispanics represent many nationalities, including Mexicans, Cubans, and Puerto Ricans, as well as residents of Central and South American countries. In addition, the U.S. Census Bureau has projected that by 2050, the U.S. Hispanic population will make up 25% of the total population.

According to statistics, the workplace continues to diversify. Therefore, construction companies cannot ignore these trends and continue their businesses as usual. They have to plan ahead and consider that this large portion of the labor force has to be trained adequately, including their own American supervisors. Demographic changes, especially changes in the U.S. construction labor force, must be taken into account when designing training programs. Furthermore, demographics can also help employers better understand the beneficial differences that this diverse workforce can make when their work is recognized and included in the company's corporate objectives.

The Hispanic workforce project was divided into two phases: Phase I is focused on the Hispanic side of the issue and Phase II considers the concerns and points of view of the American supervisors.

The research methodology included literature review, designing of questionnaires, performing of field surveys, analyzing and evaluating of results of the surveys, developing and delivering of four training courses, and evaluation of course effectiveness.

One of the objectives of this project is to develop effective integration between American supervisors and Hispanic craft workers on the construction jobsite. This objective can be best achieved through training. Therefore, after the literature review was completed,

undertakings were aimed at assessing the needs and interests of both parties. This was accomplished by designing and developing two questionnaires and performing surveys on representative samples of both populations. Both questionnaires contained 35 questions targeted to achieve 15 objectives with roughly four categories of information: a) language background, b) course information, c) safety aspects, d) personal interests and information. There were 97 Hispanic workers and 38 American supervisors surveyed. 45% of the American supervisors were interviewed personally, and the rest filled out the questionnaires and handed them in or sent them by mail. All workers and supervisors work in construction companies in the State of Iowa.

Based on the analysis and evaluation of the survey results, and with the objective of integration in mind, four training courses were developed: (1) ESL (English as a Second Language) Survival Course (2) SUTS (Stepping Up to Supervisor) Course for Hispanic Construction Workers, (3) SSL (Spanish as a Second Language) Survival Course, and (4) Concrete pavements: Construction Basics. The first two are targeted to the Hispanic workers. The SUTS Course for Hispanic Construction Workers targets those workers whose skills meet the requirements to be promoted to a supervisory position such as crew leader, foreman, or supervisor. The ESL Survival Course is targeted to develop the ability of the worker to communicate in the English language related to construction. This course makes use of the method of words-and-pictures and repeatedly pronouncing the words until they are learned.

The second two courses are targeted to American supervisors. SSL Survival Course is targeted to develop the ability of the supervisor to communicate in Spanish, thus avoiding the need to heavily depend upon the link-person to communicate through to pass on instructions to the workers. The knowledge acquired is intended to be used as a communication tool and not to develop a high level of proficiency in the language. The goal is to develop enough vocabulary to create integration and get the job done. It is also a construction-focused course.

Due to the fact that learning a second language (as an adult) is a lifelong endeavor, developing integration by training American supervisors calls for a very specialized effort on deciding what they should learn in order to use this knowledge as a communication tool on the jobsite. With this in mind, the technical curriculum of the Portland Cement Concrete Pavement Technology, housed at the Center for Transportation Research and Education, was

taken and adopted as a basis for developing a systematic approach in selecting the most appropriate technical vocabulary for American supervisors to learn and to keep as a minimum knowledge of the Spanish language related to construction of concrete roads. There are six general topics on concrete paving in the course: general principles, site preparation, slip-form paving operations, jointing, special weather considerations, and testing and troubleshooting. A full translation into Spanish was developed, and an English-Spanish brochure was created. Twelve sub-topics are included in the materials: transporting the mixture, stringline, grade finish, concrete placing, finishing, curing, safety, tools, equipment, joints, sawing, and sealing. Out of these twelve, the sub-topics on materials, joints, sawing, and sealing were fully developed as part of the scope of this dissertation. All others remain to be developed as part of Phase II of the project.

A systematic approach was used in developing the courses: the structure and the process. For the structural component, it is strongly recommended to first increase awareness, especially with Hispanics coming from other countries where safety culture is significantly different. It is also recommended to build new communication and management skills, so that they can interact more effectively with both their bosses and their subordinates, considering an understanding of cultural differences to be an advantage rather than an obstacle. The process involves the systematic building-up and development of the skills required for the worker to be able to perform according to his or her responsibilities.

Important feedback from the ESL Survival Course participants was obtained through an evaluation at the end of the course. In addition, a further evaluation was attempted to measure effectiveness on a total of 20 out of 24 participants of the ESL courses at least two months after they took the course to investigate how useful they found the English learning experience by making use of it in the job sites. The effectiveness is measured based on the worker's perceptions on how they have increased their confidence of speaking and how the different topics of the course have helped them in the jobsite. The evaluation tries to measure three important aspects of the course: (1) contents, (2) usefulness, and (3) the instructor. Most participants agreed that the contents, the focus on construction terminology, and the workbooks were very useful. Fifteen participants felt they had improved their communication skills and increased their confidence to speak. Two of them obtained salaries increase which

was a result of better performance at the jobsite. In addition, they strongly recommend that the courses be taught in both English and Spanish, which calls for bilingual instructors.

SSL and SUTS courses are scheduled to be delivered in the Fall 2004 subject to contractor's demand. Concrete Pavements: Construction Basics course remains to be scheduled.

7.2. Conclusions

When blending the responses of Hispanic workers and American supervisors, very interesting conclusions can be drawn. It is important to mention that in most cases, supervisors were not the bosses of Hispanic workers, and on the other side, workers were not accountable to the supervisors. It can be stated that they did not know each other at all. However, both parties (supervisors more than 60% and workers 57%) answered that the main problem they have on the jobsite is communication. To overcome this problem, 73% of American supervisors communicate with their workers through the "link-person," and 88% of American supervisors use English for communication. Thirty nine percent of workers had 6 years or less of formal education and 30% had between 7 and 9 years of formal education. This fact, and the lack of communication along with their lack of awareness of safety can explain the high accident rates among Hispanic workers and decreased productivity and quality of work.

The following are conclusions derived from the surveys, given in a general and qualitative form. Real percentages are included in the corresponding chapter.

Conclusions for Hispanic workers are the following:

1. Communication is their main problem.
2. There is a lack of adequate training—most of them had not taken a course to help them learn English.
3. They would like to take short duration construction-focused courses to learn English.
4. They prefer to be trained by a bilingual instructor.
5. They would like to have advancement opportunities.

6. They would like to be trained to step up to a supervisory position, possibly because of their desired to have advancement opportunities.
7. Workers' experience in construction in the U.S. ranged from 3 to 6 years. Small percentage had 7 years of experience or more.

Conclusions for American supervisors are the following:

1. Communication is their main problem.
2. They communicate through a "link-person" on the jobsite.
3. Many of them took Spanish in High school and college and it was not construction related.
4. They are willing to take courses to learn construction-related Spanish.
5. They believe that to solve the problem of communication, training to learn the language is the best approach.
6. They are willing to send skilled Hispanic workers to a course to step up to supervisor.
7. They suggest to have their workers trained in concrete-related courses.

Research findings of this research study can be applied to contexts other than the study from which the findings emerge. This has led to the development of a model that can be applied to any ethnic group that currently, or in the future, pose similar integration problems in construction as do Hispanic workers now. This is useful when other populations are represented with high percentage of workers within the construction industry, which is the case for Bosnians.

7.3. Recommendations

The results of this research project work best for construction companies which employ a high percentage of Hispanic workers in their crews. They will benefit from implementing a training program suited for their Hispanic workers as well as their American supervisors. The full program is best suited for contractors whose main line of work is the construction of concrete roads. The following recommendations can be adopted when designing their schedule of courses:

1. All Hispanic workers should take the ESL Survival course even if they have been in the U.S. for a while.
2. Only Hispanic workers who are willing and able and also who meet the requirements of knowledge and experience should take the SUTS course. There should be the need on the part of the company to have a Hispanic supervisor.
3. All American supervisors should take the SSL Survival course, even if they have dealt with Hispanic workers for years and they believe they can communicate.
4. All American supervisors should read the English-Spanish CPCB (Construction Pavements: Construction Basics) and decide which of the subtopics (if not all) best fits their needs on the jobsite. This will depend on the number of Hispanic workers they have on the different crews. They must take at least 4 subtopics.
5. The program works best if Hispanic workers and American supervisors work with each other on the jobsite.
6. Due to the fact that the contractor is responsible to schedule the work activities and resources, the training program should be contractor-driven for its adoption and implementation.

It is also recommended that both courses be delivered by people who possess bi-lingual skills (English and Spanish) and bi-cultural experience in the construction sector, specifically with the Hispanic and American cultures.

In addition, to ensure that contractors will develop and implement a training program aimed at integration, it is recommended that these courses should be made mandatory (or at least strongly recommended) by the Iowa DOT. This will assure that best results, particularly in lowering the accident rates, will be achieved in the long run.

A final recommendation calls for further research on the Hispanic Project to explore innovative ways to deliver the course material to the Hispanic construction workers and the American supervisors without interfering with their daily operations.

This effort calls for the following:

1. Obtaining the contractor's commitment.
2. Defining the target participants—Hispanic workers and American supervisors—and get their commitment too.
3. Establishing the training program

Other areas of research can be: diagnosing the training needs of contractors as related to Hispanic workers; establishing the most convenient incentives for training on both parts, the worker and the contractor; and making the training more cost and time effective, such as bringing the course to the workers on the jobsite.

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APPENDIX A

**QUESTIONNAIRES FOR HISPANIC CONSTRUCTION WORKERS
AND AMERICAN SUPERVISORS**

Questionnaire for Hispanic Construction Workers

Conducted by: Iowa State University

Date: _____

Department of Civil, Construction, and Environmental Engineering

Anonymity: Your answers to the following questions will be completely anonymous and the results will be held strictly confidential and will be used for statistical purposes only and not linked to the respondent.

General Objective

The general objective of this survey is to bridge the gap between American supervisors and Hispanic construction workers, by defining the fundamental needs created by blending the cultures in the workplace. The assessment of the needs will help develop suitable and effective ESL (English as a Second Language) and other training courses that will encourage Hispanic construction workers to be active and productively engaged participants in the refinement and accomplishment of American construction companies' goals under a safe environment.

Specific Objectives

1. To determine the types of ESL training programs currently offered by construction companies in the U.S. to Hispanic workers.
2. To determine the level of adequacy of Hispanic workforce training
3. To identify the value of training programs to Hispanic workers
 - a. As it relates to how Hispanics feel about the usefulness of the courses.
4. To identify Hispanic and American cultural differences and their implications for the workplace.
5. To determine patterns of needs, interests, and areas of training for Hispanic construction workers according to the current level of skills and working conditions.
6. To prioritize those areas of improvement for the implementation of ESL and technical training courses for Hispanic construction workers.
7. To determine the factors and problems (e.g. language barrier, lack of experience) that adversely affect the performance, quality, and safety conditions of Hispanic construction workers.
8. To determine the level of interest as expressed by Hispanic workers in relation to improving and learning new skills such as construction equipment operation.
9. To prioritize the type of equipment they would prefer to learn to operate.
10. To determine the level of satisfaction of Hispanic workers as it relates to their opportunities to learn new skills, safety conditions, and type of tasks they perform.
11. To establish by documenting the need to have key employees on the job site to overcome the language barrier.
12. To determine accident rates and types of accidents undergone by Hispanics in construction.
13. To gather background, personal, and demographic information on Hispanic construction workers.
14. To obtain mobility index of Hispanic workers.
15. To identify personal expectations and goals towards the future of Hispanics

Note: This questionnaire will take 15-20- minutes to complete.

Please circle one response for each question

Questions 1 thru 6 are related to English language training?

1. a. Have you ever taken a course to help you learn English?

1 = Yes 2 = No

b. If YES, how many total hours of training have you had? _____

c. If NO, would you like to take one?

1 = Yes 2 = No

(If you have never taken a class in English, SKIP TO QUESTION.7)

2. Was this English course related to construction?

1 = Yes 2 = No

3. How would you rate the following aspects of your English course?

	<u>Very poor</u>						<u>Very Good</u>
a. Contents	1	2	3	4	5	6	7
b. Instructor	1	2	3	4	5	6	7
c. Other: _____							

4. How would you rate the degree of difficulty?

<u>Very easy</u>							<u>Very difficult</u>
1	2	3	4	5	6	7	

5. How would you rate the length of the course?

<u>Very Short</u>							<u>Very Long</u>
1	2	3	4	5	6	7	

6. How well did your English courses met your needs or expectations?

<u>Not at All</u>							<u>Completely</u>
1	2	3	4	5	6	7	

Questions 7 thru 14 ask you about future technical training needs.

7. Would you be interested in taking a technical training course related to your job?

1 = Yes

2 = No → IF NO, SKIP TO QUESTION 15

8. If YES, what would you like to learn?

9. Is this related to your occupation? (Trade)

Yes

No

10. In future technical training courses, what degree of importance would you give to the following aspects:

	<u>Not Important</u>					<u>Very Important</u>			
	1	2	3	4	5	6	7	N/A	
a. On-the-job vocabulary?	1	2	3	4	5	6	7	N/A	
b. Equipment operation?	1	2	3	4	5	6	7	N/A	
c. Construction safety?	1	2	3	4	5	6	7	N/A	
d. Plan Reading?	1	2	3	4	5	6	7	N/A	
e. Tools?	1	2	3	4	5	6	7	N/A	
f. Measurements?	1	2	3	4	5	6	7	N/A	
g. Other: _____	1	2	3	4	5	6	7	N/A	

11. Would you like to learn to operate heavy equipment?

1 = Yes

2 = No → IF NO, SKIP TO QUESTION 13

12. Which of the following would you prefer to learn to operate? (circle all you want)

1 = Forklift

3 = Motorgrader

5 = Dump truck

2 = Backhoe

4 = Bulldozer

6 = Other _____

13. In which language would you prefer to take these technical courses?

1 = English

2 = Spanish

3 = English and Spanish combined

14. Where would you like these courses to take place?

1 = Job site 2 = Classroom 3 = Both 4 = Either one

Questions 15 thru 21 relate to your overall job site conditions

15. Is your supervisor?

1 = Non-Hispanic 2 = Hispanic 3 = Other

16. If your supervisor is Non-Hispanic, how familiar do you believe he/she is about Hispanics with regard the following:

	<u>Very Unfamiliar</u>					<u>Very Familiar</u>	
a. Culture differences	1	2	3	4	5	6	7
b. Manners	1	2	3	4	5	6	7
c. Work Ethic	1	2	3	4	5	6	7
d. Other: _____	1	2	3	4	5	6	7

17. How satisfied are you with each of the following at your current job?

	<u>Very Dissatisfied</u>					<u>Very Satisfied</u>	
a. your training opportunities to improve your skills or learn new skills	1	2	3	4	5	6	7
b. the safety conditions on the job site	1	2	3	4	5	6	7
c. the type of tasks you are asked to do	1	2	3	4	5	6	7
d. your ability to communicate in English	1	2	3	4	5	6	7

18. How often do you need a translator to communicate with your supervisor?

1 = Never 3 = Sometimes 5 = Always
 2 = Seldom 4 = Often

19. How important would it be to you to ...

	<u>Not</u> <u>Important</u>					<u>Very</u> <u>Important</u>	
	1	2	3	4	5	6	7
a. Improve your communication with your supervisor?	1	2	3	4	5	6	7
b. Improve your communication with your co-workers?	1	2	3	4	5	6	7
c. Receive training emphasizing only in construction?	1	2	3	4	5	6	7
d. Have advancement opportunities?	1	2	3	4	5	6	7

20. Have you had any construction related accidents?

1 = Yes 2 = No

21. What are the most common types of accidents you have seen or undergone in construction, if any?

Question 22 thru 33 relate to your background and some personal information

22. How long have you been living in the U.S.?

___ years ___ months

23. How much construction experience did you have prior to coming to the U.S.?

___ years ___ months Trade: _____

___ years ___ months Trade: _____

24. How long have you been involved in construction in the U.S. and in what trade?

___ years ___ months Trade: _____

___ years ___ months Trade: _____

25. How long have you been employed by the company you are currently working for?

___ years ___ months

26. How many other construction companies have you worked for in the U.S.? _____

27. How long have you worked at jobs not related to construction?

____ years ____ months

28. How old are you? _____ years old

29. What is the highest level of education you have completed?

1 = Elementary school

4 = High school

2 = Middle school

5 = College

3 = Technical school

30. Do you stay in Iowa after the construction season is over?

1 = Never

2 = Sometimes

3 = Always

31. Do you plan to stay in the U. S.?

1 = Yes

2 = No

3 = Perhaps

Why? _____

32. After having arrived in the U.S. and worked in construction, what are your main goals and expectations for the future?

33. What do you consider to be your main problem on the job site?

34. What is your country of birth? _____ State: _____

THANK YOU!

Mapping of Objectives

Objective No.	Question No.
1	2,3c,19c
2	1a,1b,4,5
3	3a,3b,6
4	15,16a,b,c
5	1c,5,7,8,9,13,14,19d
6	10a,b,c,d,e,f,33
7	17d,23a,b,24a,b,33
8	11
9	12
10	17a,b,c
11	18,19a,b
12	20,21
13	22,25,26,27,28,29,34
14	30,31
15	32, 35

Questionnaire for American Construction Supervisors who deal with the Hispanic Workforce

Conducted by: Iowa State University

Date: _____

Department of Civil, Construction, and Environmental Engineering

Anonymity: Your answers to the following questions will be completely anonymous and the results will be held strictly confidential and will be used for statistical purposes only and not linked to the respondent.

General Objective

The general objective of this survey is to bridge the gap between American supervisors and Hispanic construction workers, by defining the fundamental needs created by blending the cultures in the workplace. The assessment of the needs and interests will help develop suitable and effective SSL (Spanish as a Second Language) and other training courses that will encourage American construction supervisors to learn and use this important communication tool that will enable them to be active and productively engaged participants in the workforce in accordance with the trends that are currently affecting the construction industry. This will in turn help them accomplish their construction companies' goals under a safe environment.

Specific Objectives

1. To determine the types of training programs currently offered by construction companies to American supervisors.
2. To determine the level of adequacy of American supervisor's training as it relates to working with the Hispanic workforce.
3. To identify the value of training programs to American supervisors.
4. To identify Hispanic and American cultural differences and their implications for the workplace.
5. To determine patterns of needs, interests, and areas of opportunity for American supervisors to develop their relationship with Hispanic workers.
6. To prioritize those areas of improvement for the implementation of ESL and technical training courses for Hispanic construction workers as expressed by American supervisors.
7. To determine the factors and problems (e.g., language barrier, lack of experience) that adversely affect the performance, quality, and safety conditions of Hispanic construction workers.
8. To determine the level of interest as expressed by American Supervisors in having Hispanic workers learn to operate construction equipment.
9. To prioritize the type of equipment American supervisors would prefer Hispanic workers learn to operate.
10. To determine the level of satisfaction as expressed by American Supervisors when dealing with Hispanic workers as it relates to: a) their willingness to learn new skills, b) their willingness to comply with safety rules and regulations, and c) their willingness to do the type of tasks they are asked to do.
11. To establish by documenting the need to have key employees on the job site to overcome the language barrier.
12. To determine accident rates and types of accidents undergone by Hispanics in construction as expressed by American supervisors.
13. To gather background, personal, and demographic information on American supervisors.
14. To obtain turnover rates of American supervisors.
15. To identify personal expectations and goals of American supervisors as it relates to maintaining and developing their relationship with Hispanic workers.

Note: This questionnaire will take 15-20 minutes to complete.

Please circle one response for each question

Questions 1 thru 6 are related to Spanish language training.

1. a. Have you ever taken a course to help you learn Spanish?

1 = Yes 2 = No

b. If YES, how many total hours of training have you had? _____

c. If NO, would you like to take one?

1 = Yes 2 = No

(If you have never taken a class in Spanish, SKIP TO QUESTION.7)

2. Was this Spanish course related to construction?

1 = Yes 2 = No

3. How would you rate the following aspects of your Spanish course?

	<u>Very poor</u>						<u>Very Good</u>
d. Contents to use in your job	1	2	3	4	5	6	7
e. Contents to use in your every day life	1	2	3	4	5	6	7
f. Instructor	1	2	3	4	5	6	7
g. Other: _____							

4. How would you rate the degree of difficulty?

<u>Very easy</u>							<u>Very difficult</u>
1	2	3	4	5	6	7	

5. How would you rate the duration of the course?

<u>Very Short</u>							<u>Very Long</u>
1	2	3	4	5	6	7	

6. How well did your Spanish course(s) meet your needs or expectations?

<u>Not at All</u>							<u>Completely</u>
1	2	3	4	5	6	7	

Questions 7 thru 14 ask you about future technical training needs.

7. Would you be interested in having your Hispanic crews take a technical training course related to their trade?

1 = Yes 2 = No → IF NO, SKIP TO QUESTION 15

8. If YES, what would you like them to learn? (name the trade)

9. Is this related to your direct area of responsibility at work?

1 = Yes 2 = No

10. If your Hispanic crews were to take technical training courses in the near future, what degree of importance to the course contents would you give to the following aspects:

	<u>Not</u> <u>Important</u>					<u>Very</u> <u>Important</u>			
	1	2	3	4	5	6	7	N/A	
h. On-the-job vocabulary?	1	2	3	4	5	6	7	N/A	
i. Equipment operation?	1	2	3	4	5	6	7	N/A	
j. Construction safety?	1	2	3	4	5	6	7	N/A	
k. Plan Reading?	1	2	3	4	5	6	7	N/A	
l. Tools?	1	2	3	4	5	6	7	N/A	
m. Measurements?	1	2	3	4	5	6	7	N/A	
n. Other: _____	1	2	3	4	5	6	7	N/A	

11. Would you like them to learn to operate heavy equipment?

1 = Yes 2 = No → IF NO, SKIP TO QUESTION 13

12. Which of the following would you prefer them to learn to operate? (circle all you want)

1 = Forklift 3 = Motorgrader 5 = Dump truck
 2 = Backhoe 4 = Bulldozer 6 = Other _____

13. In which language do you think they should be taught when taking these technical courses?

1 = English 2 = Spanish 3 = English and Spanish combined

14. Where do you think would be most convenient for these courses to take place?

1 = Job site 2 = Classroom 3 = Both 4 = Either one

Questions 15 thru 24 relate to your overall job site conditions

15. How many Hispanic workers do you have in your crews?

1= 1-3 2= 4-6 3= 7-10 4= more than 10

16. How long have you supervised Hispanic workers?

1= 1-3 yrs 2= 4-6 yrs 3= 7-10yrs 4= more than 10 yrs

17. Do you have a link-person (facilitator) to help you communicate with people in your crew?

1 = yes 2 = No

18. How familiar do you think you are about Hispanics with regard to the following:

	<u>Very Unfamiliar</u>				<u>Very Familiar</u>		
e. Culture differences	1	2	3	4	5	6	7
f. Manners	1	2	3	4	5	6	7
g. Work Ethic	1	2	3	4	5	6	7
h. Other: _____	1	2	3	4	5	6	7

19. How satisfied are you with each of the following?

	<u>Very Dissatisfied</u>				<u>Very Satisfied</u>		
e. Dealing with Hispanic workers, ... their overall performance	1	2	3	4	5	6	7
f. The Hispanic worker job safety awareness	1	2	3	4	5	6	7
g. The response of Hispanic workers to the type of tasks you ask them to do	1	2	3	4	5	6	7
h. Your ability to communicate in Spanish	1	2	3	4	5	6	7

20. How often do you need a translator to communicate with people in your crew?

- 1 = Never 3 = Sometimes 5 = Always
 2 = Seldom 4 = Often

21. What language do you use when you speak to Hispanic workers in your crew?

- 1 = English 2 = Spanish 3 = English and Spanish combined

22. How important would it be to you to ...

	<u>Not</u> <u>Important</u>						<u>Very</u> <u>Important</u>
e. Improve your communication with your link-person (facilitator)?	1	2	3	4	5	6	7
f. Improve your communication with all the Hispanic workers in your crew?	1	2	3	4	5	6	7
g. Receive SSL training emphasizing only in construction?	1	2	3	4	5	6	7
h. Have more Hispanic workers in your crew?	1	2	3	4	5	6	7

23. Have you had any construction related accidents in your Hispanic crews?

- 1 = Yes 2 = No

24. What are the most common types of accidents you have seen or undergone in relation with your Hispanic workers, if any?

Question 25 thru 35 relate to your background and some personal information

25. How long have you been a construction supervisor (Superintendent, foreman)?

___ years ___ months

26. How much construction experience did you have prior to supervising Hispanic workers?

___ years ___ months Trade: _____

27. How long have you been involved in construction and in what trade?

___ years ___ months Trade: _____
___ years ___ months Trade: _____

28. How long have you been employed by the company you are currently working for?

___ years ___ months

29. How many other construction companies have you worked for? _____

30. How long have you worked at jobs not related to construction?

___ years ___ months

31. How old are you? _____ years old

32. What is the highest level of education you have completed?

1 = Elementary school No of years _____ 4 = High school No of years _____
2 = Middle school No of years _____ 5 = College No of years _____
3 = Technical school No of years _____

33. What do you consider to be your main problem(s) on the job site as they relate to Hispanic workers?

34. What solution(s) do you propose to solve the language barrier with Hispanic workers?

35. Would you like to send any or all of your Hispanic workers to a course designed to help them step up to supervisor?

1 = Yes 2 = No 3 = maybe

36. What technical course would you prefer to take that would benefit the communication between you and your crew

- | | |
|------------------------|----------------|
| 1. Concrete finishing | 3. Carpentry |
| 2. Equipment operation | 4. Other _____ |

Your collaboration is greatly appreciated....

THANK YOU!

APPENDIX B

**HISPANIC WORKERS SAMPLE SIZE
TABLES 1 & 2**

Table B.1.a. Comparison of results of surveys at 20,40,60,80, and 97 interviews

Sample size	Q1a		Q1c		Q2		Q7		Q11	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
20	35%	65%	78%	0%	25%	75%	95%	5%	100%	0%
40	35%	65%	78%	6%	36%	64%	90%	10%	97%	3%
60	38%	62%	69%	6%	17%	50%	90%	10%	92%	4%
80	36%	64%	66%	7%	12%	40%	93%	8%	94%	3%
97	32%	66%	66%	7%	9%	33%	91%	8%	91%	2%
Average	35%	64%	71%	5%	20%	52%	92%	8%	95%	2%
Max	38%	66%	78%	7%	36%	75%	95%	10%	100%	4%
Min	32%	62%	66%	0%	9%	33%	90%	5%	91%	0%
Diff	6%	4%	12%	7%	27%	42%	5%	5%	9%	4%

Sample size	Q13			Q14			
	English	Spanish	Both	Job site	Classroom	Both	Either
20	0%	15%	85%	15%	46%	38%	0%
40	0%	17%	83%	13%	47%	40%	0%
60	2%	16%	80%	10%	43%	45%	0%
80	7%	13%	78%	9%	42%	45%	3%
97	8%	11%	75%	8%	37%	48%	2%
Average	3%	14%	80%	11%	43%	43%	1%
Max	8%	17%	85%	15%	47%	48%	3%
Min	0%	11%	75%	8%	37%	38%	0%
Diff	8%	6%	10%	7%	10%	10%	3%

Sample size	Q15				
	Elementary	Middle	Technical	Highschool	College
20	25%	45%	5%	25%	0%
40	30%	28%	5%	35%	3%
60	33%	28%	3%	32%	3%
80	39%	29%	3%	25%	5%
97	39%	30%	4%	22%	5%
Average	33%	32%	4%	28%	3%
Max	39%	45%	5%	35%	5%
Min	25%	28%	3%	22%	0%
Diff	14%	17%	2%	13%	5%

Table B.1.b. Comparison of results of surveys at 20,40,60,80, and 97 interviews

Sample size	Q10a		Q10b		Q10c		Q10d		Q10e	
	Mean	Mode	Mean	Mode	Mean	Mode	Mean	Mode	Mean	Mode
20	6.85	7	5.85	5,7	6.69	7	7.31	7	6.69	7
40	6.76	7	6.17	7	6.76	7	6.9	7	6.55	7
60	6.6	7	6.23	7	6.77	7	6.77	7	6.5	7
80	6.69	7	6.25	7	6.79	7	6.57	7	6.53	7
97	6.75	7	6.39	7	6.87	7	6.68	7	6.66	7
Average	6.73	7	6.178	7	6.776	7	6.846	7	6.586	7
Max	6.85	7	6.39	7	6.87	7	7.31	7	6.69	7
Min	6.6	7	5.85	7	6.69	7	6.57	7	6.5	7
Diff	0.25	0	0.54	0	0.18	0	0.74	0	0.19	0

Sample size	Q10f		Q19a		Q19b		Q19c		Q19d	
	Mean	Mode	Mean	Mode	Mean	Mode	Mean	Mode	Mean	Mode
20	6.77	7	4	1,7	5.67	7	5.33	3,6,7	6	7
40	6.48	7	6.36	7	6.47	7	6.03	7	6.35	7
60	6.48	7	6.47	7	6.19	7	6.13	7	6.46	7
80	6.54	7	6.51	7	6.14	7	6.15	7	6.49	7
97	6.66	7	6.56	7	6.27	7	6.25	7	6.52	7
Average	6.586	7	5.98	7	6.148	7	5.978	7	6.364	7
Max	6.77	7	6.56	7	6.47	7	6.25	7	6.52	7
Min	6.48	7	4	7	5.67	7	5.33	7	6	7
Diff	0.29	0	2.56	0	0.8	0	0.92	0	0.52	0

Sample size	Q33			
	Communication	Difficult Tasks	None	No Equal Opportunity
20	80%	20%	0%	0%
40	60%	5%	0%	15%
60	48%	3%	23%	10%
80	62%	2%	17%	8%
97	56%	1%	22%	9%
Average	61%	6%	12%	8%
Diff	32%	19%	23%	15%

Q10 and Q19 scale is from 1 to 7: 1 = Not Important, 7 = Very Important

Table B.2. Comparison of Mean and Median for Question 10 a,b,c

Sample size	Q1a	
	Yes	No
20	35%	65%
40	35%	65%
60	38%	62%
80	36%	64%
97	32%	66%
Average	35%	64%
Max	38%	66%
Min	32%	62%
Diff	6%	4%

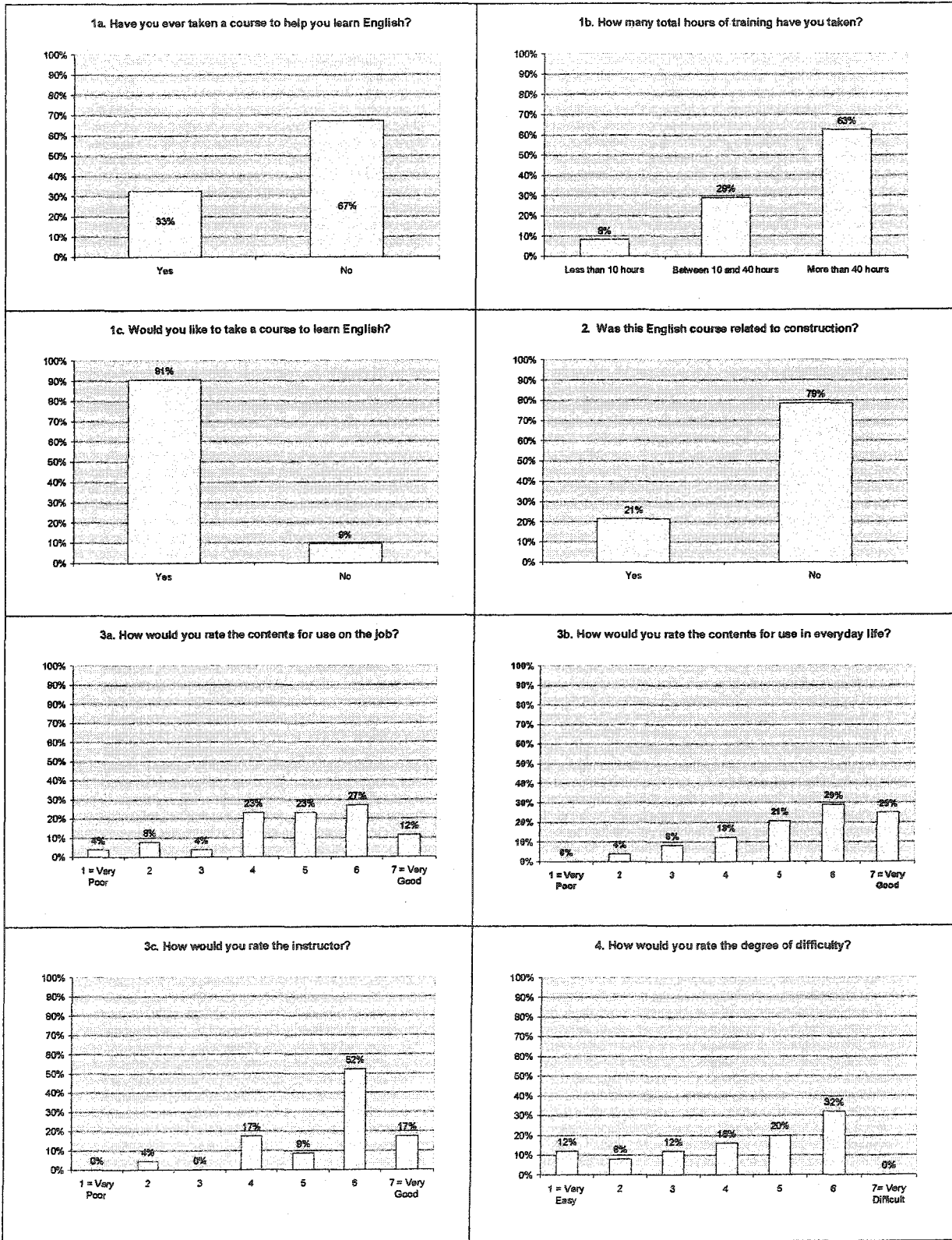
Sample size	Q10a		Q10b		Q10c	
	Mean	Median	Mean	Median	Mean	Median
20	6.85	7	5.85	6	6.69	7
40	6.76	7	6.17	7	6.76	7
60	6.6	7	6.23	7	6.77	7
80	6.69	7	6.25	7	6.79	7
97	6.75	7	6.39	7	6.87	7
Average	6.73	7	6.178	6.8	6.776	7
Max	6.85	7	6.39	7	6.87	7
Min	6.6	7	5.85	6	6.69	7
Diff	0.25	0	0.54	1	0.18	0

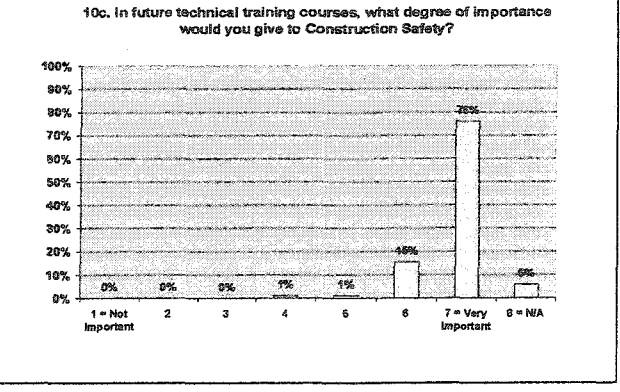
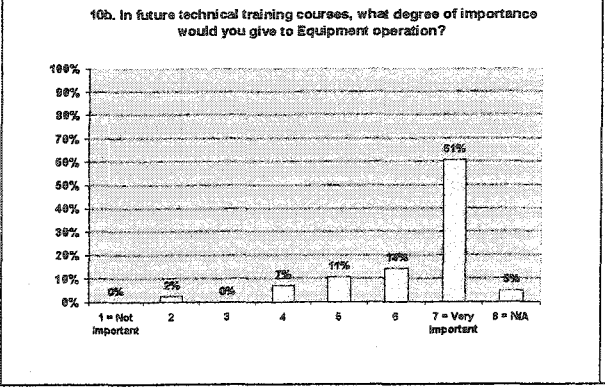
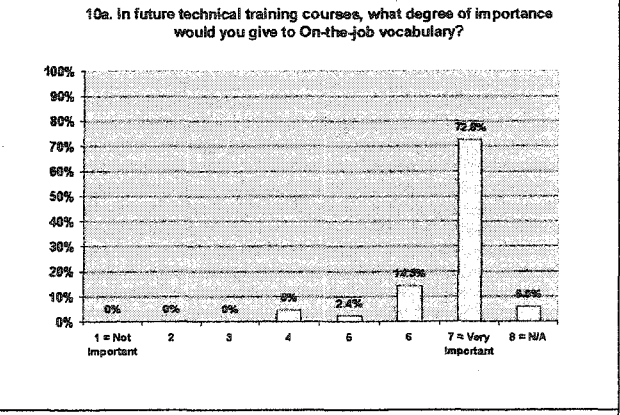
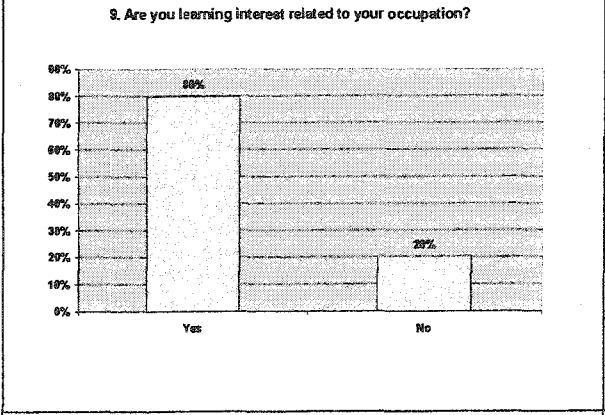
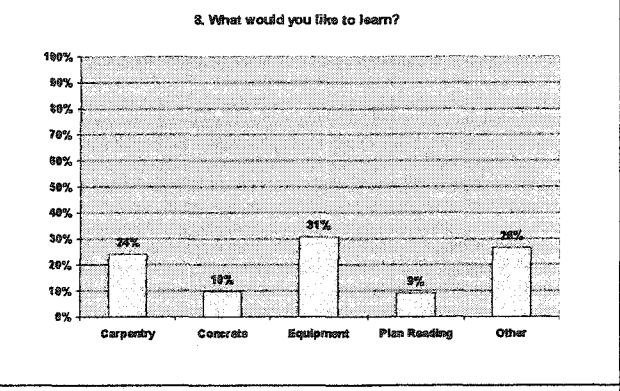
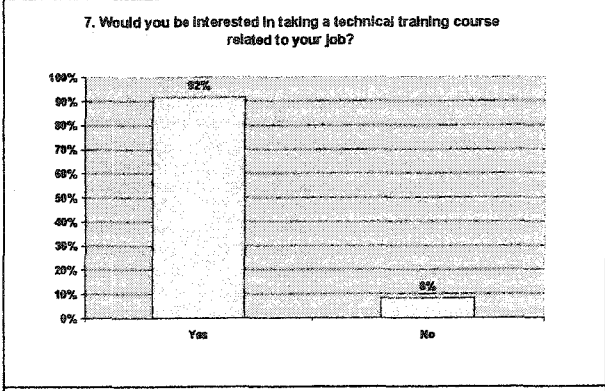
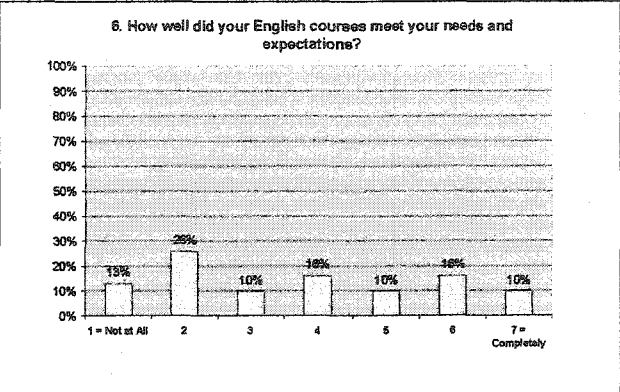
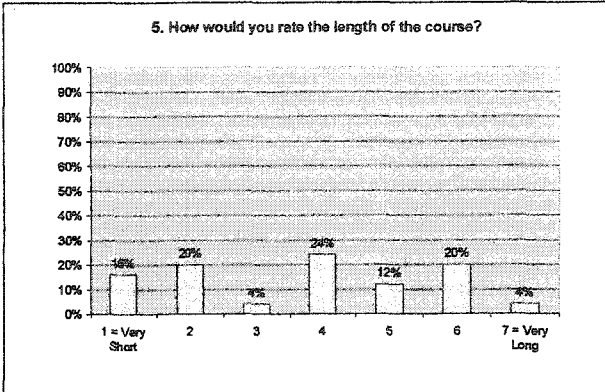
Q10 scale is from 1-7: 1 = Not Important, 7 = Very Important

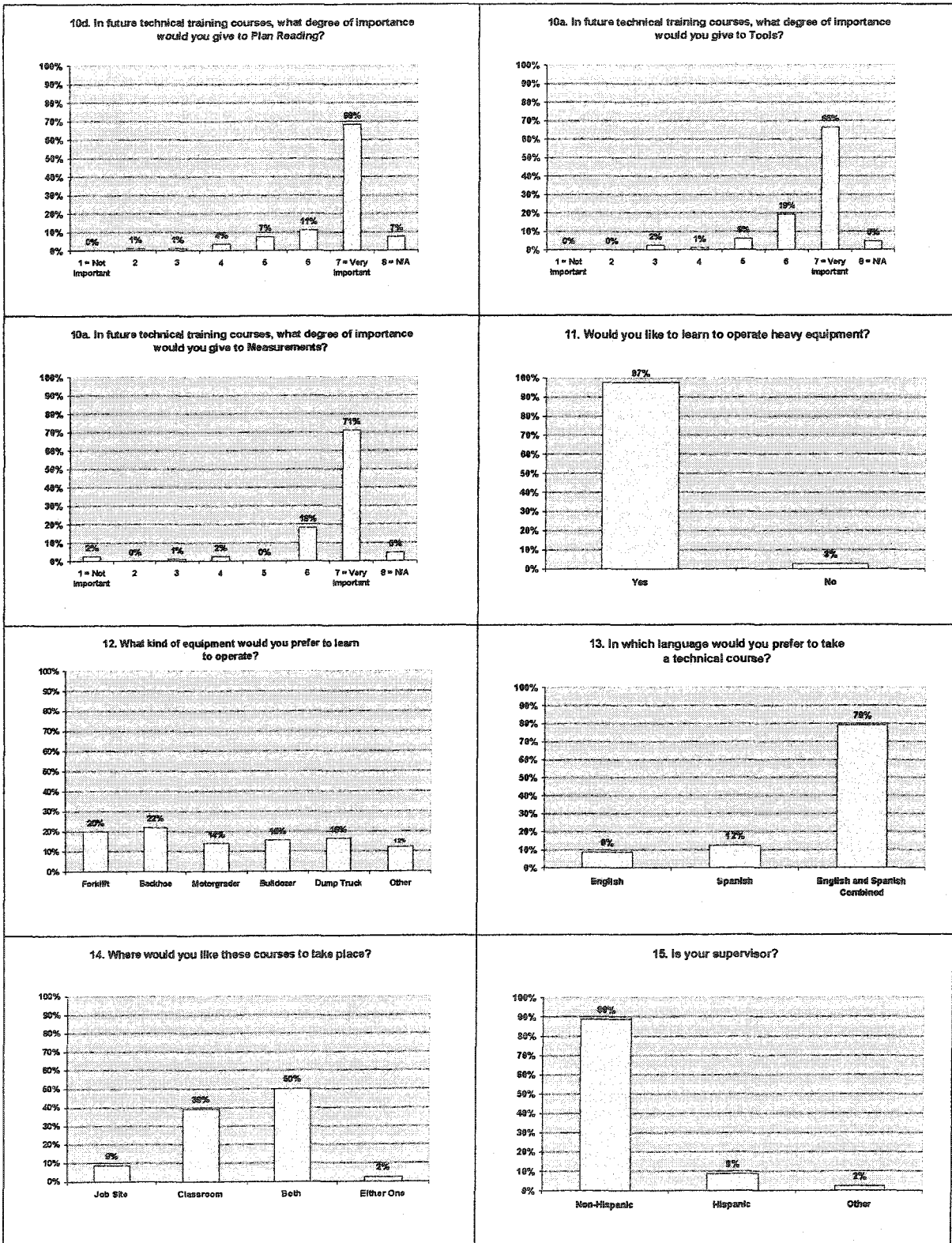
APPENDIX C

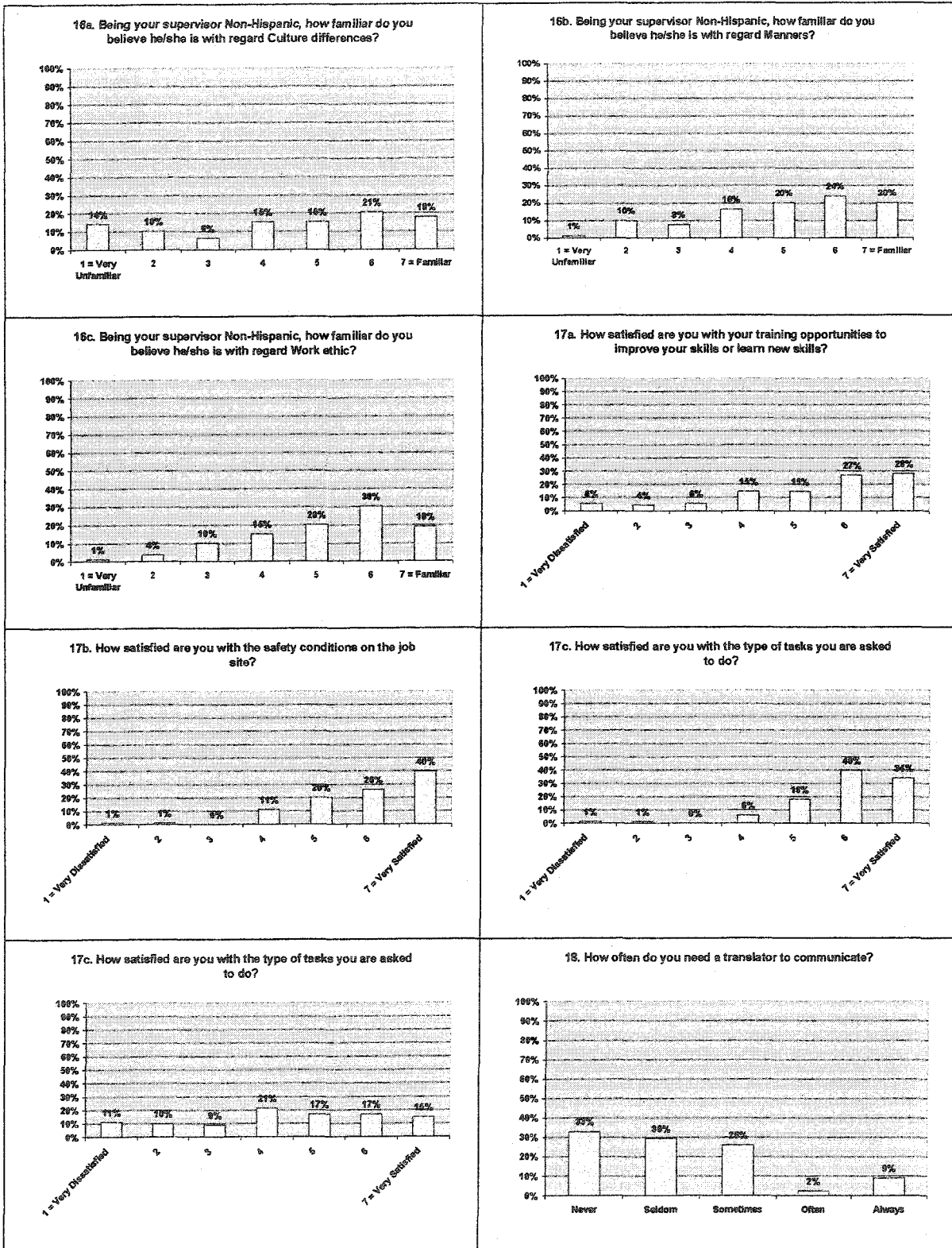
**RESULTS OF QUESTIONNAIRES FOR HISPANIC CONSTRUCTION
WORKERS AND AMERICAN SUPERVISORS**

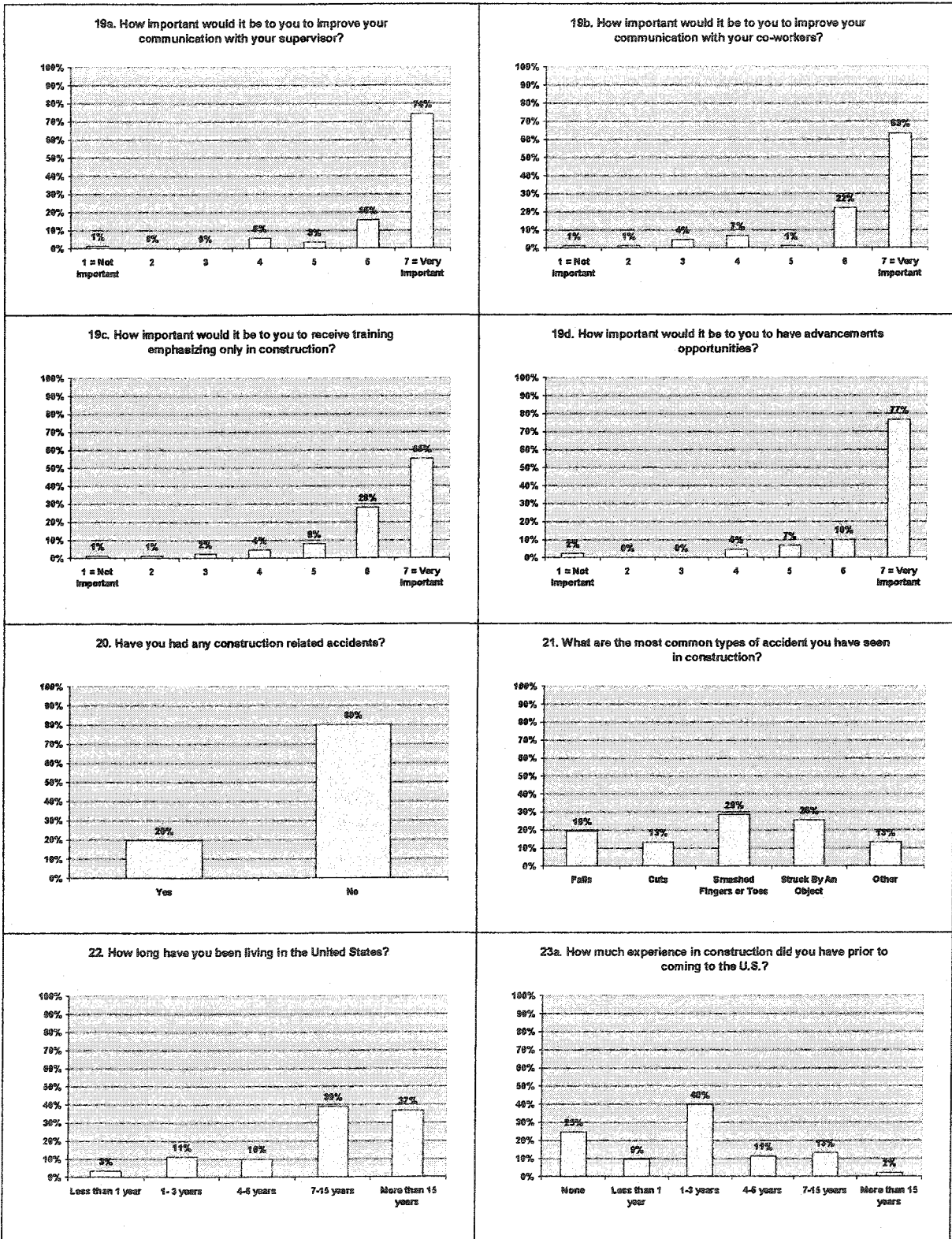
Results of Questionnaire for Hispanic Construction Workers

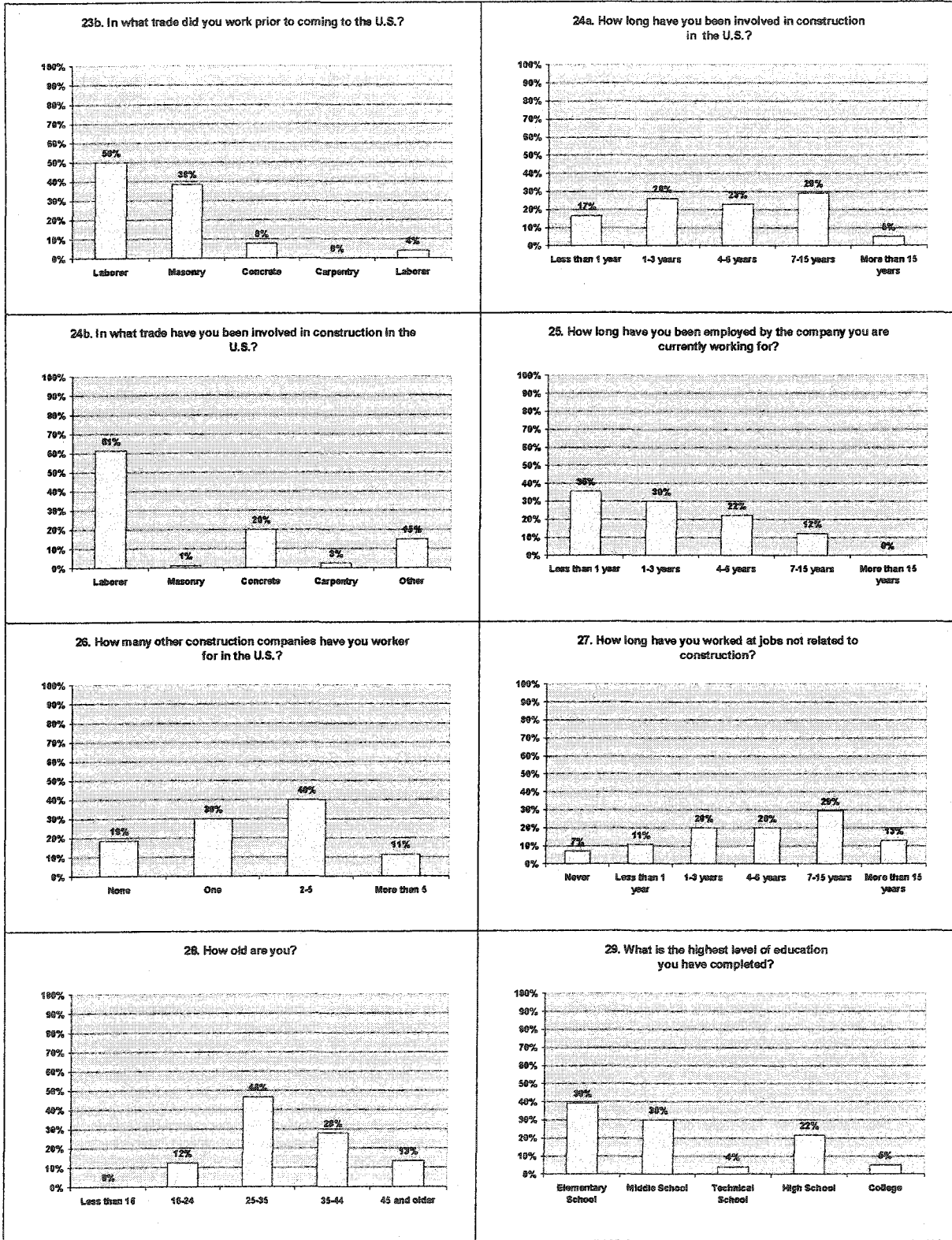


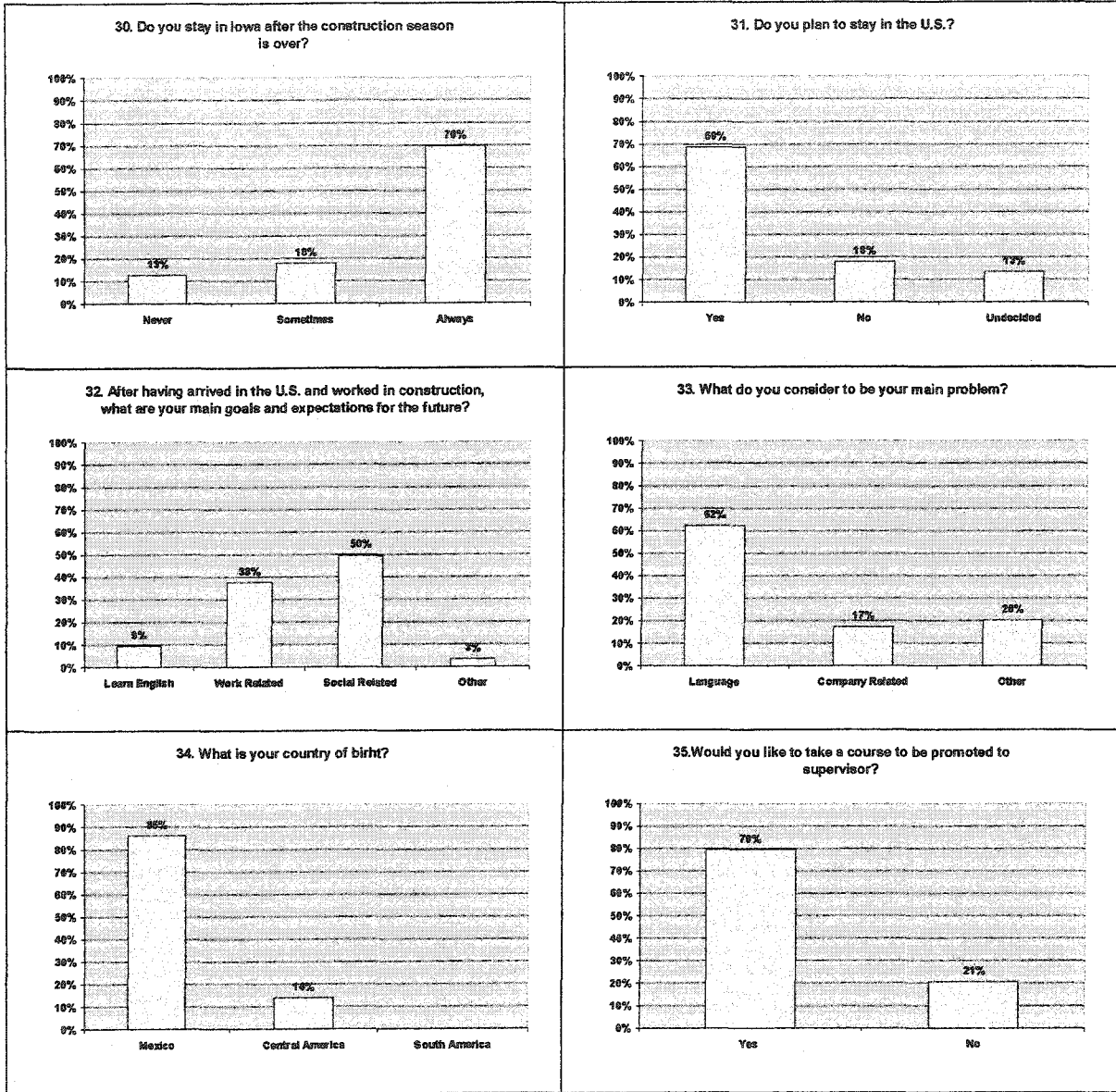












QUESTIONNAIRE FOR HISPANIC CONSTRUCTION WORKERS

CODING MANUAL

Question No.	Code	Column
1a. Have you ever taken a course to help you learn English?	1 = Yes 2 = No	<u>1</u>
1b. If YES, how many total hours of training have you had?	1 = Less than 10 hours 2 = Between 10 and 40 hours 3 = More than 40 hours	<u>2</u>
1c. If NO, would you like to take one?	1 = Yes 2 = No	<u>3</u>
2. Was this English course related to construction?	1 = Yes 2 = No	<u>4</u>
3. How would you rate the following aspects of your English course?	1 = Very Poor 2 = 3 = 4 = Neutral 5 = 6 = 7 = Very Good	-
3a. Contents for use on the job		<u>5</u>
3b. Contents for use in everyday life		<u>6</u>
3c. Instructor		<u>7</u>

4. How would you rate the degree of difficulty? 8

- 1 = Very Easy
- 2 =
- 3 =
- 4 = Normal
- 5 =
- 6 =
- 7 = Very Difficult

5. How would you rate the length of the course? 9

- 1 = Very Short
- 2 =
- 3 =
- 4 = Normal
- 5 =
- 6 =
- 7 = Very Long

6. How well did your English courses meet your needs and expectations? 10

- 1 = Not at all
- 2 =
- 3 =
- 4 = Neutral
- 5 =
- 6 =
- 7 = Completely

7. Would you be interested in taking a technical training course related to your job? 11

- 1 = Yes
- 2 = No

8. If YES, what would you like to learn? -

- 1 = Checked

8-1	Carpentry	<u>12</u>
8-2	Concrete	<u>13</u>
8-3	Equipment	<u>14</u>
8-4	Plan reading	<u>15</u>
8-5	Other	<u>16</u>

9. Is this related to your occupation? (Trade) 17

- 1 = Yes

2 = No

10. In future technical training courses, what degree of importance would you give to the following aspects:

1 = Not Important
 2 =
 3 =
 4 = Neutral
 5 =
 6 =
 7 = Very Important
 8 = N/A (Not Applicable)

10a. On-the-job vocabulary?	<u>18</u>
10b. Equipment operation?	<u>19</u>
10c. Construction safety?	<u>20</u>
10d. Plan Reading?	<u>21</u>
10e. Tools?	<u>22</u>
10f. Measurements?	<u>23</u>

-
11. Would you like to learn to operate heavy equipment? 24

1 = Yes
 2 = No

-
12. Which of the following would you prefer to learn to operate? (circle all you want) -

12-1	1 = Forklift	<u>25</u>
12-2	2 = Backhoe	<u>26</u>
12-3	3 = Motorgrader	<u>27</u>
12-4	4 = Bulldozer	<u>28</u>
12-5	5 = Dump truck	<u>29</u>
12-6	6 = Other	<u>30</u>

-
13. In which language would you prefer to take these technical courses? 31

1 = English
 2 = Spanish
 3 = English and Spanish combined

-
14. Where would you like these courses to take place? 32

1 = Job site
 2 = Classroom
 3 = Both
 4 = Either one

15. Is your supervisor?	<u>33</u>
1 = Non-Hispanic	
2 = Hispanic	
3 = Other	
<hr/>	
16. If your supervisor is Non-Hispanic, how familiar do you believe he/she is about Hispanics with regard the following:	
1 = Very Unfamiliar	
2 =	
3 =	
4 = Neutral	
5 =	
6 =	
7 = Very Familiar	
16a. Culture differences	<u>34</u>
16b. Manners	<u>35</u>
16c. Work ethic	<u>36</u>
<hr/>	
17. How satisfied are you with each of the following at your current job?	
1 = Very Dissatisfied	
2 =	
3 =	
4 = Neutral	
5 =	
6 =	
7 = Very Satisfied	
17a. Your training opportunities to improve your skills or learn new skills	<u>37</u>
17b. The safety conditions on the job site	<u>38</u>
17c. The type of tasks you are asked to do	<u>39</u>
17d. Your ability to communicate in English	<u>40</u>
<hr/>	
18. How often do you need a translator to communicate with your supervisor?	<u>41</u>
1 = Never	
2 = Seldom	
3 = Sometimes	
4 = Often	
5 = Always	

19. How important would it be to you to...

- 1 = Not Important
 2 =
 3 =
 4 = Neutral
 5 =
 6 =
 7 = Very Important

19a.	Improve your communication with your supervisor?	<u>42</u>
19b.	Improve your communication with your co-workers?	<u>43</u>
19c.	Receive training emphasizing only in construction?	<u>44</u>
19d.	Have advancement opportunities?	<u>45</u>

20. Have you had any construction related accidents? 46

- 1 = Yes
 2 = No

21. What are the most common types of accidents you have seen or undergone in construction, if any? -

22-1	Falls	<u>47</u>
22-2	Cuts	<u>48</u>
22-3	Smashed fingers or toes	<u>49</u>
22-4	Struck by	<u>50</u>
22-5	Other Run Over	<u>51</u>

22. How long have you been living in the U.S.? 52

- 1 = Less than one year
 2 = Between one and three years
 3 = Between four and six years
 4 = Between seven and fifteen years
 5 = More than fifteen years

23a. How much experience in construction did you have prior to coming to the U.S.? 53

- 0 = None
 1 = Less than one year
 2 = Between one and three years
 3 = Between four and six years
 4 = Between seven and fifteen years
 5 = More than fifteen years

23b. What trade? 54

- 1 = Laborer
 2 = Masonry

- 3 = Concrete
- 4 = Carpentry
- 5 = Equipment related

24a. How long have you been involved in construction in the U.S.? What trade? 55

- 1 = Less than one year
- 2 = Between one and three years
- 3 = Between four and six years
- 4 = Between seven and fifteen years
- 5 = More than fifteen years

24b. What trade? 56

- 1 = Laborer
- 2 = Masonry
- 3 = Concrete
- 4 = Carpentry
- 5 = Equipment related

25. How long have you been employed by the company you are currently working for? 57

- 1 = Less than one year
- 2 = Between one and three years
- 3 = Between four and six years
- 4 = Between seven and fifteen years
- 5 = More than fifteen years

26. How many other construction companies have you worked for in the U.S.? _____ 58

- 0 = None
- 1 = One
- 2 = Between two and five
- 3 = More than five

27. How long have you worked at jobs not related to construction? 59

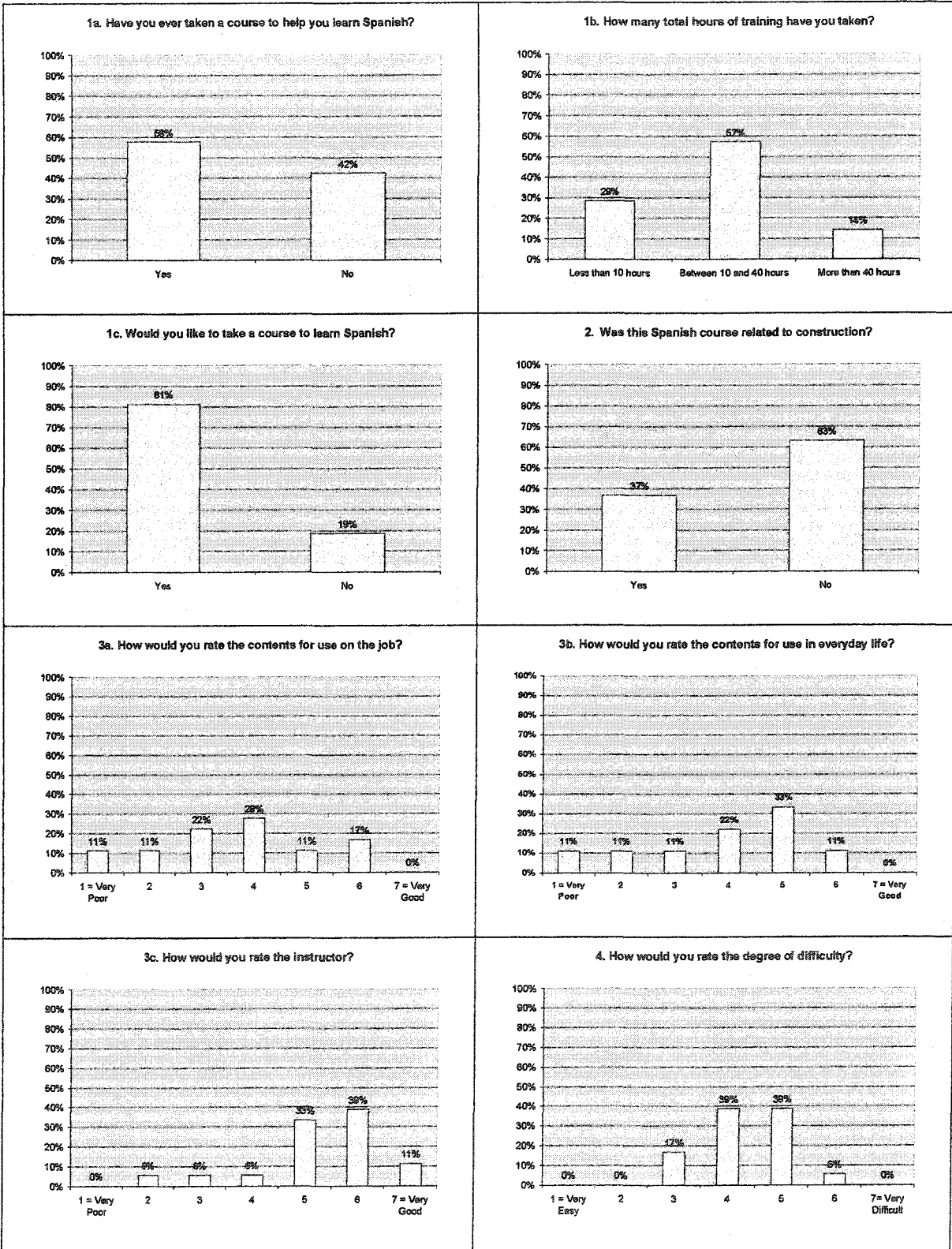
- 0 = Never
- 1 = Less than one year
- 2 = Between one and three years
- 3 = Between four and six years
- 4 = Between seven and fifteen years
- 5 = More than fifteen years

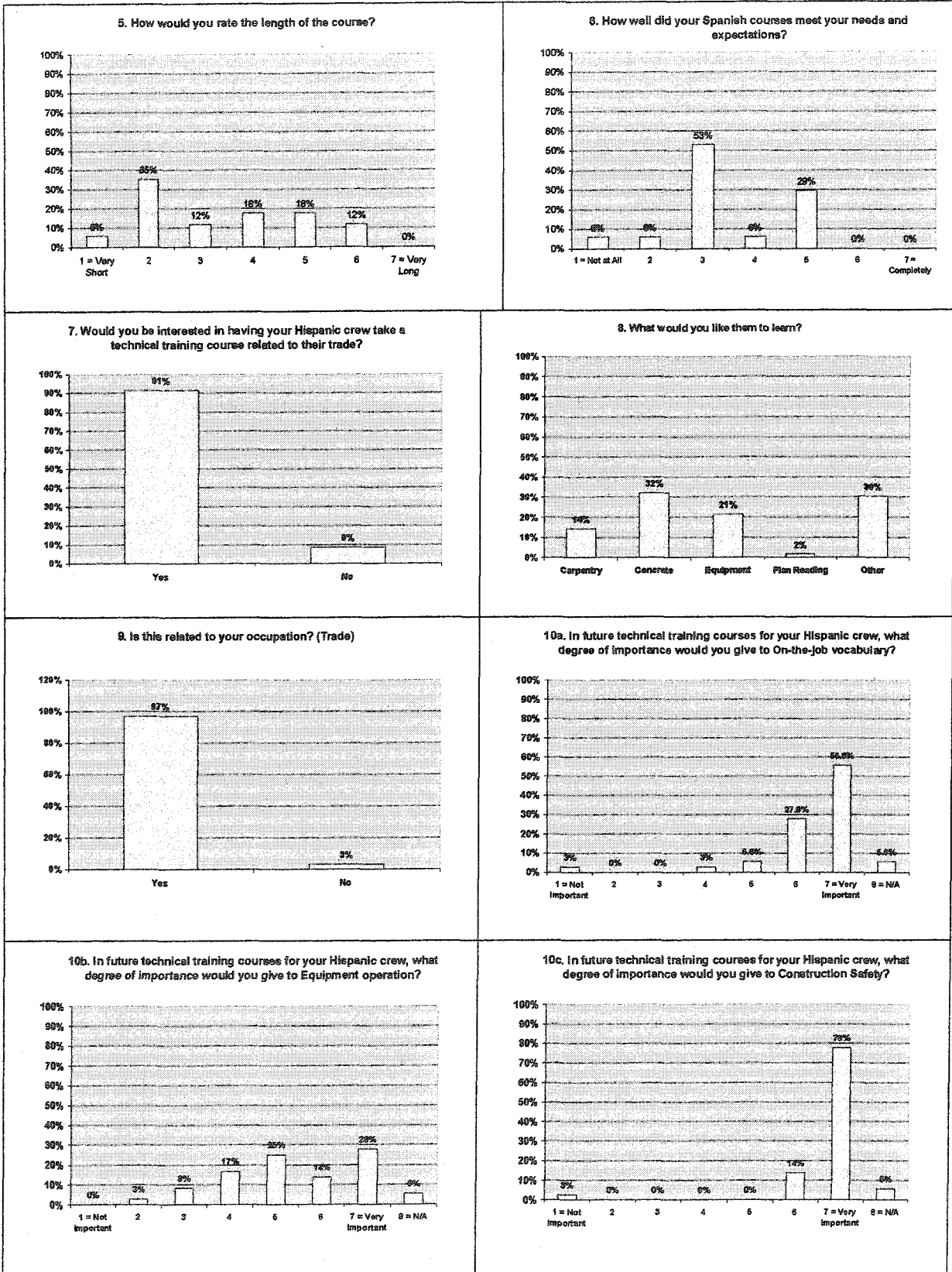
28. How old are you? _____ years old 60

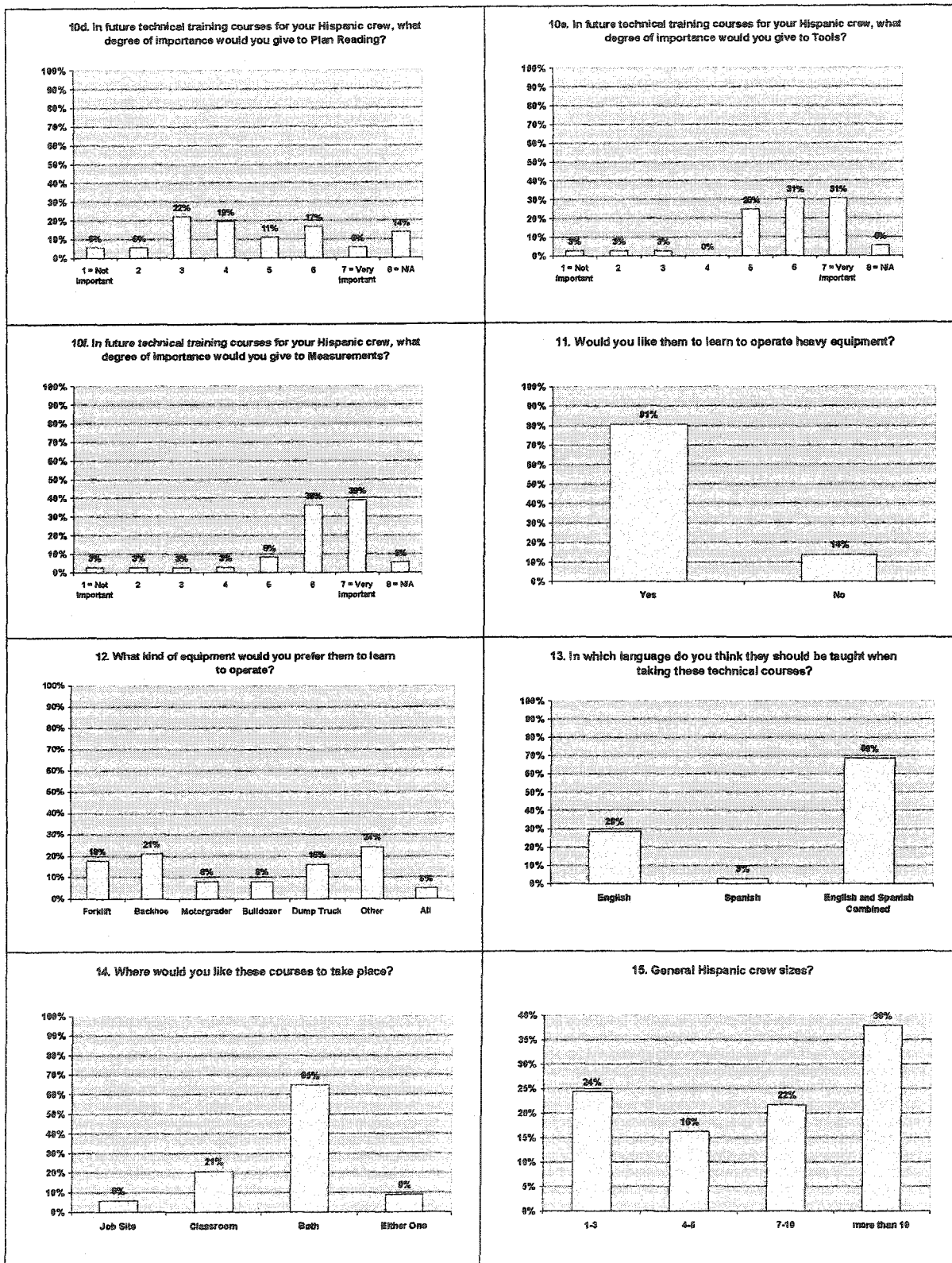
- 1 = Less than 16
- 2 = Between 16 and 24
- 3 = Between 25 and 34
- 4 = Between 35 and 44
- 5 = 45 and Older

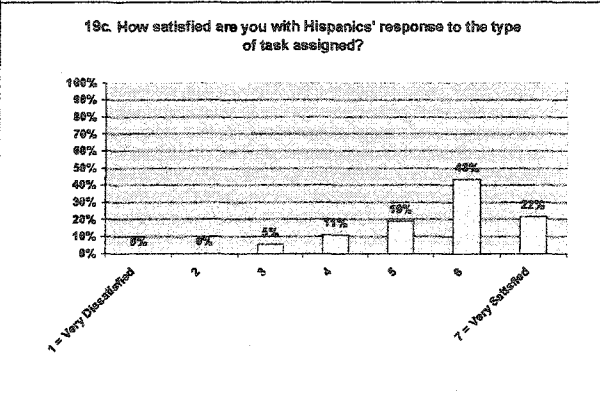
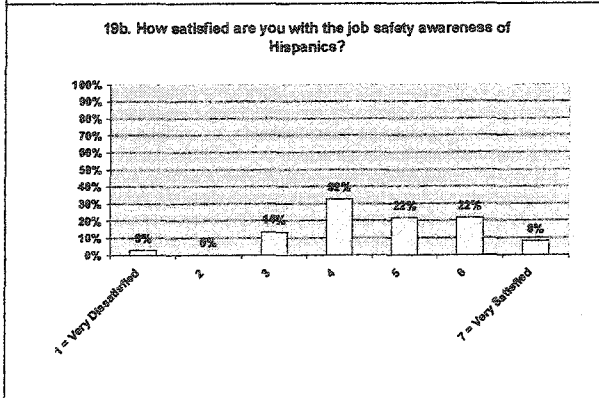
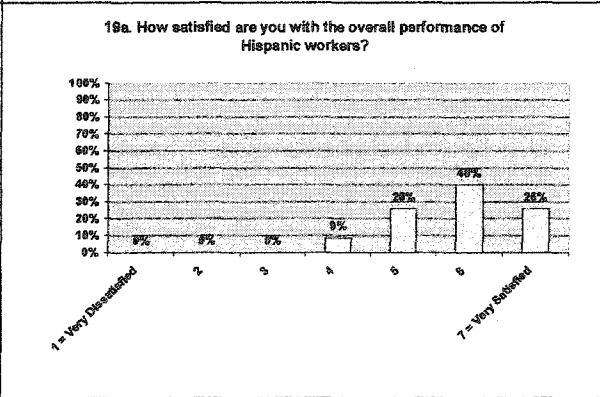
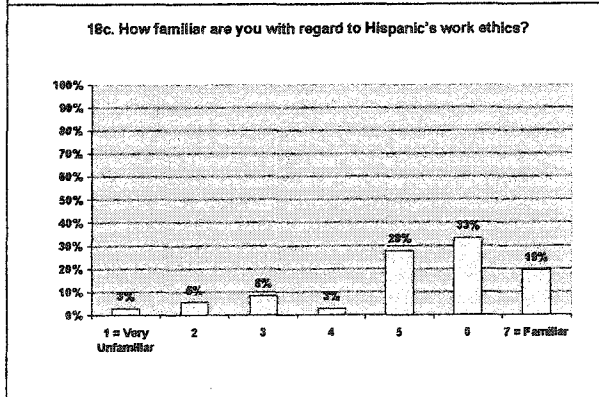
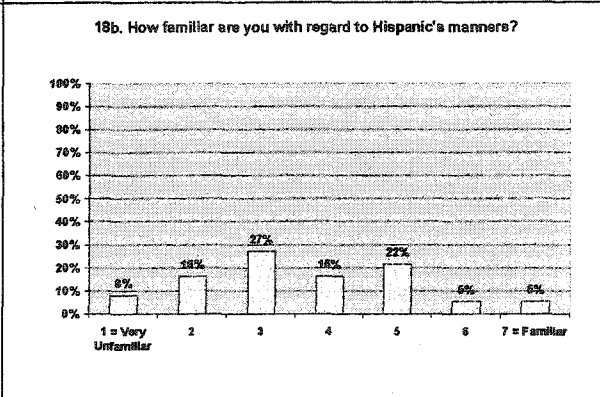
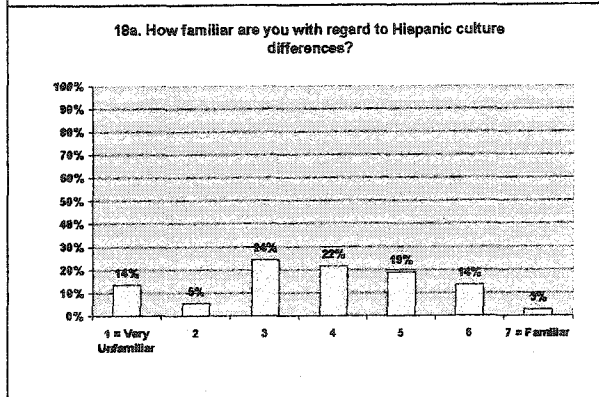
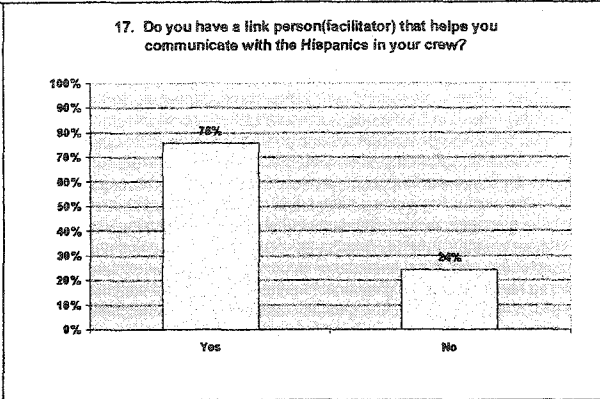
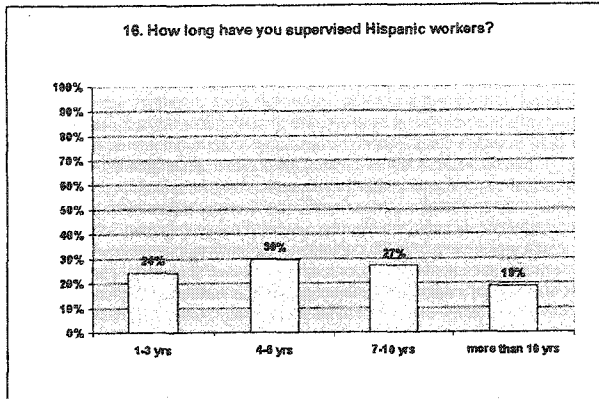
29.	What is the highest level of education you have completed?	<u>61</u>
	1 = Elementary school 2 = Middle school 3 = Technical school 4 = High school 5 = College	
30.	Do you stay in Iowa after the construction season is over?	<u>62</u>
	1 = Never 2 = Sometimes 3 = Always	
31.	Do you plan to stay in the U.S.?	<u>63</u>
	1 = Yes 2 = No 3 = Undecided	
32.	After having arrived in the U.S. and worked in construction, what are your main goals and expectations for the future?	-
32-1	Learn English	<u>64</u>
32-2	Work related	<u>65</u>
32-3	Social related	<u>66</u>
32-4	Others	<u>67</u>
33.	What do you consider to be your main problem on the job site?	-
33-1	Language	<u>68</u>
33-2	Company related	<u>69</u>
33-3	Other	<u>70</u>
34.	What is your country of birth? State: _____	<u>71</u>
34-1	Mexico	
34-2	Central America	
34-3	South America	
35.	Would you like to take a course in order to be promoted to supervisor?	<u>72</u>
	1= Yes 2= No	

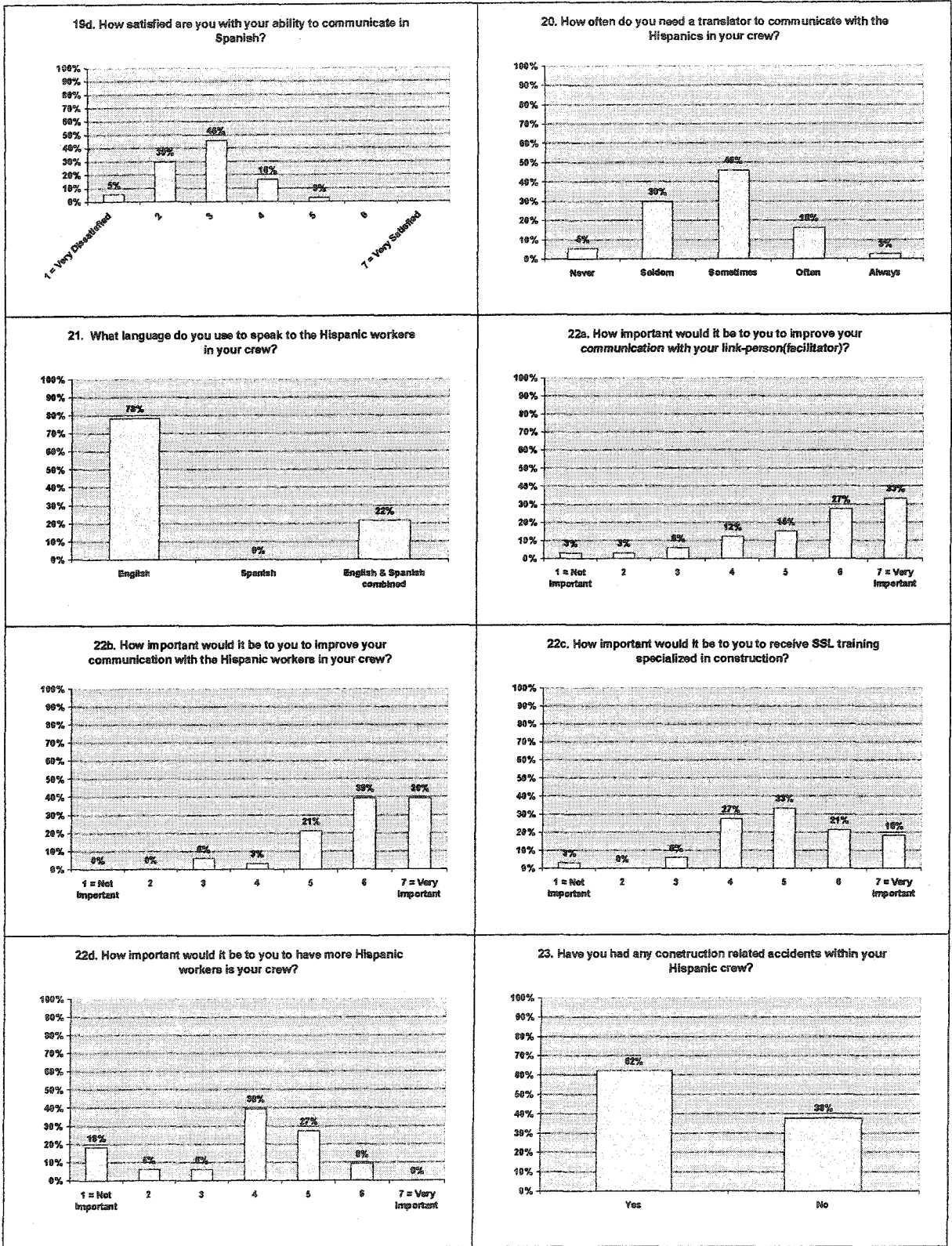
Results of Questionnaire for American Supervisors



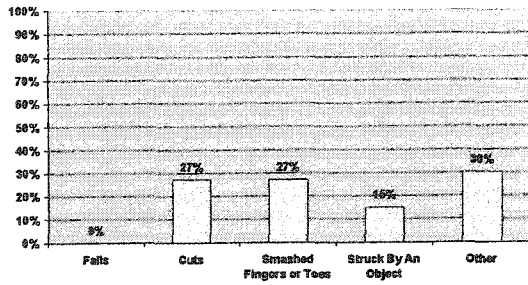




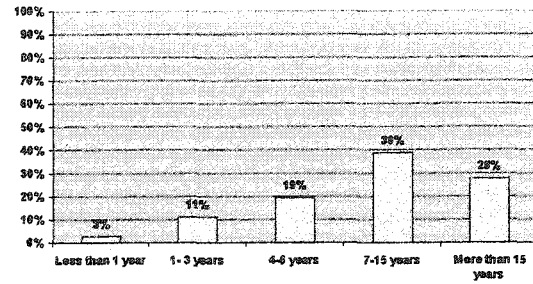




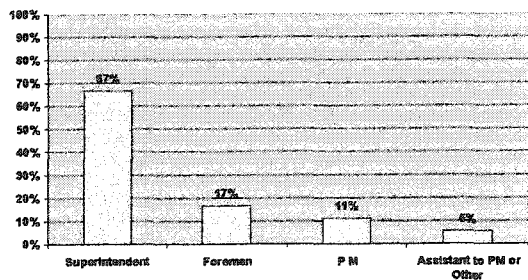
24. What are the most common types of accident you have seen or undergone in relation with the Hispanic workers, if any?



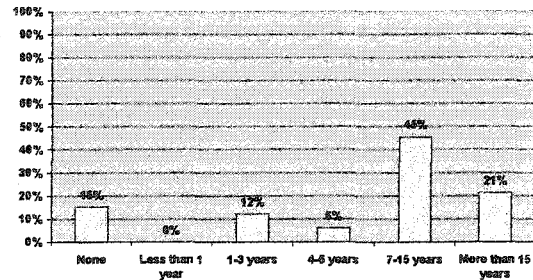
25a. How long have you been a construction supervisor?



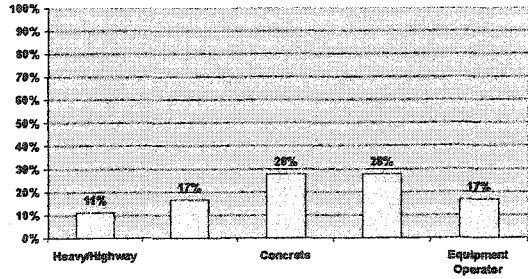
25b. What is your field title?



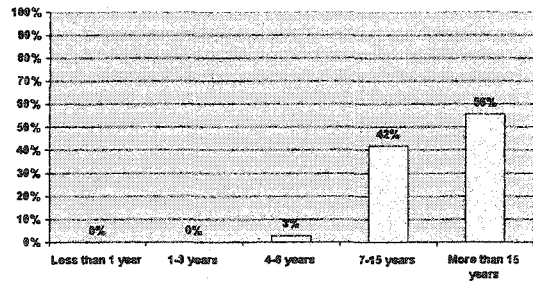
26a. How much experience in construction did you have prior to supervising Hispanics?



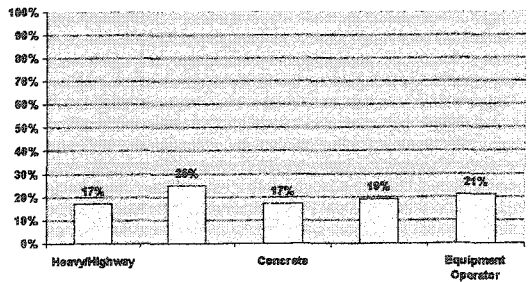
26b. In which trades did you get construction experience prior to supervising Hispanics?



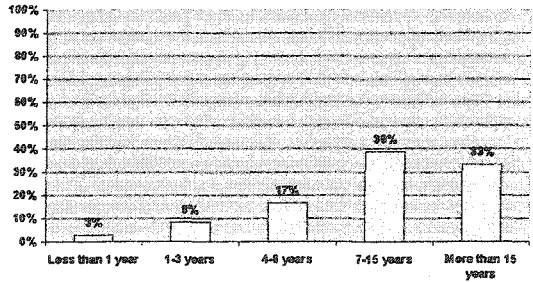
27a. How long have you been involved in construction?

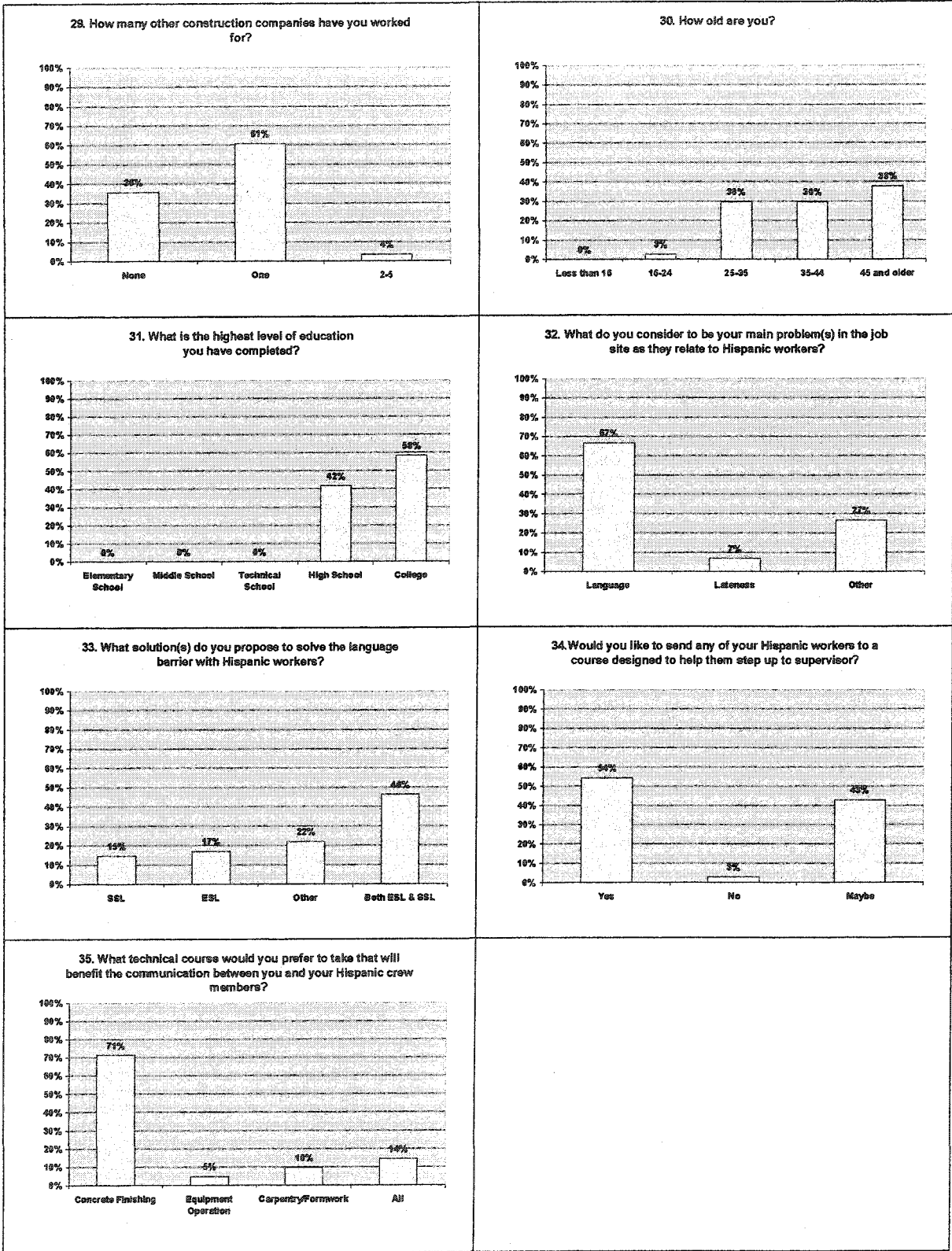


27b. In what trade/trades have you been involved in construction?



28. How long have you been employed by the company you are currently working for?





QUESTIONNAIRE FOR AMERICAN SUPERVISORS

CODING MANUAL

Question No.	Code	Column
1a. Have you ever taken a course to help you learn Spanish?	1 = Yes 2 = No	<u>1</u>
1b. If YES, how many total hours of training have you had?	1 = Less than 10 hours 2 = Between 10 and 40 hours 3 = More than 40 hours	<u>2</u>
1c. If NO, would you like to take one?	1 = Yes 2 = No	<u>3</u>
2. Was this Spanish course related to construction?	1 = Yes 2 = No	<u>4</u>
3. How would you rate the following aspects of your Spanish course?	1 = Very Poor 2 = 3 = 4 = Neutral 5 = 6 = 7 = Very Good	-
3a. Contents for use on the job		<u>5</u>
3b. Contents for use in everyday life		<u>6</u>
3c. Instructor		<u>7</u>

4. How would you rate the degree of difficulty? 8

- 1 = Very Easy
- 2 =
- 3 =
- 4 = Normal
- 5 =
- 6 =
- 7 = Very Difficult

5. How would you rate the length of the course? 9

- 1 = Very Short
- 2 =
- 3 =
- 4 = Normal
- 5 =
- 6 =
- 7 = Very Long

6. How well did your Spanish courses meet your needs and expectations? 10

- 1 = Not at all
- 2 =
- 3 =
- 4 = Neutral
- 5 =
- 6 =
- 7 = Completely

7. Would you be interested in having your Hispanic crews take a technical training course related to their trade? 11

- 1 = Yes
- 2 = No

8. If YES, what would you like them to learn? -

- 1 = Checked

8-1	Carpentry	<u>12</u>
8-2	Concrete	<u>13</u>
8-3	Equipment	<u>14</u>
8-4	Plan reading	<u>15</u>
8-5	Other	<u>16</u>

9. Is this related to your occupation? (Trade) 17

- 1 = Yes
- 2 = No

10. If your Hispanic crews were to take technical training courses in the near future, what degree of importance to the course contents would you give to the following aspects:

- 1 = Not Important
 2 =
 3 =
 4 = Neutral
 5 =
 6 =
 7 = Very Important
 8 = N/A (Not Applicable)

10a. On-the-job vocabulary?	<u>18</u>
10b. Equipment operation?	<u>19</u>
10c. Construction safety?	<u>20</u>
10d. Plan Reading?	<u>21</u>
10e. Tools?	<u>22</u>
10f. Measurements?	<u>23</u>

-
11. Would you like them to learn to operate heavy equipment? 24

- 1 = Yes
 2 = No

-
12. Which of the following would you prefer them to learn to operate? (circle all you want)

12-1	1 = Forklift	<u>25</u>
12-2	2 = Backhoe	<u>26</u>
12-3	3 = Motorgrader	<u>27</u>
12-4	4 = Bulldozer	<u>28</u>
12-5	5 = Dump truck	<u>29</u>
12-6	6 = Other	<u>30</u>
12-7	7 = All of the above	<u>31</u>

-
13. In which language do you think they should be taught when taking these technical courses? 32

- 1 = Spanish
 2 = Spanish
 3 = Spanish and Spanish combined

-
14. Where do you think would be most convenient for these courses to take place? 33

- 1 = Job site
 2 = Classroom
 3 = Both
 4 = Either one

15. How many Hispanic workers do you have in your crews? 34

- 1 = 1-3
- 2 = 4-6
- 3 = 7-10
- 4 = more than 10

16. How long have you supervised Hispanic workers? 35

- 1 = 1-3 yrs
- 2 = 4-6 yrs
- 3 = 7-10 yrs
- 4 = more than 10 yrs

17. Do you have a link-person (facilitator) to help you communicate with people in your crew? 36

- 1 = Yes
- 2 = No

18. How familiar do you think you are about Hispanics with regard to the following:

- 1 = Very Unfamiliar
- 2 =
- 3 =
- 4 = Neutral
- 5 =
- 6 =
- 7 = Very Familiar

18a. Culture differences 37

18b. Manners 38

18c. Work Ethic 39

19. How satisfied are you with each of the following?

- 1 = Very Dissatisfied
- 2 =
- 3 =
- 4 = Neutral
- 5 =
- 6 =
- 7 = Very Satisfied

19a.	Dealing with Hispanic workers, ...their overall performance	<u>40</u>
19b.	The Hispanic worker job safety awareness	<u>41</u>
19c.	The response of Hispanic workers to the type of tasks you ask them to do	<u>42</u>
19d.	Your ability to communicate in Spanish	<u>43</u>

20.	How often do you need a translator to communicate with people in your crew?	<u>44</u>
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- 1 = Never
- 2 = Seldom
- 3 = Sometimes
- 4 = Often
- 5 = Always

21.	What language do you use when you speak to Hispanic workers in your crew?	<u>45</u>
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- 1 = Spanish
- 2 = Spanish
- 3 = Spanish and Spanish combined

22.	How important would it be to you to ...	
-----	---	--

- 1 = Not Important
- 2 =
- 3 =
- 4 = Neutral
- 5 =
- 6 =
- 7 = Very Important

22a.	Improve your communication with your link-person (facilitator)?	<u>46</u>
22b.	Improve your communication with all the Hispanic workers in your crew?	<u>47</u>
22c.	Receive SSL training emphasizing only in construction?	<u>48</u>
22d.	Have more Hispanic workers in your crew?	<u>49</u>

23.	Have you had any construction related accidents?	<u>50</u>
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- 1 = Yes
- 2 = No

24.	What are the most common types of accidents you have seen or undergone in construction, if any?	
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24-1	Falls	<u>51</u>
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24-2	Cuts	<u>52</u>
24-3	Smashed fingers or toes	<u>53</u>
24-4	Struck by	<u>54</u>
24-5	Other	<u>55</u>

25a.	How long have you been a construction supervisor?	<u>56</u>
------	---	-----------

- 1 = Less than one year
- 2 = Between one and three years
- 3 = Between four and six years
- 4 = Between seven and fifteen years
- 5 = More than fifteen years

25b.	Superintendent or foreman?	<u>57</u>
------	----------------------------	-----------

- 1 = Superintendent
- 2 = Foreman
- 3 = Project Manager
- 4 = Assistant PM

26a.	How much construction experience did you have prior to supervising Hispanic workers?	<u>58</u>
------	--	-----------

- 0 = None
- 1 = Less than one year
- 2 = Between one and three years
- 3 = Between four and six years
- 4 = Between seven and fifteen years
- 5 = More than fifteen years

26b.	What trade?	
	1 = Heavy/Highway	<u>59</u>
	2 = Masonry/Laborer	<u>60</u>
	3 = Concrete	<u>61</u>
	4 = Carpentry	<u>62</u>
	5 = Equipment related	<u>63</u>

27a.	How long have you been involved in construction and in what trade?	<u>64</u>
------	--	-----------

- 0 = None
- 1 = Less than one year
- 2 = Between one and three years
- 3 = Between four and six years
- 4 = Between seven and fifteen years
- 5 = More than fifteen years

27b.	What trade?	
	1 = Heavy/Highway	<u>65</u>
	2 = Masonry/Laborer	<u>66</u>
		<u>67</u>

3 = Concrete	<u>68</u>
4 = Carpentry	<u>69</u>
5 = Equipment related	<u>70</u>

28. How long have you been employed by the company you are currently working for?	<u>71</u>
---	-----------

- 1 = Less than one year
- 2 = Between one and three years
- 3 = Between four and six years
- 4 = Between seven and fifteen years
- 5 = More than fifteen years

29. How many other construction companies have you worked for in the U.S.? _____	<u>72</u>
--	-----------

- 0 = None
- 1 = One
- 2 = Between two and five
- 3 = More than five

30. How old are you? _____ years old	<u>73</u>
--------------------------------------	-----------

- 1 = Less than 16
- 2 = Between 16 and 24
- 3 = Between 25 and 34
- 4 = Between 35 and 44
- 5 = 45 and Older

31. What is the highest level of education you have completed?	<u>74</u>
--	-----------

- 1 = Elementary school
- 2 = Middle school
- 3 = Technical school
- 4 = High school
- 5 = College

32. What do you consider to be your main problem(s) on the job site as they relate to Hispanic workers?	-
---	---

32-1 Communication	<u>75</u>
32-2 Lateness	<u>76</u>
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33. What solution(s) do you propose to solve the language barrier with Hispanic workers?	
--	--

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33-3 Other

80

-
34. Would you like to send any or all of your Hispanic workers to a course designed to help them step up to supervisor? 81

1 = Yes
2 = No
3 = Maybe

-
35. What technical course would you prefer to take that will benefit the communication between you and your crew?

1 = Concrete Finishing 82
2 = Equipment Operation 83
3 = Carpentry/Formwork 84
4 = Other 85

APPENDIX D

**CONCRETE PAVEMENTS: CONSTRUCTION BASICS
BILINGUAL BROCHURE
(DRAFT FOR COMMITTEE REVIEW JUNE 16 2004)**

concrete paving

notes

Construction No. 1

Portland Cement Concrete Pavements: Construction Basics

by Jim Grove, P.E., Harold Smith, P.E., and Marcia Brink
Translated into Spanish by Augusto Canales

This booklet will help developers, consultants, and engineers planning concrete pavement construction projects, superintendents and supervisors who want a basic training aid and reference, and crew members new to the concrete paving industry. It provides a general description of current concrete pavement construction practices, from establishing preconstruction control mechanisms to sealing joints. It also provides a quick troubleshooting reference.

General principles

Understanding and adhering to the following concrete paving principles will go a long way toward delivering a well constructed, durable pavement:

- Everyone at the construction site, particularly foremen and supervisors, is responsible for recognizing and troubleshooting potential problems as they arise.
- Batches of concrete should be consistent and uniformly mixed.
- The primary cause of pavement failure is unstable subgrade. The subgrade should consist of uniform material and the subgrade system must drain well.
- Dowel bars are important for load transfer at transverse joints on pavements with high truck volumes. Dowels must be carefully aligned, horizontally and vertically, to prevent pavement damage at the joints.
- Stringlines control the slipform paver's horizontal and vertical movement and ensure a smooth pavement profile. Once stringlines are set, they should be checked often and not disturbed.
- Overfinishing the new pavement and/or adding water to the surface can seriously damage the pavement surface. If the concrete isn't sufficiently workable, crews should contact the project manager. Changes to the mixture or to paver equipment may reduce the problem.
- Proper curing is critical to preventing pavement damage from rapid moisture loss at the pavement surface.
- A well spaced and constructed system of joints is critical to preventing random cracking.
- Joints are simply controlled cracks. They must be sawed during the brief time after the pavement has gained enough strength to prevent raveling but before it begins to crack randomly (the "sawing window").
- Seasonal and daily weather variations affect setting time and other variables in new concrete. Construction operations should be adjusted appropriately.

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Pavimentos de Concreto a base de Cemento Portland: Las bases de Construcción

Por Jim Grove, P.E., Harold Smith, P.E., y Marcia Brink

Este folleto ayudará a los desarrolladores, consultores, Ingenieros que planean los proyectos de construcción de pavimentos, superintendentes y supervisores que desean una capacitación básica, y personal nuevo en las cuadrillas en la industria de pavimentos de concreto. Provee una descripción general de las practicas actualizadas de la construcción de pavimentos de concreto, desde establecer los mecanismos de control durante la preconstrucción hasta el sellado de las juntas. También provee una referencia rápida para resolver problemas.

Principios generales

Entender y adherirse a los siguientes principios de los pavimentos de concreto ayudará grandemente en la construcción y entrega de un pavimento duradero y muy bien construido:

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- Todos en la obra de construcción, particularmente los mayordomos y supervisores, son responsables de ubicar y resolver los problemas como se vayan presentando.
- Las cargas (coladas) de concreto deben ser consistentes y mezcladas uniformemente.
- La causa primaria en la falla de los pavimentos es una sub-base inestable. La sub-base debe consistir de material uniforme y debe drenar libremente.
- Las dovelas son importantes para la transferencia de carga a través de las juntas. Deben ser alineadas cuidadosamente, de forma horizontal y vertical para prevenir el daño al pavimento en las juntas.
- Un cordel acotado controla el movimiento vertical y horizontal de la cimbra de la pavimentadora para asegurar un perfil de pavimento liso. Toda vez que el cordel ha sido colocado, no debe desajustarse.
- Sobre-acabado en el nuevo pavimento y/o agregar mas agua a la superficie puede dañar seriamente la superficie del pavimento. Si el concreto no esta suficientemente trabajable, las cuadrillas deben llamar al Gerente de Proyecto. Cambios en la mezcla o al equipo pavimentador puede reducir el problema.
- El curado adecuado es critico para prevenir daño al pavimento debido a la perdida de humedad en la superficie del mismo.
- Un sistema de juntas adecuadamente espaciadas y construidas es critico para evitar las grietas al azar.
- Las juntas no son mas que grietas controladas. Deben ser ranuradas durante el breve periodo de tiempo después que el pavimento ha ganado suficiente esfuerzo para prevenir desmoronamientos pero antes de que empiece a agrietarse al azar ("La ventana del corte").
- Las variaciones de clima y temperaturas diarias afectan el tiempo de fraguado y otras variables en el nuevo concreto. Las operaciones de construcción deben ajustarse apropiadamente.

Site preparation

Before construction begins, the construction site must be carefully prepared. This includes preparing the grade, establishing control mechanisms (the stringline), and placing dowel baskets.

Preparing the grade, or roadbed

The majority of concrete pavement failures are not caused by failure of the concrete slab but by problems with the materials beneath the slab. These problems can include poor drainage, unstable or nonuniform materials, or poor compaction.

Adequate preparation of the roadbed—the subgrade, subbase, and base—is essential for a strong, durable concrete pavement system.

Subgrade: Earth that has been graded to the desired elevation. (In county and municipal paving projects with low traffic volumes, concrete is often placed directly on the prepared earth subgrade.)

Subbase: A course of material placed on the subgrade to protect it from frost and provide good drainage. In Iowa, three kinds of subbases may be used:

Granular subbase is a mixture of granular material that is uniformly shaped and minimally compacted. It does not provide significant structural support; no construction traffic is allowed on a granular subbase. Iowa DOT uses granular subbase under most concrete pavements.

Modified subbase contains a greater percentage of crushed particles and a denser gradation than granular backfill, providing even more stability.

Special backfill provides more stability and support. It is generally a uniform mixture of crushed concrete or crushed limestone, or a mixture of gravel, sand, and soil, with or without crushed stone. Special backfill is often used under pavement in urban areas to support construction traffic.

Base: A course of fairly rigid material, sometimes cement- or asphalt-treated, placed on the subbase to provide a stable platform for the concrete pavement slab.

Note: A base course is rarely used in Iowa. When it is used, only one course of fill material is placed on the subgrade, and it is generally referred to as the subbase. It is designed to be porous enough to provide adequate drainage and stable enough to provide a strong platform for the concrete slab.

Preparación del sitio

Antes del inicio de la construcción, el sitio debe ser cuidadosamente preparado. Esto incluye preparar la terracería, establecer los mecanismos de control (El cordel acotado), y colocar las canastas de dovelas.

Preparación de la terracería, o cama del camino

La gran mayoría de las fallas en los pavimentos no son causadas por fallas de la losa de concreto, sino por problemas con los materiales bajo la losa. Estos problemas pueden ser mal drenaje, materiales no uniformes e inestables, o una mala compactación.

La adecuada preparación de la cama del camino—la terracería, la subbase, y base—es esencial para un sistema de pavimento fuerte y durable.

Terracería: Es el terreno que ha sido nivelado a la elevación deseada. (en los proyectos de los condados, y municipales que tienen bajo volumen de tráfico, el concreto a menudo es colocado directamente sobre la terracería preparada.

Sub-base: Es una capa de material colocado sobre la terracería para protegerla de la congelación y para proveerle buen drenaje. En Iowa, tres tipos de sub-bases se pueden usar:

La sub-base granular es una mezcla uniforme de material granular que se humedece uniformemente, se le da forma y se le compacta. No provee soporte estructural significativo; no se permite tráfico de construcción sobre la sub-base. El DOT de Iowa usa sub-bases granulares debajo de la mayoría de sus pavimentos de concreto.

Un relleno especial provee más estabilidad y soporte. Es generalmente una mezcla uniforme de concreto triturado o caliza triturada, o una mezcla de grava arena y suelo, con o sin piedra triturada. (Un Pavimento Asfáltico Reciclado (PAR) es un pavimento de asfalto de mezcla caliente que es procesado para cumplir con los requerimientos especiales para rellenos del DOT de Iowa.). Rellenos especiales son usados seguido en áreas urbanas.

La sub-base modificada contiene un porcentaje más alto de partículas trituradas y una graduación más densa, lo cual provee más estabilidad.

Base: Es una capa de material de relleno mas bien rígido, algunas veces tratado con cemento o con asfalto, que se coloca sobre la sub-base para proveer una plataforma estable para la losa de concreto del pavimento.

Nota: la capa de base es raramente usada en Iowa. Generalmente una capa de material se coloca sobre la terracería, y se le llama sub-base. Se diseña de tal manera que sea lo suficientemente porosa para proporcionar drenaje y suficientemente estable para proveer una plataforma firme para la losa de concreto.

Preparing the Subgrade

First the site is graded to cut high points and fill low areas to the desired roadway profile elevations. Generally, cut material can be used as embankment fill. However, peat, organic silt, or soil with high organic content should not be used; borrow material should be used instead.

Stabilization

Stable soils are generally defined as those that can support loads. Loam or clay loam of glacial till origin or clean sand is typically desirable.

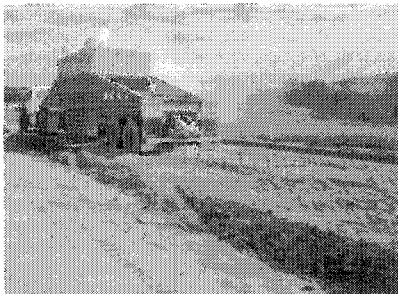
Just as important as the soil's quality, however, is its uniformity. During excavation, localized pockets of different kinds of soil may be encountered. Different soils absorb water differently, have different densities, and expand and contract at different rates, so these pockets provide different levels of support. These differences make the subgrade soil "unstable."

To stabilize the subgrade so that it will provide uniform support to the rest of the pavement structure, localized pockets of undesirable material should be removed and replaced with the dominant soil type or with select backfill, or the soil should be treated with additives.

Typical stabilizing materials are select soils or backfill—loam or clay loam, clean sand, or other stable soil material—excavated from road cuts or borrow sites.

Typical stabilizing additives include the following:

- lime: either quicklime or hydrated lime, either high calcium or dolomitic. Through chemical reactions with soil, lime reduces soil plasticity and increases compressive strength. It is sometimes used to stabilize wet soils.
- portland cement: hydrates with moisture in the soil and hardens. Portland cement reacts best with well graded, sandy, and gravelly materials with 10 to 35 percent fines. More cement is usually needed for soils with little or no fines and with clay soils.
- fly ash: a byproduct of coal furnaces. When mixed with soil and water, it forms a low-grade concrete. Self-cementing Class C fly ash is used for treating subgrades, according to Iowa DOT specifications.



Fly ash can be used as a soil-stabilizing additive.

La ceniza volante puede usarse como aditivo estabilizador del suelo.

Preparando la Terracería

Primeramente el sitio se nivela cortando los puntos altos y rellenando las áreas bajas a la elevación deseada. El área nivelada, o terracería, deberá extenderse por lo menos tres pies más allá de la orilla del pavimento planeado. Esto provee una cimentación para las estacas y un suelo firme para los carriles del equipo pavimentador.

Generalmente material producto del corte puede ser usado como relleno del terraplén. Sin embargo, la turba, o limo orgánico, o material con alto contenido orgánico no debe ser usado; material de préstamo debe ser usado en estos casos.

Estabilización

A los suelos estables se les define generalmente como aquellos que pueden soportar cargas. Suelos arcillosos o tilita de origen glacial, o arenas limpias son típicamente deseables.

Sin embargo, tan importante como la calidad del suelo, es su uniformidad. Durante la excavación, se pueden encontrar lentes de diferentes tipos de suelo. Diferentes suelos absorben agua de diferente manera, tienen densidades diferentes y se expanden o contraen a diferente velocidad, por lo tanto proporcionan diferentes niveles de soporte. Estas diferencias hacen que el suelo de terracería sea "inestable".

Para estabilizar la terracería de tal forma que pueda proveer soporte uniforme al resto de la estructura de pavimento, algunos suelos son removidos y reemplazados con material selecto de relleno, o el suelo es tratado con aditivos.

Los típicos materiales para estabilización son suelos para relleno seleccionados—arcilla limosa, arenas limpias u otros materiales de suelo estable—excavados de cortes de caminos o préstamo de banco.

Típicos aditivos estabilizantes incluyen los siguientes:

- Cal: ya sea cal viva o cal hidratada, sea con alto contenido de calcio o dolomítica. A base de las reacciones químicas con el suelo, la cal reduce el Índice Plástico del suelo y aumenta su esfuerzo compresivo. Algunas veces se usa para estabilizar suelos mojados.
- Cemento Pórtland: se hidrata con la humedad del suelo y se endurece como cemento. El cemento Pórtland reacciona mejor con suelos bien graduados, arenas y gravas con 10 a 35 por ciento de finos. Se necesita más para suelos con muy poco o nada de contenido de finos y para suelos arcillosos.

A layer of polymer geosynthetic, called geogrid, may be used as a foundation under special backfill to provide underlying tension reinforcement. The grid interlocks with aggregates in special backfill and spreads wheel loads over a large area.

Compaction and trimming

Before compacting, wet subgrade material may have to be disked (or dry subgrade sprayed with water) to obtain proper moisture levels. The subgrade must be thoroughly compacted, generally with a sheep's foot roller, to provide a strong platform for construction activities.

After compaction, a proof-roller (a heavy, loaded, pneumatic-tired vehicle) is driven over the subgrade to locate soft areas or other problems that may require additional stabilization.

Finally, an electronically controlled trimmer machine is used to trim the subgrade surface to the profile grade. The trimmer runs off the stringline for both elevation and alignment control. Trimming should occur within a week of proof-rolling.

The subgrade cannot be used for a haul road. Trucks are only allowed to drive on the grade for dumping.



Trimming a granular subbase

Afinando una sub-base granular

Constructing the subbase (Iowa method)

On Iowa's primary roads, the concrete will be placed directly on the subbase, so it must provide adequate structural support. Generally, one course of well graded aggregate is placed on the subgrade. (Other subbase materials are modified subbases and special backfill.) Granular subbases must be compacted with a non-vibratory roller and trimmed.

The subbase must also provide good drainage. However, during the trimming process, fine aggregates can separate from the larger particles, creating a thin layer of fines on the surface that reduces the subgrade's permeability. This is most likely to happen if the subbase material is very dry.

Establishing the stringline

A stringline must be set outside the pad line, parallel to the proposed pavement, to guide the trimmer, slip-form paver, and other paving equipment, both horizontally and vertically. The paver's elevation-sensing wands ride beneath the string, and the alignment-sensing wands ride against the inside of the string.

Ceniza volante: es un sub-producto de los hornos de carbón. Cuando se le mezcla con suelo y agua, forma un concreto de baja calidad. La ceniza volante clase C auto cementante se usa para tratar las terracerías, de acuerdo con las especificaciones del DOT de Iowa.

Una capa de polímero geosintético, llamado geored, puede usarse como cimentación. Abajo del relleno especial a manera de proporcionar soporte a la tensión. La red se entrelaza con los agregados del relleno especial y distribuye las cargas sobre un área mayor.

Compactación y afine

Antes de compactarse, el material seco de terracería debe ser rociado con agua y homogenizado para obtener los niveles adecuados de humedad. La terracería debe ser totalmente compactada, generalmente con un rodillo pata de cabra, para proporcionar una plataforma firme para las actividades de construcción.

Después de la compactación, un rodillo de prueba (un vehículo sobre neumáticos, pesado y cargado) debe ser pasado sobre la terracerías con el fin de ubicar áreas blandas o cualquier otro problema que requiera estabilización adicional.

Finalmente, una máquina afinadora electrónicamente controlada es usada para afinar la superficie de la terracería al nivel deseado. La afinadora se ajusta al cordel para control tanto de la elevación como del alineamiento. El afine debe ocurrir en el lapso de una semana del roleo de prueba.

La terracería no puede usarse como camino. A los camiones se les permite usarla solo para descargar.

Construyendo la sub-base (El método de Iowa)

El concreto será colocado directamente sobre la sub-base, por lo tanto esta debe proveer adecuado soporte estructural. Generalmente en Iowa, una capa de de agregado bien graduado es colocado sobre la terracería. (otros materiales para sub-base son sub-bases modificadas o rellenos especiales). Las sub-bases granulares deben ser compactadas con un rodillo no-vibratorio y posteriormente afinadas.

La sub-base debe también proveer buen drenaje. Sin embargo, durante el proceso de afine, las partículas finas pueden separarse de las partículas gruesas, creando una delgada capa de finos en la superficie que reduce la permeabilidad de la terracería. Esto es muy posible que ocurra si el material de sub-base esta muy seco.

Colocando el cordel

Un cordel debe ser colocado fuera de la sub-base, paralela al propuesto pavimento, para guiar a la afinadora, la pavimentadora de cimbra deslizante, y a cualquier otro equipo de pavimentación, de forma horizontal y vertical. Las guías de los sensores de elevación de la pavimentadora viajan debajo del cordel, y las guías de los sensores de alineamiento viajan contra el lado interior del cordel.

An accurately set, taut stringline is critical to constructing a pavement of uniform thickness and with the desired profile.

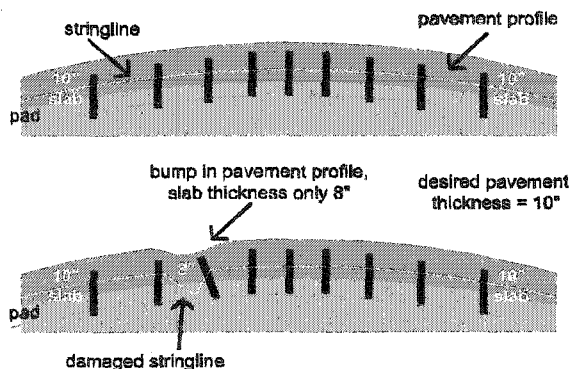
Meticulous setting of the stringline cannot be overemphasized. Before paving begins, the stringline must be carefully inspected for accuracy.

Once the stringline is set, be careful not to bump it out of alignment or knock the wands loose. Do not operate trucks or other equipment close to the pad line; this could disturb the stringline. Any of these situations could cause the paver to deflect from the correct elevation, creating a dip or a bump in the slab.

During paving operations, the stringline must be eyeballed often for correct alignment. If you notice a disturbance in the stringline, notify your supervisor.

Placing dowel baskets

Dowel bars transfer heavy loads across joints in the pavement, preventing faulting at the joint that can lead to pavement damage.



Un cordel bien estirado es crítico para la construcción de un pavimento de espesor uniforme y con el perfil deseado.

Una meticulosa instalación del cordel es sumamente importante.

El cordel debe ser cuidadosamente revisado en cuanto a su precisión antes del inicio del colado.

Una vez colocado el cordel, tenga cuidado de no tropezarse con el y hacer que pierda el alineamiento o que se aflojen las guías. No opere camiones u otro tipo de equipo cerca del cordel. Esto pudiera dañar el cordel. Cualquiera de estas situaciones pudiera causar que la pavimentadota se desviara de la correcta elevación creando un hundimiento o un bordo en la losa.

Si se observa una discrepancia en el cordel o el borde de la sub-base, notifica al supervisor.

Colocando las canastas de dovelas

Las dovelas transfieren pesadas cargas a través de las juntas del pavimento, previniendo la falla en la junta que hará daño al pavimento.

The stringline controls the pavement profile (top). A damaged stringline (bottom) can cause a dip in the profile, making the slab thinner at the dip.

El cordel controla el perfil del pavimento (arriba). Un cordel dañado (abajo) puede causar una caída en el perfil y provocar un espesor más delgado.

Eyeball the stringline for alignment.
Revisar a ojo la alineación del cordel.

Setting the stringline

Before the grade is prepared for paving operations, surveyors install the stringline. The stringline may be wire, cable, woven, nylon, polyethylene rope, or similar material.

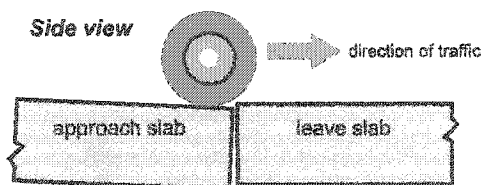
1. Paving hubs, or construction stakes, are installed at certain intervals outside the pad line, along with pie stakes (flats) showing the difference between the top of the slab and the hub elevations. A stringline support stake is securely placed just outside each hub so that the stringline will be directly over the hub.
2. The appropriate stringline height is calculated relative to the hub elevations, the offset distance (either level or projected) between hub and pavement reference point, and the desired grade.
3. Finally, the line is installed between stakes, adjusted to the desired height, and made taut.
4. Hand winches are generally installed at about 1,000-foot intervals. The winches allow the line to be tightened to prevent sagging between stakes. (Apply stringline tension carefully; a line break may cause injuries.)
5. For maximum control, contractors may set stringlines on both sides of the proposed pavement.

Instalando el Corde!l

Los topógrafos instalan el cordel mientras que la terracería esta siendo preparada para las operaciones de pavimentación. El cordel puede ser de alambre, cable, o cuerda de nylon o polietileno tejido, o materiales similares.

1. Estacas acotadas para construcción de 2" x 2", se instalan a ciertos intervalos afuera de la línea del avance de la máquina, junto con estacas triangulares para escribir que muestren la diferencia entre la parte superior de la losa y la elevación de la estaca de construcción. Una soporte del cordel se coloca justo al lado y afuera de cada estaca de tal manera que el cordel estará directamente sobre el estaca.
2. La altura apropiada del cordel se calcula de las elevaciones de al estaca, la distancia (sea a nivel o proyectada) entre la estaca y el pavimento, y el perfil deseado.
3. Finalmente, el cordel se instala entre las estacas de soporte, ajustada a la altura deseada y bien estirado.
4. Malacates de mano se instalan generalmente a intervalos de 1000 pies. Los malacates permiten que la línea sea estirada para prevenir se cuelgue entre estacas. (aplique la tensión cuidadosamente, una línea que se quiebren puede causar lesiones)
5. Para máximo control, los contratistas pueden instalar cordeles en ambos lados del pavimento propuesto.

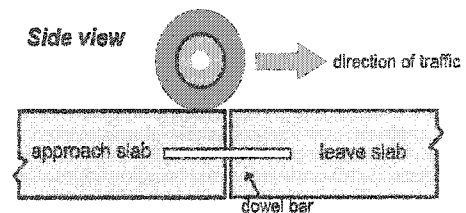
The Iowa DOT requires dowel bars on 8-inch or thicker pavements; this includes almost all Iowa DOT projects.



Without dowels, the slab on either side of a joint tends to move up and down; that is, there is little "load transfer" at the joint.

Sin dovelas, las losas a cada lado de la junta tienden a moverse independiente hacia arriba y hacia abajo; y no existe "Transferencia de Carga" en la junta.

El Departamento de Transporte de Iowa (Iowa DOT) requiere que se coloquen dovelas en pavimentos con espesor de 8 pulgadas o mas gruesos; esto incluye la mayoría de los pavimentos de Iowa DOT.



Dowels help provide load transfer at the joint. Las dovelas proveen transferencia de carga en la junta.

Dowels must be positioned and aligned perfectly so that, as joints open in winter and close in summer with contraction and expansion of the concrete, the pavement on either side of the joints can move in a straight line along the smooth dowels.

If a dowel bar is not aligned truly across the joint, the pavement can't move and a torque results. The stress can crack the pavement.



Here, misalignment of the dowel bars could eventually lead to joint damage.

Aquí, el alineamiento chueco de las dovelas pudiera eventualmente crear daño en la junta.

Basket placement

After the subbase has been properly trimmed and inspected, dowel baskets are set on the road bed, perpendicular to the pavement edge or at a slight skew (often 6:1). The dowel bars must be carefully aligned, horizontally and vertically, and the baskets secured. Iowa requires eight stakes placed behind the basket wire (relative to the direction of paving).

The location of dowel centers is then marked on both sides of the roadbed, either by setting pins or painting marks. The markers indicate where joints should be sawed, ensuring that they will be sawed across the center of the dowel assembly.

Final check

Dowel positions should be checked from three perspectives:

1. Sight down the grade to make sure all dowels are straight.
2. Sight across the dowel baskets to make sure all dowels are level.
3. Sight across the basket, imagining a line from the pin or mark on one side to the pin or mark on the other side. Make sure the middle of the dowels falls exactly along that line.

After dowels have been placed, an inspector must check basket spacing, alignment, and skew.

Las dovelas deben ser posicionadas y alineadas perfectamente, de tal forma que cuando las juntas se abran en el invierno y se cierran en el verano debido a la contracción y expansión del concreto, el pavimento a cada lado de las juntas se puede deslizar a lo largo de las dovelas.

Si una varilla de las dovelas no está bien alineada al cruzar la junta, el pavimento no se puede deslizar. Los esfuerzos resultantes pueden agrietar el pavimento.

Colocación de la canasta

Después de que la sub-base ha sido adecuadamente afinada e inspeccionada, las canastas de dovelas deben ser colocadas en la cama del camino, perpendicular o esquinadas a la orilla del pavimento. Las varillas de la dovela deben ser cuidadosamente alineadas, horizontal y verticalmente, y las canastas fijadas con ocho estacas colocadas atrás del alambre de la canasta (relativo a la dirección del pavimento).

La ubicación de los centros de dovelas se marcan en ambos lados de la cama del camino, ya sea con pijas o con marcas de pintura. Las marcas indican el lugar donde las juntas deben ser ranuradas, asegurando que serán ranuradas a lo largo del centro del montaje de dovelas.

Revisión final

Las posiciones de las dovelas deben ser revisadas desde tres perspectivas:

1. Vista hacia lo largo del camino para asegurar que las dovelas están derechas.
2. Vista transversal de las canastas de dovelas para asegurar que todas las dovelas están niveladas.
3. Vista a lo largo de la canasta, imaginando una línea desde la pija o marca en un extremo hasta el pija o marca en el otro extremo. Asegurarse de que el centro de las dovelas cae exactamente a lo largo de la línea.

Después de que las dovelas han sido colocadas, un inspector deberá revisar el espaciamiento de las canastas, el alineamiento, y el ángulo.

Slip-form paving operations

From delivery of the concrete mixture to curing the slab, slip-form paving operations should proceed at a consistent pace. Every construction worker should have a basic understanding of the entire operation.

Wetting the grade

A dry subbase draws water from the bottom of the concrete mixture, potentially resulting in stresses in the concrete, and resulting cracking, due to differential moisture levels throughout the slab.

To help prevent these stresses, thoroughly spray the subbase with water shortly before placing the concrete. The subbase should be noticeably wet but should not have standing water.

Wetting may not be necessary after a recent rain.

Delivering the mix

When transporting the mixture from plant to construction site, the goal is to deliver well mixed, workable concrete to the construction site. It is essential that the mixture be uniform and consistent from batch to batch.

Generally, concrete mixtures are transported by dump trucks, agitator trucks, or ready-mix trucks. One factor affecting choice of transport methods is the time available for delivery. Exceeding the appropriate delivery times affects the concrete's workability. Extensive delays may make it necessary to shut down paving operations and construct a header joint (see page 7).

Dump trucks

By Iowa specifications, dump trucks generally have only 30 minutes after the concrete is mixed to deliver and place it at the job site. (If retarding admixtures are used, the supervising engineer may extend the delivery time to 60 minutes.)

Agitator trucks

Agitator trucks have an agitator paddle inside the truck box.

If the paddle is not rotating, the vehicle is no different from a dump truck, and the 30-minute rule applies. If the paddle is constantly rotating, agitator trucks generally have up to 90 minutes from initial mixing to delivery.

Operaciones de pavimentación con cimbra deslizante

Desde el envío de la mezcla de concreto hasta el curado de la losa, las operaciones de pavimentación con cimbra deslizando deben proceder a un paso consistente. Cada trabajador debe tener un conocimiento básico de la operación completa.

Humedeciendo el terreno

Una sub-base seca absorbe agua de la parte inferior del concreto fresco, lo cual potencialmente genera esfuerzos en el concreto, que crean grietas debido a humedades diferenciales en la losa.

Para ayudar a prevenir estos esfuerzos, se debe humedecer la superficie de la sub-base con agua justo antes de la colocación del concreto. La sub-base debe estar apreciablemente mojada pero sin charcos.

El humedecimiento pudiera no ser necesario debido a lluvia reciente.

El envío de la mezcla

Cuando la mezcla es transportada desde la planta hasta el lugar de construcción, el objetivo es que la misma este bien mezclada y trabajable. Es esencial que la mezcla sea uniforme y consistente de carga a carga.

Generalmente, las mezclas de concreto son transportadas por camiones de volteo, camiones agitadores, o camiones revolvedores. La diferencia principal entre estos métodos de transporte es el tiempo disponible para el envío. Excederse en los tiempos de envío afecta la trabajabilidad del concreto. Retrasos importantes pueden hacer necesario detener las operaciones de pavimentación.

Camiones de volteo

Los camiones de volteo generalmente disponen de 30 minutos desde que el concreto es mezclado y su entrega en el lugar de la obra. (si se usan aditivos retardantes, el ingeniero supervisor puede extender el tiempo de envío a 60 minutos.)

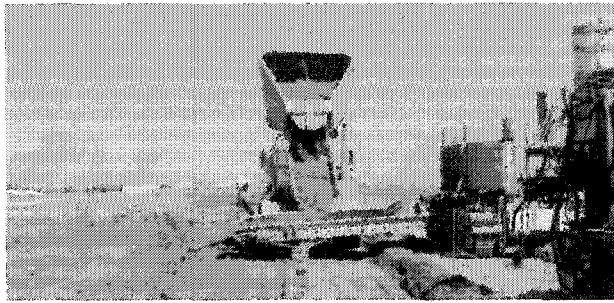
Camiones agitadores

Los camiones agitadores tienen un alabe agitador dentro de la caja del camión.

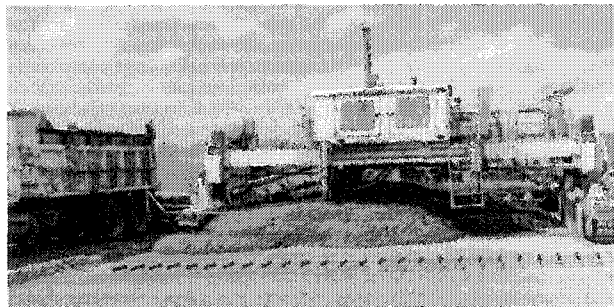
Si el alabe no esta activado, el camión no difiere de uno de volteo y la regla de los 30 minutos aplica. Si el alabe esta continuamente activado, los camiones agitadores generalmente disponen de hasta 90 minutos desde la mezcla inicial hasta la entrega final.



Top to bottom: ready-mix truck, dump truck with agitator paddle, mixture in front of paver



De arriba a abajo: Camión revoledor, camión de volteo con alabe agitador, mezcla enfrente de la pavimentadora



Ready-mix trucks

Ready-mix trucks can be used for both mixing and delivery. They are most commonly used for dry batch operations and lower-volume paving projects, such as urban paving.

They generally have up to 90 minutes from initial mixing to delivery.

Placing the concrete

To prevent differential compaction that can interfere with good drainage, haul trucks should not be driven on the subbase. If the grade provides adequate space, delivery vehicles should deliver the concrete mixture from the side of the area to be paved.

The mix is deposited, from off the grade, in front of the paver. It may be deposited by a belt placer or by the "Iowa special" method.

Camiones revoladores

Los camiones revoladores pueden ser usados para ambas, la mezcla y el envío. Estos camiones son comúnmente usados para operaciones de carga seca y proyectos de pavimentación de bajo volumen, tales como pavimentación urbana.

Estos camiones generalmente disponen de hasta 90 minutos desde el mezclado inicial hasta la entrega final.

Colocación del concreto

Después de que la sub-base ha sido compactada, afinada y humedecida, no debe permitirse el tráfico sobre la misma. De ser posible, los camiones que acarrean la mezcla de concreto, deben suministrarlo desde un lado del área por pavimentar.

La mezcla es depositada directamente sobre el terreno enfrente de la pavimentadora, por medio de una banda transportadora o por el método "Especial de Iowa".

A belt placer conveys concrete from the delivery trucks to the middle of the paving area just in front of the paver. The "Iowa special" conveys concrete from haul trucks to the area just behind the trimmer and ahead of the paver.

(Modified subbase and special backfill may be specified on some projects; it can be driven on for concrete delivery and deposit.)

Spreading and consolidating the concrete

Slip-form paving is used when large amounts of concrete must be placed efficiently. Unlike fixed-form paving, where stationary forms are constructed to hold the concrete mixture, slip-form pavers form and consolidate fresh concrete while they travel.

Slip-form pavers should be operated at a consistent speed. This helps provide steady productivity and a smoother pavement. Maintaining a consistent speed is tied to scheduling the appropriate number of concrete delivery trucks. If there are too few, the paver will have to slow down or stop. If there are too many, they may get backed up at the construction site.

The slip-form paver/finishing machine has three main parts: augers, vibrators, and profile pan.

Augers

Augers—large horizontal screws in front of the paver—spread the concrete sideways across the width of the pavement to create uniform depth ahead of the pan.

The paver should maintain a uniform head of concrete (not too big and not too small) in front of the augers. A large head of concrete can cause the paver to rise, creating a bump in the finished pavement. On the other hand, too little concrete at the augers can leave voids at the edge of the pavement. If this happens, the paver has to be stopped and the voids filled.

Vibrators

Vibrators consolidate the concrete as it is being placed.

In Iowa, large projects require electronic vibrator monitoring systems that display vibrator frequencies. Monitoring the frequencies allows crews and inspectors to detect and correct under- or over-vibration.

Under-vibration may leave large pockets or voids in the concrete. Over-vibration may cause aggregate to settle, causing variations in consistency and strength within the concrete slab. It can also cause loss of entrained air, which can reduce pavement life and durability.

La banda toma el concreto desde el camión y lo deposita al centro del tramo justo enfrente de la pavimentadora. El "Especial de Iowa" acarrea el concreto desde el camión hasta el tramo atrás de la afinadora y delante de la pavimentadora.

(Sub-bases modificadas y rellenos especiales pueden ser especificados en algunos proyectos: Estas aceptan tráfico.)

Extendiendo y consolidando el concreto

Cuando se requiere colocar eficientemente grandes cantidades de concreto es necesario usar cimbra deslizante. A diferencia de la cimbra fija, donde cimbra estacionaria se coloca para mantener la mezcla de concreto en el lugar, las pavimentadoras con cimbra deslizante, forman y consolidan el concreto mientras avanzan.

Las pavimentadoras con cimbra deslizante deben ser operadas a velocidad consistente. Esto ayuda a mantener la producción estable y un pavimento mas liso. Mantener una velocidad consistente esta ligado a programar un numero adecuado de camiones de transporte. Si se tienen de menos, la pavimentadora trabaja mas despacio o se detiene. Si se tienen de mas, se genera una fila en la obra de construcción.

Las pavimentadoras / extendedoras tienen tres partes principales: los barrenos, los vibradores y la corona.

Barrenos

Barrenos—son grandes tornillos sin fin horizontales al frente de la pavimentadora—ellos extienden el concreto hacia lo ancho de la pavimentadora para crear un espesor uniforme de la cama del camino.

Las cuadrillas deben mantener una carga uniforme (no muy grande, no muy pequeña) al frente de los barrenos. Una carga muy grande de concreto puede hacer que la pavimentadora se levante, creando una joroba en el pavimento terminado. Por el contrario, muy poco concreto en los barrenos puede dejar huecos o vacíos en la orilla del pavimento. Si esto sucede, la pavimentadora se debe detener y los huecos rellenar.

Vibradores

Los vibradores consolidan el concreto al tiempo de su colocación. Esto elimina grandes huecos o vacíos en el concreto.

Los grandes proyectos requieren sistemas electrónicos de monitoreo vibratorio que muestran la frecuencia del vibrador. Monitorear las frecuencias permite a las cuadrillas detectar y corregir cualquier sobre o baja vibración, generalmente causados por vibradores inadecuados.

La sobre-vibración causa que los agregados se asienten, produciendo variaciones en la consistencia y en el esfuerzo en toda losa de concreto. También puede causar pérdida de aire incluido, lo cual ocasiona reducción en la vida y durabilidad del pavimento.

Profile pan

The profile pan is located behind the augers and vibrators. It trims excess concrete (also called screeding or strikeoff) at the proper elevation and smooths the surface. It can be adjusted to trim a straight grade or parabolic crown and to construct superelevations. Superelevations are horizontal pavement curves that slope to the inside of the curve. This slope is an important roadway safety feature.

The paver may include finishing equipment as well, such as oscillating screeds or V-floats.

Setting header joints

Header joints are built at the end of a section of pavement where, in the future, pavement construction will continue.

Header joints must be constructed at the end of a pour or a day's run, or if paving is delayed or will be delayed by 30 minutes or more.

Header construction (fresh concrete)

1. A header board is placed just beyond the line where the paver has pulled away from the slab.
2. Tie-bars protruding through the header board are placed into the fresh concrete and stick out beyond the board. (The protruding ends will be incorporated into the next pavement section.)
3. The header area is hand-poured, then vibrated, finished, and cured. Concrete should be well consolidated against the header board and finished with an edging tool.

Sawed header (hardened concrete)

1. The paving machine paves beyond the header location and leaves an irregular pavement end.
2. The next day, a full-depth saw cut is made at the header location and the irregular portion removed.
3. Holes are drilled into the sawed face of the pavement and tie-bars grouted into the slab.

Resuming placement at a header

- Fresh concrete header: wait at least 6 hours before resuming paving at the header.
- Headers in hardened concrete: paving may resume one hour after grouting tie bars.
- Remove header boards and all supports before resuming paving.

La Corona

La corona esta ubicada atrás de los barrenos y los vibradores. Corta el exceso de concreto (también llamado acabado) a la elevación apropiada y lisa de la superficie. Puede ser ajustada para cortar en línea recta, corona parabólica o para construir secciones transversales especiales. Las sobre-elevaciones son curvas horizontales en el pavimento que tienen la pendiente hacia adentro de la curva. La pendiente es una característica de seguridad de un camino.

La pavimentadora puede incluir equipo de acabado también, tal como acabadores oscilatorios y llanas en V.

Colocación de juntas de construcción o cabezal

Las juntas cabezal son colocadas al final de una sección de pavimento.

Estas juntas cabezal deben construirse al final de un colado o al termino de un día de trabajo, o si las operaciones se retrasan por 30 minutos o mas.

Construcción del cabezal (concreto fresco)

1. Una tabla gruesa se coloca perpendicular al pavimento justo al término de la línea donde la pavimentadora se detuvo, la tabla tiene agujeros centrados a cada 12" a lo largo.
2. Luego se colocan barras de unión corrugadas que atraviesan la tabla cabezal, mitad en el concreto fresco y mitad volando. (las puntas salientes serán incorporadas a la próxima sección del pavimento.)
3. El área del cabezal es colada a mano, vibrada, acabada y luego curada. El concreto debe ser muy bien consolidado contra la tabla cabezal y acabado con una herramienta bordeadora.

Cabezal ranurado (concreto endurecido)

1. La máquina pavimentadora pasa mas allá de la ubicación de la junta y deja una superficie irregular en el pavimento.
2. Al siguiente día, un corte a profundidad completa se hace en la ubicación de la junta y la porción irregular es retirada.
3. Agujeros son taladrados en la cara ranurada del pavimento y barras de unión se groutean en la losa.

Continuar el colado en el cabezal

- Cabezal de concreto fresco; esperar por lo menos 6 horas antes de reiniciar el colado en el cabezal.
- Cabezal en el concreto endurecido; el colado puede reiniciar una hora después del grouteo de la barras de unión.
- Remover las tablas cabezal y todos los soportes antes de reiniciar el colado.

The sawed method of header construction is preferred and generally reduces the severity of a potential bump along the header joint.

Placing tiebars during construction

When two or more lanes are placed, tie bars must be placed across the centerline or lane lines to prevent movement along the line. If the paver does not install tie bars mechanically, a crew member rides on the paver and inserts them manually. In either case, a timing device—usually a wheel of a specific circumference riding on the paver track—is used to ensure the correct spacing.

Finishing

Immediately after the paver passes, the surface is normally finished to close holes and create a tight surface. Normally, crews standing along the slab edge run finishing tools (floats and straightedges) across the surface.

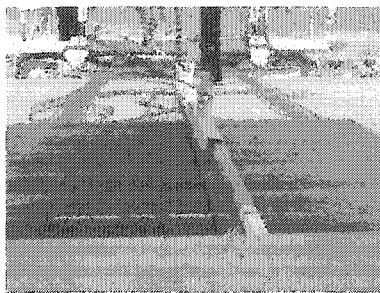
If the concrete is not workable, crews tend to overwork the surface or add water in an effort to close the finish. Both overfinishing and adding water, however, can cause surface scaling, reducing the pavement's long-term durability.

Never add water to the pavement surface. If the concrete is not workable, notify the project manager so the concrete mixture and/or the paver can be adjusted for better concrete workability.

Texturing

After finishing, two operations are used to create micro-texture (to provide adequate surface friction during dry weather) and macro-texture (to help prevent hydroplaning during wet weather).

Micro-texture is created by dragging astroturf along the roadway. Finally, macro-texture is created with a tining device or rake that makes transverse or longitudinal grooves in the wet pavement surface. The orientation, depth, and spacing of the grooves are specified for each job.



Longitudinal tining

Ranurado longitudinal

El método de ranurado para la construcción de cabezales es preferido ya que reduce la severidad del bordo a lo largo de la junta cabezal.

Colocación de las barras de unión durante la construcción

Cuando dos carriles se cuejan separadamente, barras de unión deben ser instaladas transversal a la línea de centros para prevenir separación a lo largo de la línea. Si la pavimentadora no instala las barras de unión mecánicamente, un miembro de la cuadrilla viaja en la pavimentadora y las inserta manualmente. En cualquier caso, un instrumento de tiempo—usualmente una rueda de circunferencia específica montada en el carril de la pavimentadora—es usado para asegurar el espaciamiento correcto.

Acabado / texturizado

Inmediatamente después de que la pavimentadora pasa, se da el acabado a la superficie para cerrar oquedades y crear una superficie cerrada. Algunas veces esto se logra arrastrando una manta ligeramente mojada atrás de la pavimentadora. Otras veces, las cuadrillas ubicadas a la orilla de la losa le dan el acabado a la superficie utilizando herramienta especializada.

Si el concreto no es trabajable, las cuadrillas tienden a sobre trabajar la superficie o agregar agua en su esfuerzo para dar el acabado. Si esto sucede, notificar al gerente de proyecto para que la mezcla de concreto y/o la pavimentadora puedan ser ajustados para mejorar la trabajabilidad.

Nunca se debe agregar agua a la superficie de concreto del pavimento. Ambas sobre-acabado y agregar agua pueden ocasionar que la superficie se desquebraje, por tanto reduciendo su durabilidad a largo plazo.

Finalmente, un instrumento de texturizado forma ranuras longitudinales o transversales en la superficie fresca del pavimento. El ranurado aumenta la tracción de las llantas. La orientación, profundidad, y espaciamiento del ranurado son especificados para cada proyecto. En general ranuras muy superficiales resultan en pavimentos más silenciosos.

Curado

Es muy importante proteger la humedad en el concreto inmediatamente después del colado.

La humedad en el concreto se protege con un curado apropiado—esto es, aplicando un compuesto de curado uniformemente sobre la superficie y las orillas expuestas del concreto para sellarlo y así retardar la evaporación del agua.

El curado preserva el agua para la hidratación del cemento, maximizando la resistencia del pavimento y su durabilidad. También ayuda a prevenir que la superficie se seque más rápidamente que el resto de la losa, reduciendo así

Curing

The importance of managing moisture and in concrete immediately after placement cannot be overemphasized.

Concrete moisture is managed primarily through proper curing—that is, by applying curing compound uniformly to the entire surface and exposed edges of the concrete to slow the evaporation of mix water into the atmosphere.

Curing preserves water for hydration, maximizing pavement strength and durability. It also helps prevent the surface from drying out more quickly than the rest of the slab, reducing the possibility of surface damage due to differential shrinkage. (The appearance of small, plastic shrinkage cracks on the concrete surface is a sign that moisture has evaporated too quickly.)

Insulating

If air temperatures drop quickly during the first night after placement, the concrete surface will cool quickly compared to the rest of the concrete. Such extreme temperature variations in the slab can cause concrete to change volume at different rates (differential thermal contraction), which in turn can cause tensile stress and random cracking in the slab.

Covering the new concrete can help reduce extreme variations in temperature throughout the depth of the slab.

Jointing

Why joints are important

Joints help relieve stresses in concrete in a controlled fashion, preventing random cracking and other potential problems. An effective, well constructed pattern of joints

- allows concrete to crack at predetermined locations,
- improves pavement durability and extends pavement life, and
- helps divide pavement into traffic lanes.

Rules of thumb

- Follow the joint layout on project plans. The engineer must approve any change.
- If joint layout plans are not available, work with the engineer.

la posibilidad de daño a la superficie debido a contracciones diferenciales. (la aparición de pequeñas grietas de contracción plástica en la superficie del concreto es una señal segura de que la humedad se está evaporando muy rápidamente.

Aislamiento

Si la temperatura del aire baja rápidamente durante la primera noche después del colado, la superficie del concreto se enfriará muy rápido comparado con el resto del concreto. Tal variación extrema en la losa puede ocasionar que el concreto cambie de volumen a tasas diferentes (contracción termal diferencial), lo cual causa esfuerzos de tensión y agrietamiento irregular en la losa.

Cubriendo el pavimento fresco con mantas de aislamiento (capas múltiples de lona y sabanas de polietileno) ayuda a reducir las variaciones extremas de temperatura.

Ranurado de juntas

Porque la juntas son importantes

Las juntas ayudan a aliviar los esfuerzos en el concreto de una manera controlada, previniendo agrietamiento de forma irregular y otros problemas potenciales. Un sistema de juntas efectivo y bien construido:

- Permite al concreto agrietarse en lugares predeterminados
- Mejora la durabilidad del pavimento y extiende su vida útil, y
- Ayuda a dividir el pavimento en carriles de tráfico

Reglas de dedo

- Construya las juntas de acuerdo a los planos de proyecto. El ingeniero debe aprobar cualquier cambio
- Si no hay planos de juntas, pregúntele al ingeniero.

Las juntas pueden ser:

- Ranuradas con sierra en concreto duro
- Formadas en concreto fresco con un junteador longitudinal, o
- Construidas (como en las juntas cabezal)

La siguiente información se enfoca en la construcción de juntas a base de cortes con sierra.

Juntas ranuradas

Aunque el ranurado convencional es usado en algunos proyectos, ranurar a una temprana edad en el concreto se está convirtiendo en una norma en los proyectos del Iowa DOT.

Joints are either

- sawed into hardening concrete,
- formed in plastic concrete with a longitudinal joint former,
- constructed (as in header joints) where new pavement abuts existing pavement, or
- occur where new pavement abuts existing pavement.

The following information focuses on constructing joints with saw cuts.

Sawing joints

Although conventional saws are still used on some projects, early-age sawing is fast becoming the norm on Iowa DOT projects.

Transverse contraction joints

Early-age saw cuts should be stopped just short of the pavement edge to prevent “blowing out” spalls at the slab edge and to prevent joint sealant from flowing out of the joint end. Once the crack forms at the joint, it will easily proceed through the small uncut portion of the slab.

Longitudinal contraction joints

Most longitudinal joints are constructed by conventional sawing. (Iowa DOT specifications and Iowa’s statewide urban specifications do not allow early-age sawing of longitudinal joints.)

However, new techniques are being tested to “form” a joint by way of a small knife pulled through the concrete by the slipform paver.

Expansion joints

All expansion joints are sawed or formed.

Saw cut timing (“sawing window”)

There is a brief period of time—the “sawing window”—during which joints can be sawed successfully.

Begin saw cuts after the concrete has hardened enough to permit sawing without raveling or moving aggregates. You must finish saw cuts before random, uncontrollable cracking takes place.

With conventional saws, the window generally begins 8 to 12 hours after placement, depending on weather conditions and mixture properties.

If light, early-age saws are used, the window begins as soon as walking on the pavement is permitted, generally within about 3 hours of placement.

To finish sawing joints before the window ends, it may be necessary to continue sawing operations regardless of weather or daylight conditions.

Juntas de contracción transversales

Los cortes ranurados a temprana edad deben detenerse justo antes del borde del pavimento para evitar que el concreto se quiebre en las orillas y también para evitar que el material para sellado de la junta escurra hacia fuera de la junta. Una vez que las grietas se formen en la junta, muy fácilmente continuará a través de la porción no cortada de la losa.

Juntas de contracción longitudinales

La mayoría de las juntas longitudinales se construyen por ranurado convencional. (Las especificaciones del Iowa DOT y las especificaciones urbanas en el Estado de Iowa no permiten ranurado a edad temprana del concreto en juntas longitudinales.)

Sin embargo, nuevas técnicas están siendo probadas para “formar” una junta usando un pequeño cuchillo hincado en el concreto por la pavimentadora de cimbra deslizante.

Juntas de expansión

Todas las juntas de expansión son ranuradas o formadas

El corte de ranurado (“la ventana de ranurado”)

Hay un pequeño periodo de tiempo—la “ventana de ranurado”—durante la cual las juntas pueden ser ranuradas exitosamente.

Inicia los cortes de ranura

- Después de que el concreto se ha endurecido lo suficiente para permitir el ranurado sin desmoronamiento en las orillas o sin que los agregados se muevan de su lugar, y
- Antes de que el agrietamiento sin control se empiece a producir.

En ranurados convencionales, la ventana generalmente inicia de 8 a 12 horas después del colado, dependiendo de las condiciones climatológicas y las propiedades de la mezcla.

Para ranuras tempranas y ligeras, la ventana comienza tan pronto como se pueda caminar sobre el pavimento, generalmente después de las primeras tres horas del colado

Para poder terminar el ranurado de las juntas antes de que se acabe la ventana, puede ser necesario continuar las operaciones sin importar las condiciones meteorológicas o la hora del día.

Si grietas se presentan delante de la ranura, el ranurado debe detenerse. Corte la ranura para el sello de la junta más tarde a lo largo de la grieta.

If cracks develop ahead of a saw, stop sawing that joint. Later, use crack saws to form joint-sealant reservoirs along the crack line.

Depth of saw cuts

The joint layout plans should indicate the width and depth of saw cuts. The design depth of saw cuts is the minimum depth required to create a properly functioning joint.

Cuts that are too shallow may not relieve stresses adequately, allowing random cracks to occur. Cuts that are unnecessarily deep require additional effort (take longer), cause unnecessary equipment wear, and reduce aggregate interlock.

In general, conventional saw cuts are 1/3 of the pavement thickness.

Effect of aggregate on saw cutting

Hard aggregates like river gravel, quartzite, or granite do not saw easily and can dull or damage saw blades more quickly than other aggregates.

Sawing concrete made with hard aggregate will require more time, so sawing should begin as soon as possible and may require additional saw operators.

Cleaning and sealing joints

Within three hours of sawing, joints must be cleaned to remove incompressible residue, such as saw-cut swarf, soil, sand, or gravel. These materials in joints can prevent proper sealant adhesion, resulting in joints that do not function properly.

After wet-sawing, flush the residue away with a high-pressure water blast. After dry-sawing, residue can be flushed away with high-pressure air. If joints are 3/8-inch wide or wider, the joint faces must be sandblasted before sealing, per Iowa DOT specifications.

Sealing joints prevents water and incompressible materials from moving into the joint space, ensuring proper joint performance (expansion and contraction) and preventing freeze-thaw damage at the joint.

Place joint sealer only when the joint surfaces appear dry and the pavement and surrounding air temperature are 40 degrees F (4 degrees C) or higher. Most sealants are approved by manufacturer and product name.



Profundidad de los cortes de la ranura

Lo planos de arreglo de juntas deben indicar el espesor y la profundidad de los cortes de ranura. La profundidad de diseño de los cortes debe ser la profundidad mínima requerida para crear una junta perfectamente funcional.

Los cortes muy superficiales pueden no aliviar los esfuerzos adecuadamente, propiciando el agrietado sin control. Los cortes innecesariamente muy profundos requieren esfuerzo adicional (se tarda demasiado), causa desgaste innecesario en el equipo y reduce el amarre de las partículas del agregado.

En general los cortes convencionales de ranuras son de 1/3 del espesor del pavimento.

Efecto del agregado en el ranurado

Agregados duros, tales como grava de río, cuarcita, o granito, no se pueden ranurar fácilmente y pueden desafilarse y aun dañar las cuchillas más rápidamente que otros agregados. Ranuras que deben hacerse sobre agregados duros deben iniciarse tan pronto sea posible.

Limpieza y sellado de Juntas

Dentro de las tres horas siguientes al ranurado, las juntas deben ser limpiadas para remover el residuo incompresible tal como polvo del corte, suelo, arena, o grava; estos materiales pueden prevenir que la junta funcione adecuadamente.

Después del ranurado utilizando agua, el residuo debe ser retirado con chorro de agua a alta presión. Después del ranurado en seco, el residuo puede ser retirado con aire a alta presión. Si las juntas son de 3/8" de espesor o más anchas, estas deben ser limpiadas a base de chorro de arena a presión.

El sellado de las juntas previene que el agua y material incompresible se introduzca en la junta, asegurando así un desempeño apropiado de la junta (expansión y contracción) y evitando daño a la punta por el efecto congelación-deshielo.

Coloque el sellador de junta solamente cuando la superficie de la misma esta seca y la temperatura del pavimento y del aire es 40 grados F (4 grados C) o más alta. La mayoría de los selladores son aprobados por productor y por nombre de producto.

Cleaning joints with high-pressure air
Limpieza de juntas con aire a alta presión

Special weather considerations

Cold weather paving

Definición

Air temperature of 38 degrees Fahrenheit or less (3 degrees Centigrade)

Challenges

During cold weather, hydration slows, slowing strength development. Concrete cools faster at the surface than inside the slab, causing stress in the slab. If the stress is severe enough, the slab will crack randomly.

Precautions

- Do not pave on frozen subgrade.
- Do not use aggregates with frozen lumps.
- Heat materials to raise concrete temperature and promote hydration.
- Minimize use of fly ash and slag. (Note: Class C fly ash from some sources may not retard the set.)
- Do not pave if air temperature is 38°F (3°C) or less and falling.
- Do not pave if the concrete cannot reach adequate strength before it freezes.
- Resume paving only when weather permits and air temperature is 34°F (1°C) and rising.
- Pave only if fresh concrete temperature is 40°F or greater.
- If concrete is less than 36 hours old, protect it with insulating material.

Hot, dry weather paving

Definición

Temperature above 90 to 95°F (32 to 35°C), low relative humidity, high wind speed, sunny conditions

Challenges

- Concrete loses moisture more rapidly during hauling and placing.
- Aggregate stockpiles dry out, affecting the consistency of stockpile moisture between batches.
- The pavement subbase dries out before the mixture is placed, then absorbs water from the mixture.
- Rapid water evaporation at the pavement surface can result in shrinkage cracks.

Condiciones especiales de clima

Pavimentando en clima frío

Definición

Temperatura de aire de 38 grados Fahrenheit o menos (3 grados Centígrados).

Retos

En clima s fríos, la hidratación se hace lenta, retardando el desarrollo de la resistencia del concreto. El concreto se enfría mas rápido en la superficie que dentro de la losa, causando esfuerzos en la misma. Si los esfuerzos son grandes, la losa se puede agrietar sin control.

- No pavimentar sobre la terracería congelada.
- No usar agregados con trozos congelados.
- Calentar los materiales para aumentar la temperatura y facilitar la hidratación.
- Minimizar el uso de la ceniza volante y escoria.
- No pavimentar si la temperatura del aire es 38° F (3° C) o menos y disminuyendo.
- No pavimentar si el concreto no alcanza suficiente resistencia antes de que se congele.
- Continuar el pavimento solamente cuando el tiempo lo permite y la temperatura del aire 34° F (1° C) y esta aumentando.
- Pavimentar solamente si la temperatura del concreto fresco es de 40° F o mayor.
- Si el concreto tiene 36 horas o menos, protegerlo con material aislante.
- Una vez detectados los problemas con alta temperatura, ya es muy tarde para resolverlos.

Pavimentando en clima seco y caliente

Definición

Temperatura arriba de 90 a 95° F (32 a 35° C), baja humedad relativa, alta velocidad del viento y condiciones soleadas.

Retos

- El concreto pierde humedad mas rápidamente durante el acarreo y la colocación.
- Las pilas de agregados y la sub-base del pavimento se pueden secar y entonces absorber agua de la mezola.
- La rápida evaporación en la superficie del pavimento resulta en grietas por contracción.
- Es mas difícil mantener el aire incluido cuando las temperaturas son altas. El aire incluido es importante par la durabilidad del pavimento.

- It's more difficult to entrain air when temperatures are high. Entrained air is important for pavement durability.
- Concrete sets rapidly, perhaps twice as fast, making finishing more difficult.

Once heat-related problems develop, it may be too late to fix them.

Precautions

- If possible, do not pave in very hot, dry weather.
- Pave in the morning, evening, or night when it's cooler.
- Maintain uniform moisture in stockpiles.
- Use retarders in the mixture to slow hydration.
- Use fly ash and slag in the mixture to slow hydration. (Caution: Class C fly ash may not retard the set.)
- Keep subbase, forms, and equipment damp and cool.
- Use additional curing compound.

Rain

Challenges

- Before final set, rain can damage the new pavement surface by leaving imprints or washing away paste at the surface.
- After final set, rain can induce rapid cooling at the surface, leading to rapid development of thermal restraint stresses and possibly early-age, uncontrolled cracking.

Precautions

If it starts to rain during operations,

- Stop batching and placing operations and cover the fresh concrete immediately with protective coverings like polyethylene sheeting or burlap. (Do not try to remove extra surface water first. Do not add dry cement or floating dry cement to the surface.)
- As soon as the surface has dried, apply curing membrane.
- After the curing period, diamond grind may be required to remove surface blemishes and provide texture. any surface exposed to rain where damage has occurred.



- El concreto fragua rápidamente, tal vez doblemente rápido, haciendo el acabado mas difícil.

Precauciones

- Si es posible no pavimentar en clima muy seco y caliente.
- Pavimentar en la mañana, en la tarde, o en la noche cuando este mas fresco.
- Mantener humedad uniforme en los almacenes.
- Usar retardantes en la mezcla para desacelerar la hidratación.
- Usar ceniza volante y escoria en la mezcla para retardar la hidratación.
- Mantener la sub-base, la cimbra y el equipo húmedo y fresco.
- Usar compuestos adicionales para el curado.

Lluvia

Retos

- Antes del fraguado final, la lluvia puede dañar la superficie del nuevo pavimento dejando huellas o lavando la pasta en la superficie.
- Después del fraguado final, la lluvia puede inducir un enfriamiento superficial, creando el rápido desarrollo de esfuerzos restrictivos y posiblemente agrietamiento no controlado a edad temprana.

Precauciones

Si empieza a llover durante las operaciones,

- Detener las operaciones de colado y cubrir el concreto fresco inmediatamente con cubiertas protectoras tal como hojas de polietileno o cobertores de lona. (No trate de drenar los charcos. No agregue cemento seco o cemento seco flotante a la superficie.)
- Tan pronto como se seque la superficie, aplique membrana para curado.
- Después del periodo de curado, desbastar con cuchilla de diamante la superficie expuesta a la lluvia para remover cualquier área dañada y proveer textura.

A heavy rain before final set can wash away cement paste and expose coarse aggregates.

Una lluvia abundante antes del fraguado final puede deslavar partes de la superficie del pavimento.

Troubleshooting

General Problems Problemas Generales	Potential Result (s) Resistencia: Potenciales	Possible Cause(s) Causas Posibles	What to do? Qué Hacer?
False set Falso fraguado	Stiff, unworkable mixture Mezcla dura, no trabajable	Form of gypsum in cement and/or admixture incompatibility Algo de yeso en el cemento y/o incompatibilidad del aditivo	Perform additional mixing Dar mezclado adicional
Flash set Fraguado rápido	Reduced workability, poor rapid set (can not be fixed) Trabajabilidad reducida, consolidación pobre, fraguado rápido (no se puede arreglar)	Low gypsum content in Portland cement Bajo contenido de yeso en el cemento Portland	Get new supply of Portland Cement Abastecerse de nuevo cemento Portland
Equipment breakdown Descompostura de equipo	Costly reductions in productivity and pavement quality Reducciones costosas en productividad y calidad del pavimento	Poor maintenance Mantenimiento pobre	Maintain equipment regularly Dar mantenimiento regular al equipo
High water/cement (w/c) ratio Alta relación agua/cemento (a/c)	Reduced strength; layers with different strengths Disminución de la resistencia; capas con diferente resistencia	Adding water on site Agregar agua en el sitio	Reduce water added at plant if it will be added on site Reducir el agua en la planta si se le agregará en el sitio
Inadequate consolidation and workability Consolidación y trabajabilidad inadecuadas	Reduced strength and durability Resistencia y durabilidad reducidas	Vibrator problems; inadequate mixing Problemas con el vibrador; mezclado inadecuado	Monitor vibrators for compliance and repair as needed; provide adequate mixing Revisar los vibradores y repararlos según se requiera; mezclar adecuadamente
Inadequate entrained air Aire incluido inadecuado	Reduced concrete durability; possible negative effect on pay factors Reducción en la durabilidad del concreto; posible efecto negativo en los factores de pago	Weather, time, and finishing El clima, la duración, y el acabado	Monitor consistently, especially on extreme weather days Revisar consistentemente, especialmente en días de clima extremo
Dips in pavement profile; variations in slab thickness Caída en el perfil del pavimento; variaciones en el espesor de la losa	Reduced pavement smoothness; Variations in durability Se reduce la finura del pavimento; variaciones en durabilidad	Moved or otherwise disturbed stringline Cordel movido de su lugar o dañado	Monitor stringline regularly; notify supervisor of stringline disturbances Revisar el cordel regularmente, notificar al supervisor de daños al cordel
Bumpy, rutty haul road Camino de acceso dañado con baches	Increased mix delivery time; reduced productivity Aumento en el tiempo de la entrega; reducción en la productividad	Poorly maintained haul road Mal mantenimiento al camino de acceso	Maintain road before construction as needed (with permission) Dar mantenimiento al camino de acceso antes de la construcción (con permiso)
Sudden weather change: rain Cambio súbito en el clima: lluvia	Increased w/c ratio and finishing problems; reduced durability Se incrementa la relación agua / cemento (a/c), problemas con el acabado, y reduce la durabilidad		Stop paving if weather is outside allowable specs Detener el colado si el clima se sale de las especificaciones
Sudden weather change: cold front Cambio súbito en el clima: frente frío	Stresses due to sudden temperature change that can result in increased random cracking Esfuerzos debido al cambio súbito en la temperatura pueden resultar en el agrietamiento sin control		Protect fresh concrete with additional curing; consider insulation Proteger el concreto fresco con curado adicional; considerar aislamiento

Hot and Cold Weather Clima Caliente y Frío	Characteristics Características	Possible Effect(s) and Problem(s) Posibles Efecto(s) y Problema(s)	What to do? Que Hacer?
Hot and Dry Caliente y Seco	High air temp (above 90 to 95 degrees F or 32 to 35 degrees C); low relative humidity; high wind speed; sunny Alta temperatura del aire (arriba de 90 a 95 F o 32 a 35 C), humedad relativa baja, alta velocidad del aire, soleado -	High rate of water evaporation from mixture, especially with hot concrete (above 90 degrees F) • Dry stockpiles • Rapid slump loss • Long-term strength loss due to added water • Rapid setting; less time for finishing Rápida evaporación de agua de la mezcla, especialmente con concreto caliente (arriba de 90 F) • Agregados secos • Pérdida rápida de revestimiento • Pérdida de resistencia a largo plazo por el agua agregada • Fraguado rápido, menos tiempo para el acabado	<ul style="list-style-type: none"> • If possible, do not pave in very hot, dry weather. • Plan ahead (once problems are noticed, it may be too late to correct them). • Pave in the morning, evening, or night. • Maintain stockpile moisture. • Keep subbase and/or forms damp and cool. • Keep equipment cool. • Take extra care with curing; use additional curing compound. <p>• Si es posible, no pavimentar en clima muy caliente y seco • Anticipa y toma medidas a tiempo (una vez que los problemas aparecen, puede ser muy tarde para corregirlos) • Pavimenta en la mañana, ya tarde, o en la noche. • Mantén los agregados húmedos. • Mantenga la sub-base y/o las formas húmedas y frescas. • Mantenga el equipo fresco. • Tome especial cuidado con el curado y use compuestos adicionales</p>
Cold Frío	Low air temp (below 40 to 50 degrees F or 5 to 10 degrees C) Baja temperatura de aire (abajo de 40 a 50 F o 5 a 10 C)	<ul style="list-style-type: none"> • Low heat of hydration; very slow set • Frozen concrete mixture • Low strength gain (no gain below 14 degrees F) • Increased concrete permeability <p>• Baja calor de hidratación, fraguado muy lento • Mezcla de concreto congelado • Bajo aumento de resistencia (no aumento debajo de 14 F) • Reducción en la durabilidad del concreto. Aumento en la permeabilidad del concreto</p>	<ul style="list-style-type: none"> • If possible, do not mix or pave in very cold weather. • Heat materials <p>• Proteger el pavimento con cubiertas aislantes • Si es posible, no mezclar o pavimentar en clima muy frío. • Calentar los materiales. • Proteger el pavimento con cubiertas.</p>
Sawing problems Problemas de ranurado	Potential Result (s) Resultado(s) Potenciales	Possible Cause(s) Causas Posibles	What to do? Que Hacer?
Cracks form before sawing Las grietas se forman antes del ranurado	Random, irregular cracks Grietas irregulares sin control	Sawing too late Ranurar demasiado tarde	Stop sawing; use crack saw along cracks; clean and seal. Detener el corte; ranurar a lo largo de las grietas; limpiar y sellar
Cracks form during sawing, in front of the saw Las grietas se forman durante el ranurado, enfrente del corte	If sawcutting continues, the cut will not function correctly; this could lead to spalling and other performance problems Si el ranurado continua, el corte no funcionara correctamente; esto puede provocar el concreto se despostilla y otros problemas	Sawing too late Ranurar demasiado tarde	Stop sawing; use crack saw along cracks; clean and seal. Detener el corte; ranurar a lo largo de las grietas; limpiar y sellar.
Sawcut ravel during sawing El corte se desmorona durante el ranurado	Spalled joints Juntas despostilladas	Sawing too early Ranurar demasiado pronto	Stop sawing and wait for more strength to develop in the concrete. Detener el corte y esperar a que el concreto adquiera mayor resistencia
Joint face ravel or spalls La cara de la junta se desmorona o se despostilla	Poor joint performance Mal desempeño de las juntas	Sawcutting performed too early; poor sawcutting operation; joint area not cured properly Ranurar demasiado pronto; mala operación de ranurado; el área de la junta no ha sido curada apropiadamente	Apply curing compound after first cut; review sawcutting operations; review joint face curing process. Aplicar compuesto para curado después del primer corte; revisar las operaciones de ranurado; revisar el proceso de curado de las caras de las juntas

Sealing problems Problemas de sellado	Potential Result (s) Resultado(s) Potenciales	Possible Cause(s) Causas Posibles	What to do? Que Hacer?
Poured joint sealant does not adhere El sellador aplicado a la junta no se adhiere	Water or residue may enter joint, causing freeze-thaw damage or other poor joint performance El agua o los residuos pueden entrar a la junta, causando daño por congelación-deshielo o algún otro daño	Joint face is dirty; joint shape factor is incorrect La cara de la junta esta sucia; el factor de forma de la junta es incorrecto	Check joint face for cleanliness; check joint shape factor; replace sealer. Revisar que la junta este limpia; revisar el factor de forma de la junta; reemplazar el sellador
Poured joint sealant fails (it is not cohesive) El sellador aplicado a la junta falla (no se adhiere)	Water or residue may enter joint, causing freeze-thaw damage or other poor joint performance El agua o los residuos pueden entrar a la junta, causando daño por congelación-deshielo o algún otro daño	Poor sealant properties due to over or under heating Propiedades pobres del sellador debido al sobre o bajo calentamiento	Reduce heat; apply proper heat; use insulated hoses; replace sealant Reducir el calor; aplicar el calor apropiado; usar mangueras con aislamiento; reemplazar el sellador
Preformed sealant is loose El sellado preformado esta suelto	Water or residue may enter joint, causing freeze-thaw damage or other poor joint performance El agua o los residuos pueden entrar a la junta, causando daño por congelación-deshielo o algún otro daño	Sealant is not sized properly; joint too wide; stretched sealant El sellador no esta dimensionado apropiadamente; la junta esta demasiado ancha; sellador estirado	Use properly sized sealant (check joint width); check sealant quality; review installation procedure. Usar el sellador apropiadamente dimensionado (revisar el ancho de la junta); revisar la calidad del sellador; revisar el procedimiento de instalación

Authors and reviewers

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About the oversight committee

To ensure the quality and accuracy of Concrete Paving Notes, a PCC Center committee oversees their development, reviews drafts, and provides technical input.

Committee members include the following:

Chris Brakke	Iowa Department of Transportation
Marcia Brink	Center for Transportation Research and Education, Iowa State University
Jim Cable	Iowa State University
Tom Cackler	PCC Center
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Todd Hanson	Iowa Department of Transportation
Gordon Smith	Iowa Concrete Paving Association
Harold Smith	PCC Center
Bob Steffes	PCC Center
Kejin Wang	Iowa State University

Employees of local transportation agencies and Iowa contractors also review drafts and provide feedback to ensure the notes (1) provide useful technical information, (2) are easy to understand, and (3) are valuable educational tools for staff training and development.

ConcreteNotesConstruction1.pmd June 2004

APPENDIX E

COURSE EVALUATION RESULTS:

QUESTIONNAIRES

ENGLISH AS A SECOND LANGUAGE

SPANISH AS A SECOND LANGUAGE

STEPPING UP TO SUPERVISOR

**ESL: CURSO DE SUPERVIVENCIA
EVALUACION**

Personal	Nombre de su compañía: _____	Teléfono: _____
	Su nombre: _____	Fecha: _____
	Ocupación: _____	

Contenidos del Curso	¿Cómo estuvo el contenido general del curso? <input type="checkbox"/> Muy básico <input type="checkbox"/> Normal <input type="checkbox"/> Muy difícil
	¿El orden de los temas fue fácil de seguir? <input type="checkbox"/> Si <input type="checkbox"/> No
	¿Qué tanta información presentada será útil para tu trabajo? <input type="checkbox"/> Toda <input type="checkbox"/> La mayoría <input type="checkbox"/> Un 50% <input type="checkbox"/> Alguna <input type="checkbox"/> Nada
	¿De la información que recibiste, cuál es la más útil? _____ _____
	¿De la información que recibiste, cuál es la menos útil? _____ _____

Instructor & Asistente	Nombre del Instructor (1): _____	Nombre del Asistente (2): _____										
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		<u>Deficiente</u>	<u>Justo</u>	<u>Bueno</u>	<u>Excelente</u>							
		(1) (2)	(1) (2)	(1) (2)	(1) (2)							
	Conocimiento del tema	— —	— —	— —	— —							
	Se comunicó claramente	— —	— —	— —	— —							
Usó herramientas efectivas	— —	— —	— —	— —								
Respondió bien a preguntas	— —	— —	— —	— —								
¿Cómo calificarías el interés de los instructores en capacitarte? <input type="checkbox"/> Sin interés <input type="checkbox"/> Imparcial <input type="checkbox"/> Con interés <input type="checkbox"/> Muy interesado												

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	¿El curso fue lo que esperabas? Comentarios: _____																
	¿Valió la pena el tiempo invertido? Comentarios: _____																
¿Sientes que tu confianza mejoró? Comentarios: _____																	
¿Recomendarías este curso a otros? <input type="checkbox"/> No <input type="checkbox"/> Tal vez <input type="checkbox"/> Probablemente <input type="checkbox"/> Definitivamente																	

Folletos y Facilidades utilizadas	¿Cómo calificarías los libros de trabajo? <input type="checkbox"/> Malo <input type="checkbox"/> Promedio <input type="checkbox"/> Excelente
	¿Estaban completos los libros de trabajo? <input type="checkbox"/> Malo <input type="checkbox"/> Promedio <input type="checkbox"/> Excelente
	¿Fueron específicos los libros de trabajo? <input type="checkbox"/> Malo <input type="checkbox"/> Promedio <input type="checkbox"/> Excelente
	¿Las actividades fueron útiles? <input type="checkbox"/> Malo <input type="checkbox"/> Promedio <input type="checkbox"/> Excelente
	Comentarios: _____
	¿Cómo calificarías el salón de clase y equipo? <input type="checkbox"/> Malo <input type="checkbox"/> Promedio <input type="checkbox"/> Excelente
	Comentarios: _____

La siguiente información será utilizada para mejorar el curso en todos los aspectos evaluados anteriormente para futuras oportunidades

Yo le diría a alguien que este considerando este curso que...

Este curso podría ser mejor si...

¿Qué les podrías decir a aquellos que piensan que capacitación no es necesaria? ¿Por qué debería una persona considerar participar en este curso?

**FOLLOW UP QUESTIONNAIRE
FOR HISPANIC CONSTRUCTION WORKERS
PARTICIPANTS OF THE ESL COURSE**

Conducted by: Iowa State University
Department of Civil, Construction, and Environmental Engineering

Date: _____

General Objective

The general objective of this survey is to determine the effectiveness of the ESL Survival course you have previously taken. The ultimate objective is to help Hispanic construction workers develop the ability to communicate with their supervisors in order to be active and productively engaged participants in the refinement and accomplishment of American construction companies' goals under a safe environment.

Specific Objectives

1. To determine if workers have found the ESL survival course to be useful?
2. To determine if workers have used the workbook that was given when taking the course.
3. To determine if workers remember the specific class activities.
4. To determine if workers have increased their confidence to communicate in English as it relates to their work.
5. To determine those areas of improvement for the implementation of the ESL survival course.
6. To gather background, personal, and demographic information on Hispanic construction workers.

Note: This questionnaire will take 15-20- minutes to complete.

**ESL: SURVIVAL COURSE
FOLLOW UP QUESTIONNAIRE, TWO MONTHS AFTER TRAINING**

Company's Name: _____	Phone: _____
Name : _____	Date: _____
Trade: _____	

Please circle one response for each question as applicable

- | | <u>Not at</u> | | | | | | <u>Definitely</u> |
|--|---------------|---|---|---|---|---|-------------------|
| | <u>all</u> | | | | | | |
| 1. Has the ESL survival course useful? | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Can you explain?

- | | <u>Not at</u> | | | | | | <u>Completely</u> |
|---|---------------|---|---|---|---|---|-------------------|
| | <u>all</u> | | | | | | |
| 2. Did the English course meet your needs and expectations? | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Can you explain?

	<u>Definitely</u>				<u>Definitely</u>		
	<u>no</u>				<u>yes</u>		
3. Of the information presented, I have used all of it.	1	2	3	4	5	6	7
4. The course was just what I was expecting to get.	1	2	3	4	5	6	7
5. The course was worth the time I invested in it.	1	2	3	4	5	6	7
6. I feel that my confidence has improved since taking the course.	1	2	3	4	5	6	7
7. I would recommend the course to others.	1	2	3	4	5	6	7
8. I have used the workbooks very much in my daily work.	1	2	3	4	5	6	7
9. I think the workbook was appropriate to improve my speaking capabilities.	1	2	3	4	5	6	7
10. I think the class activities were useful.	1	2	3	4	5	6	7
11. I remember what I learned through the activities I was asked to do in the classroom.	1	2	3	4	5	6	7
12. Of the information you obtained What has been the most useful?	<hr/>						
13. Of the information you obtained What has been the least useful?	<hr/>						

Question 14 thru 20 relate to your background and some personal information

14. How long have you been living in the U.S.?

___ years ___ months

15. How much construction experience did you have prior to coming to the U.S.?

___ years ___ months Trade: _____
___ years ___ months Trade: _____

16. How long have you been involved in construction in the U.S. and in what trade?

___ years ___ months Trade: _____
___ years ___ months Trade: _____

17. How old are you? _____ years old

18. What is the highest level of education you have completed?

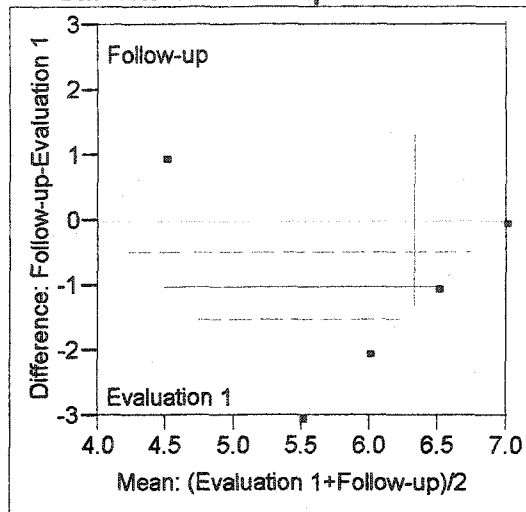
- 1 = Elementary school 4 = High school
- 2 = Middle school 5 = College
- 3 = Technical school

19. What do you consider to be your main problem on the job site?

20. What is your country of birth? _____ State: _____

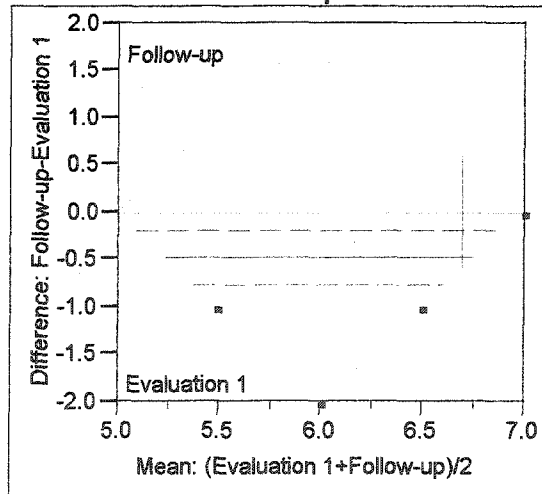
THANK YOU!

Q1 Matched Pairs
Difference: Follow-up-Evaluation 1



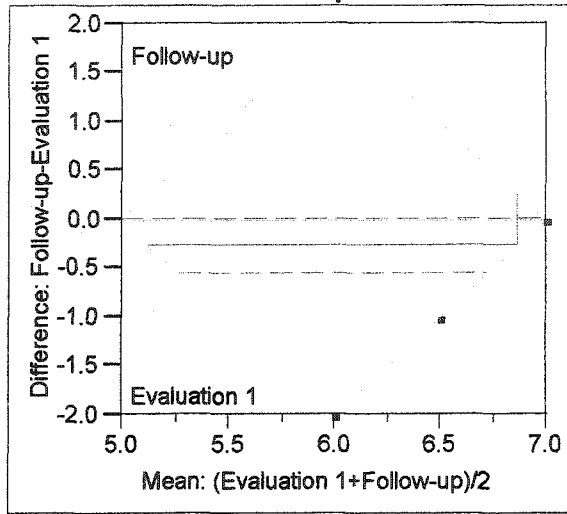
Follow-up	5.84211	t-Ratio	-3.94277
Evaluation 1	6.84211	DF	18
Mean Difference	-1	Prob > t	0.0010
Std Error	0.25363	Prob > t	0.9995
Upper95%	-0.4671	Prob < t	0.0005
Lower95%	-1.5329		
N	19		
Correlation	0.20101		

Q4 Matched Pairs
Difference: Follow-up-Evaluation 1



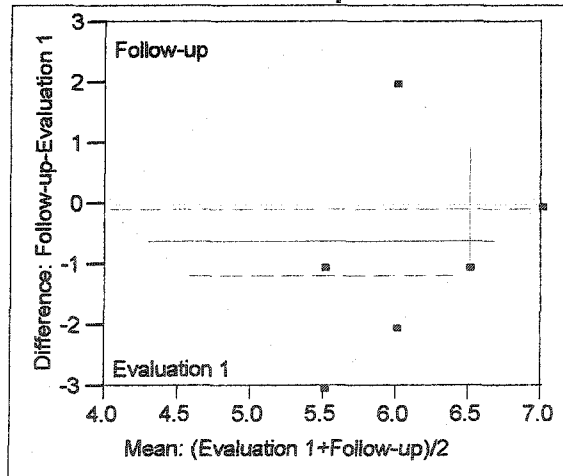
Follow-up	6.47368	t-Ratio	-3.375
Evaluation 1	6.94737	DF	18
Mean Difference	-0.4737	Prob > t	0.0034
Std Error	0.14035	Prob > t	0.9983
Upper95%	-0.1788	Prob < t	0.0017
Lower95%	-0.7686		
N	19		
Correlation	0.51223		

Q5 Matched Pairs
Difference: Follow-up-Evaluation 1



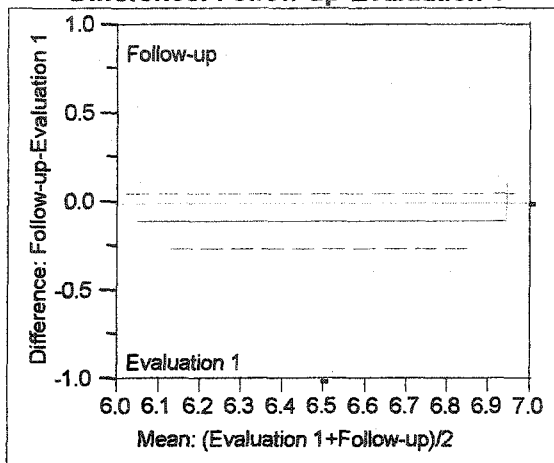
Follow-up	6.73684	t-Ratio	-2.04124
Evaluation 1	7	DF	18
Mean Difference	-0.2632	Prob > t	0.0562
Std Error	0.12892	Prob > t	0.9719
Upper95%	0.00769	Prob < t	0.0281
Lower95%	-0.534		
N	19		
Correlation	0		

Q6 Matched Pairs
Difference: Follow-up-Evaluation 1



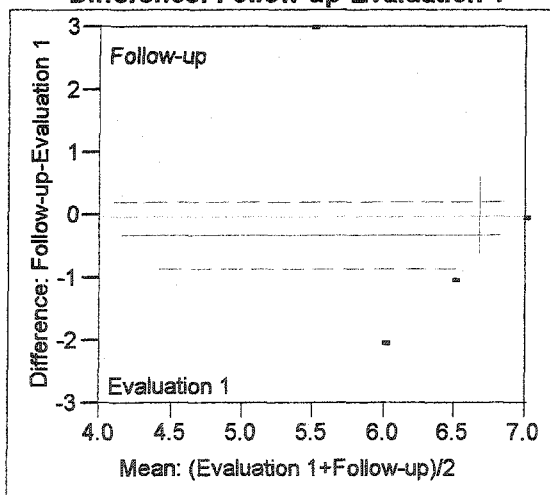
Follow-up	6.21053	t-Ratio	-2.46668
Evaluation 1	6.84211	DF	18
Mean Difference	-0.6316	Prob > t	0.0239
Std Error	0.25604	Prob > t	0.9880
Upper95%	-0.0937	Prob < t	0.0120
Lower95%	-1.1695		
N	19		
Correlation	-0.0418		

Q7 Matched Pairs
Difference: Follow-up-Evaluation 1



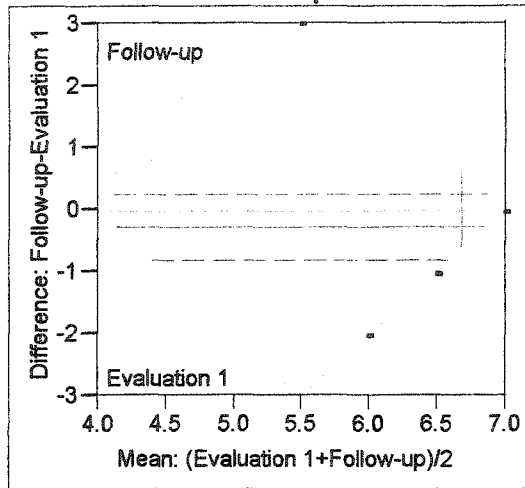
Follow-up	6.89474	t-Ratio	-1.45521
Evaluation 1	7	DF	18
Mean Difference	-0.1053	Prob > t	0.1628
Std Error	0.07234	Prob > t	0.9186
Upper95%	0.04671	Prob < t	0.0814
Lower95%	-0.2572		
N	19		
Correlation	0		

Q9 Matched Pairs
Difference: Follow-up-Evaluation 1



Follow-up	6.52632	t-Ratio	-1.24212
Evaluation 1	6.84211	DF	18
Mean Difference	-0.3158	Prob > t	0.2301
Std Error	0.25423	Prob > t	0.8849
Upper95%	0.21834	Prob < t	0.1151
Lower95%	-0.8499		
N	19		
Correlation	-0.1485		

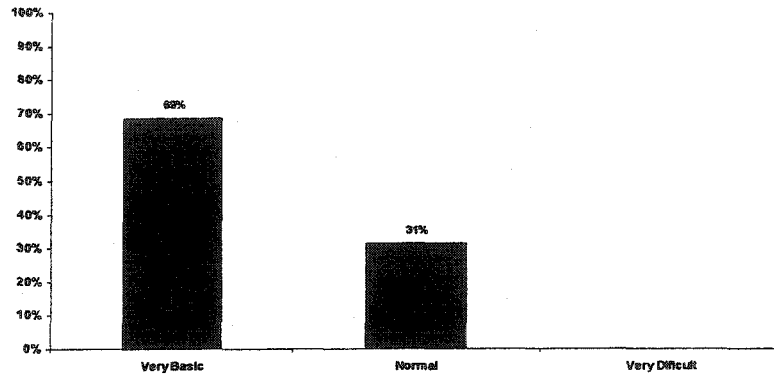
**Q10 Matched Pairs
Difference: Follow-up-Evaluation 1**



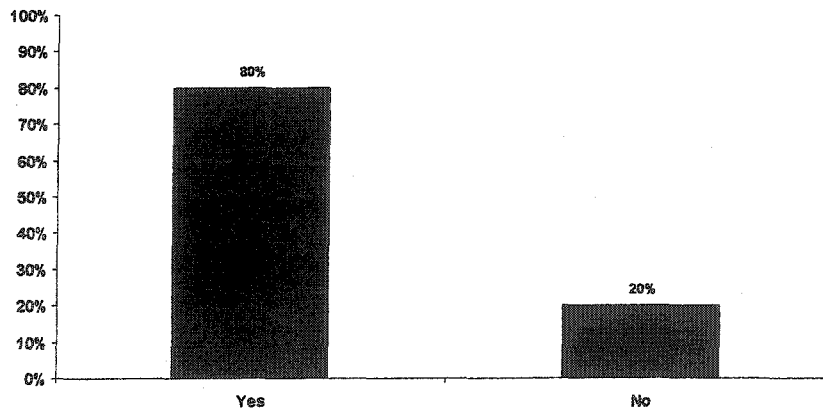
Follow-up	6.55556	t-Ratio	-1.09725
Evaluation 1	6.83333	DF	17
Mean Difference	-0.2778	Prob > t	0.2878
Std Error	0.25316	Prob > t	0.8561
Upper95%	0.25634	Prob < t	0.1439
Lower95%	-0.8119		
N	18		
Correlation	-0.1574		

ENGLISH AS A SECOND LANGUAGE

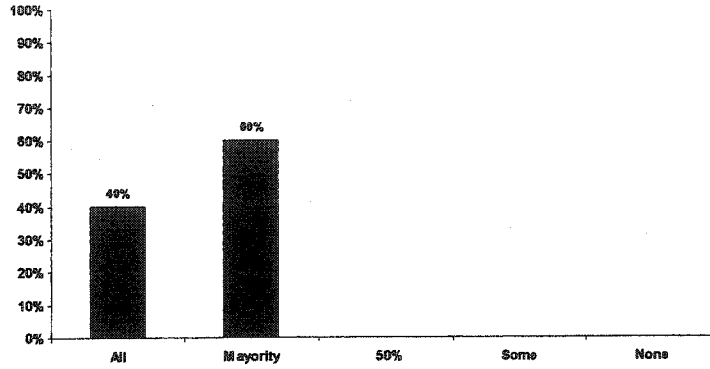
Course Content



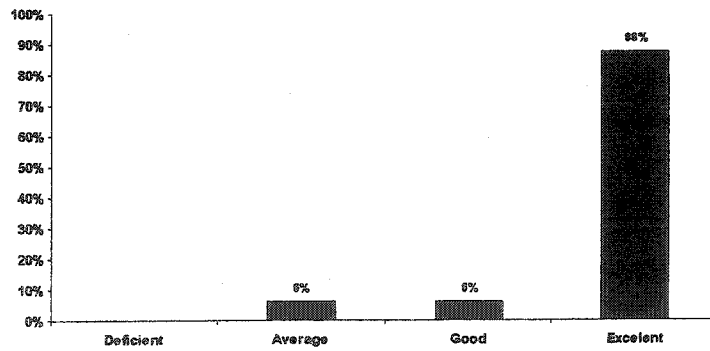
Was the course easy to follow?



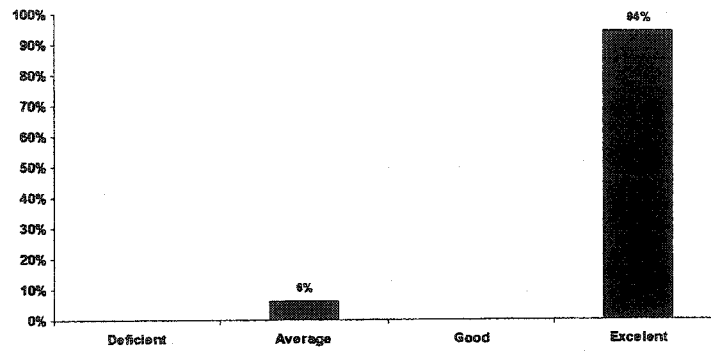
How much of the information provided is going to be useful in your working environment?



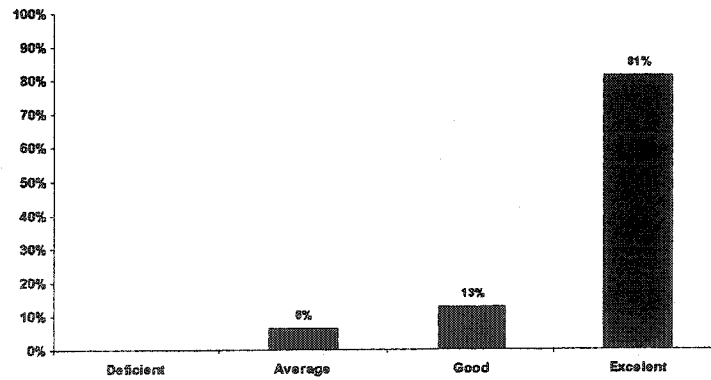
Did the instructor had knowledge of the subjects discussed during the course?



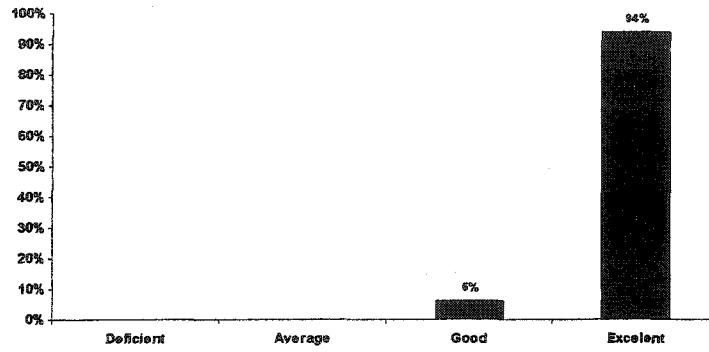
Was the instructor communicating clearly?



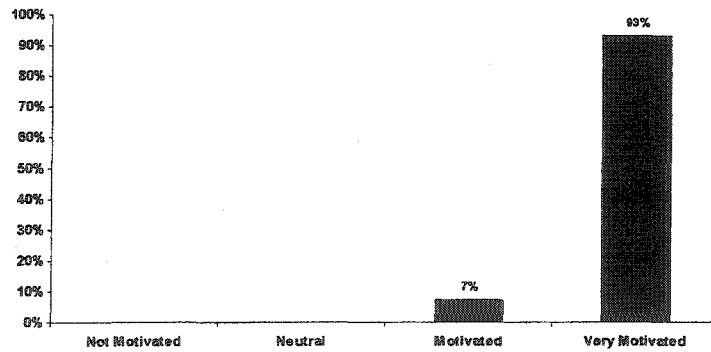
How good were the teaching aids used for this course?



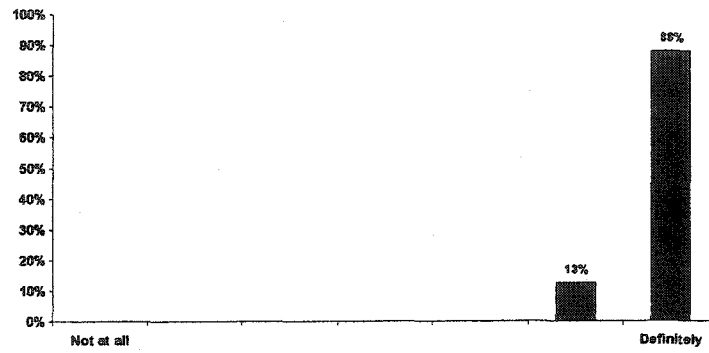
Were all questions addressed to the instructor answered appropriately?



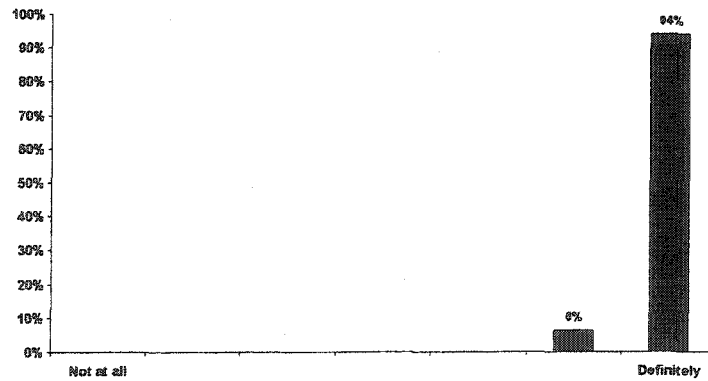
How motivated was the instructor to teach you the course?



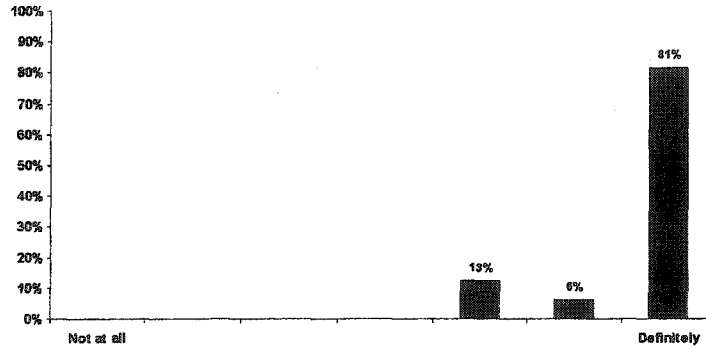
Was the course what you expected?



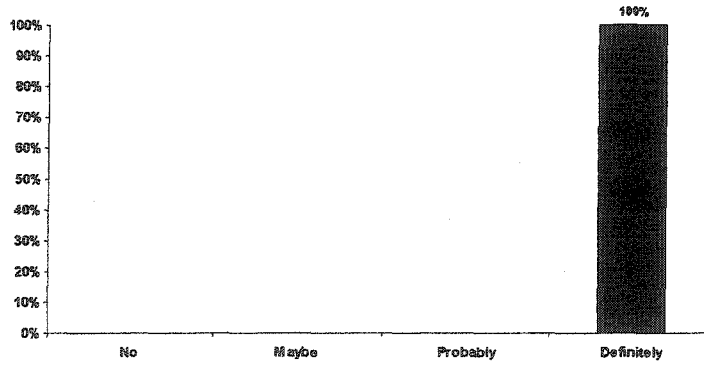
Was it worth taking the time to attend the course?



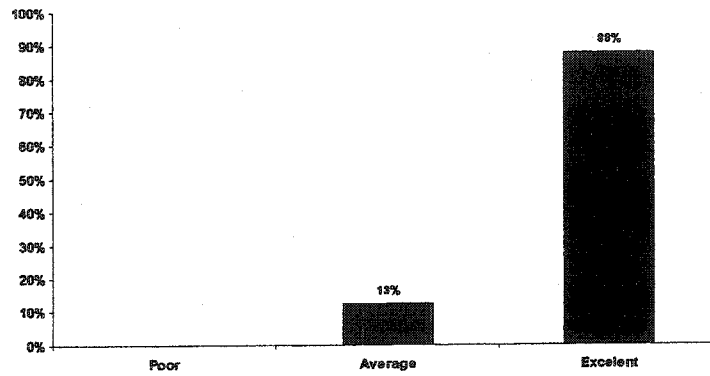
Did your confidence grow?



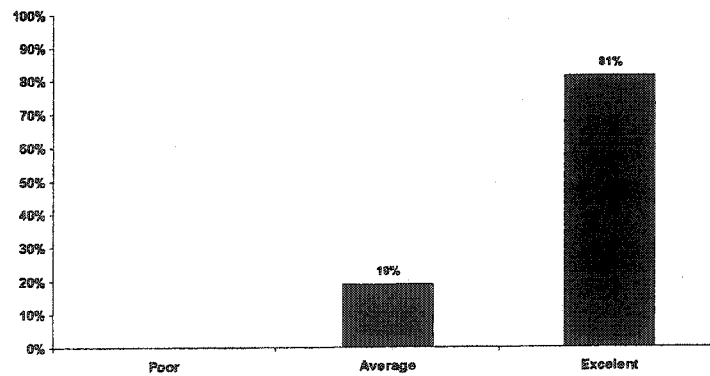
Would you recommend this course to others?



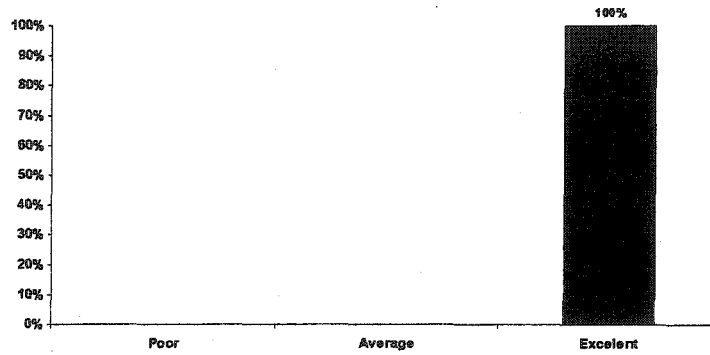
How would you qualify the workbooks?



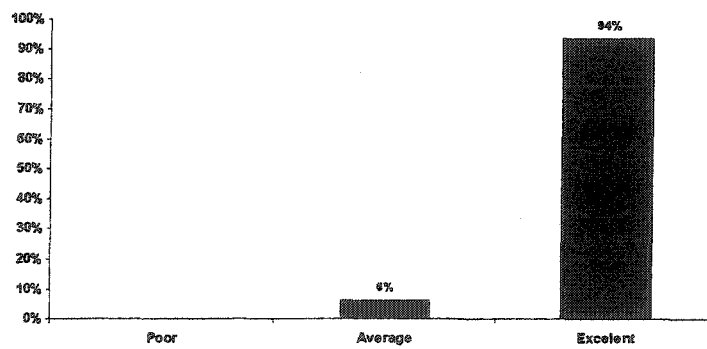
How complete was the content of the workbooks?



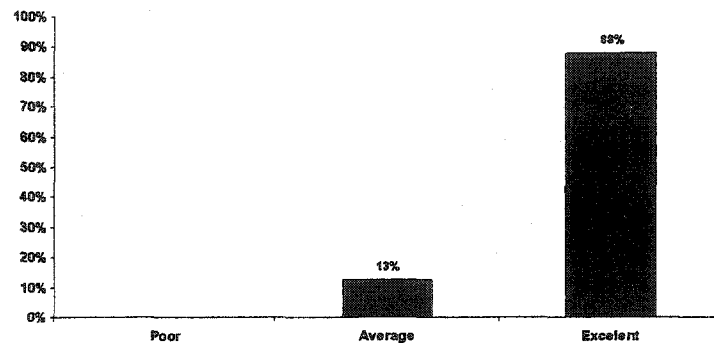
Where the workbooks specific enough?



How useful were the course activities?

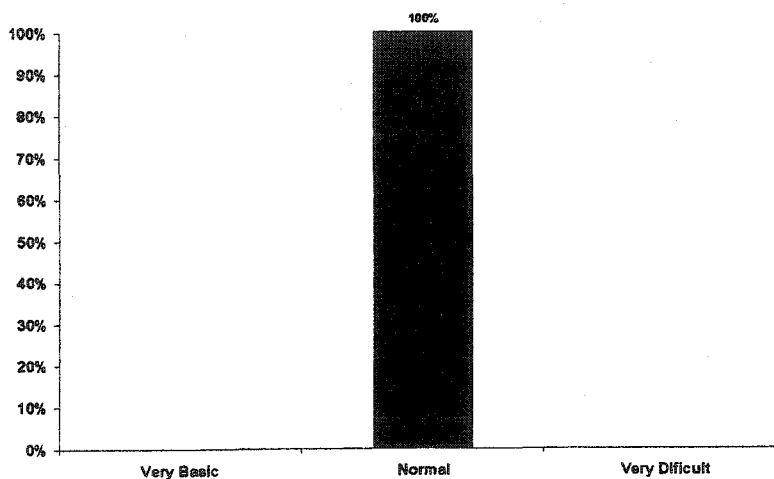


How would you qualify the classroom setting and equipment?

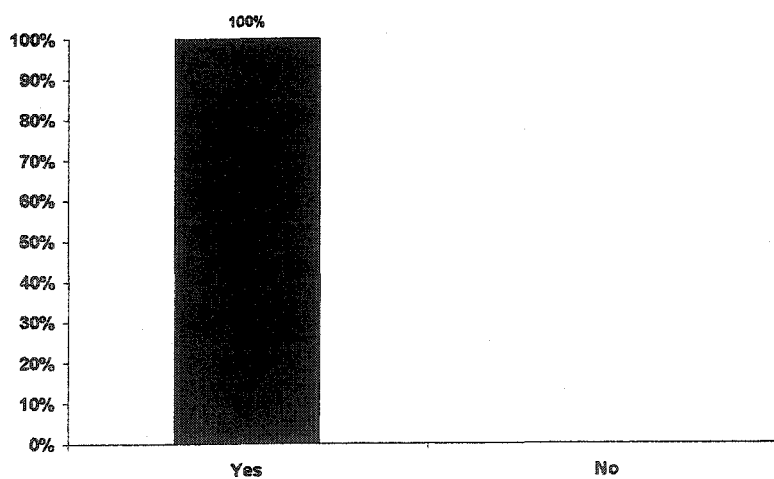


SPANISH AS A SECOND LANGUAGE

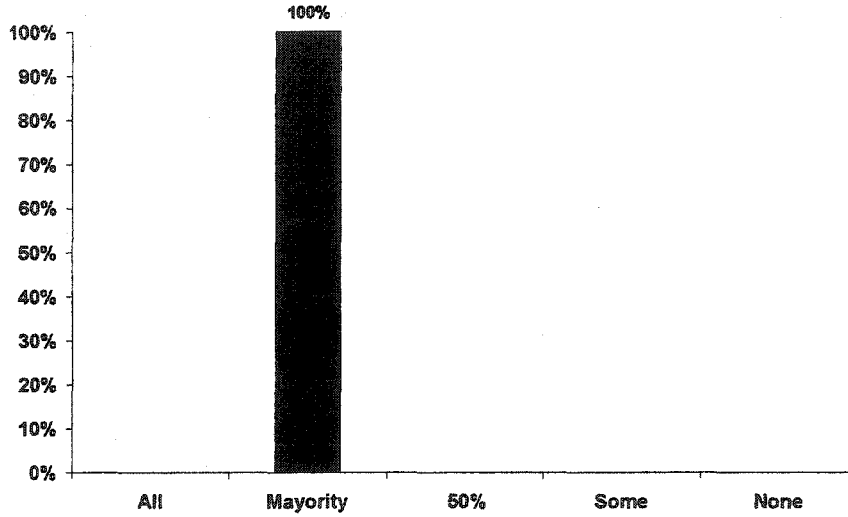
Course Content



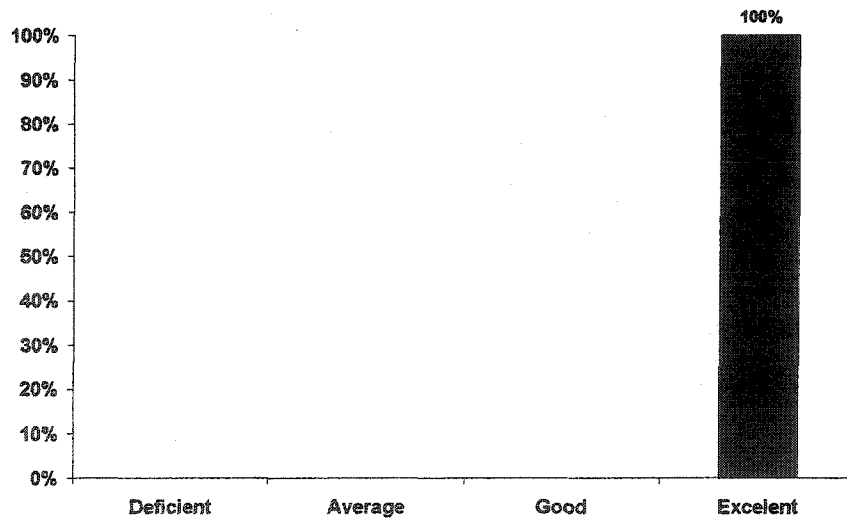
Was the course easy to follow?



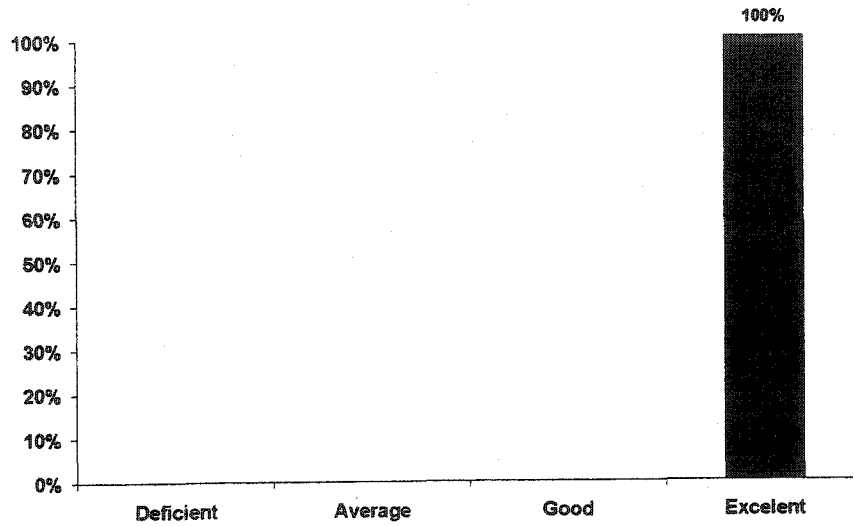
How much of the information provided is going to be useful in your working environment?



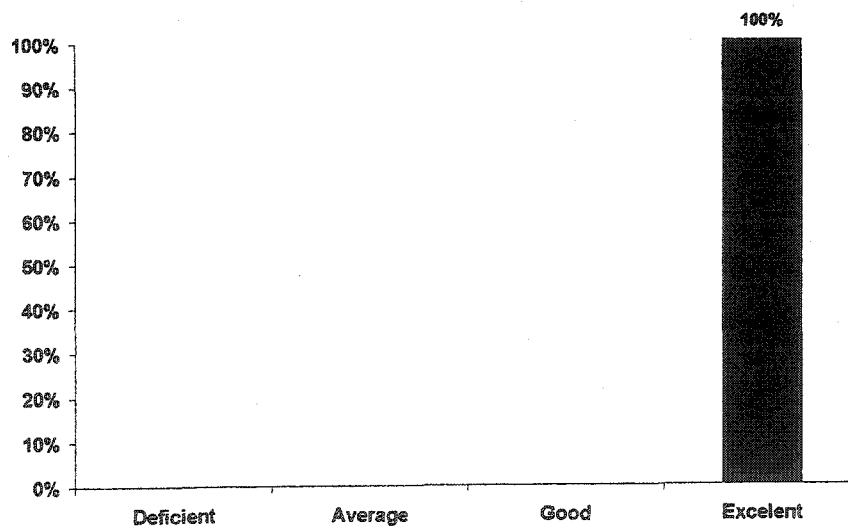
Did the instructor had knowledge of the subjects discussed during the course?



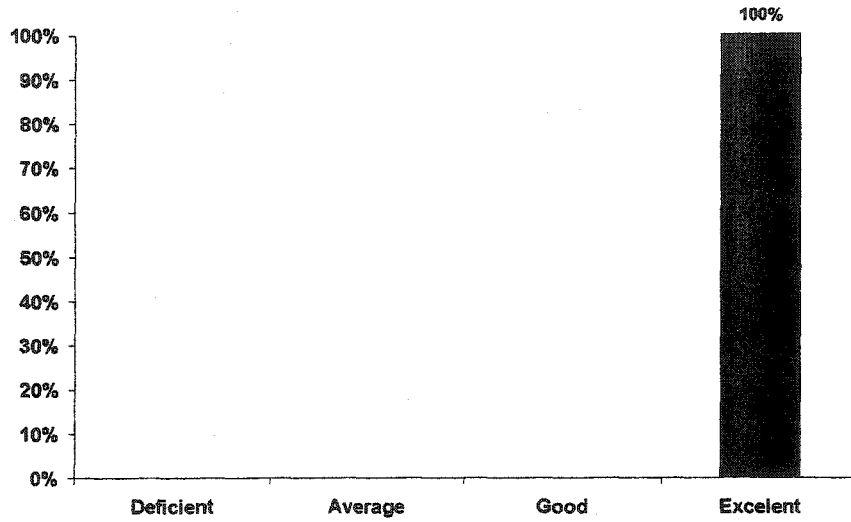
Was the instructor communicating clearly?



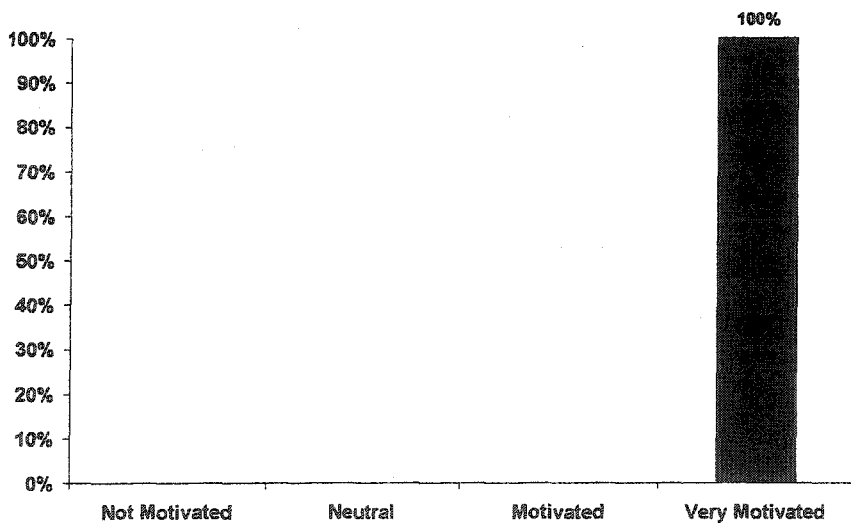
How good were the teaching aids used for this course?



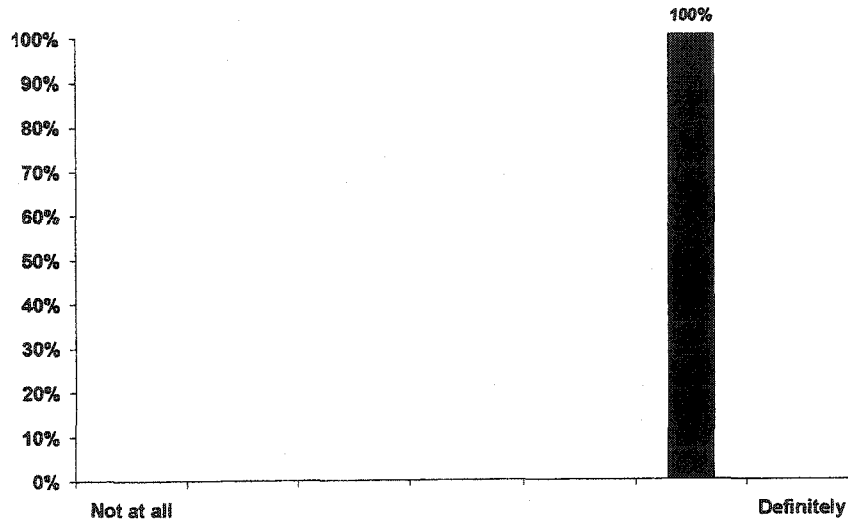
Were all questions addressed to the instructor answered appropriately?



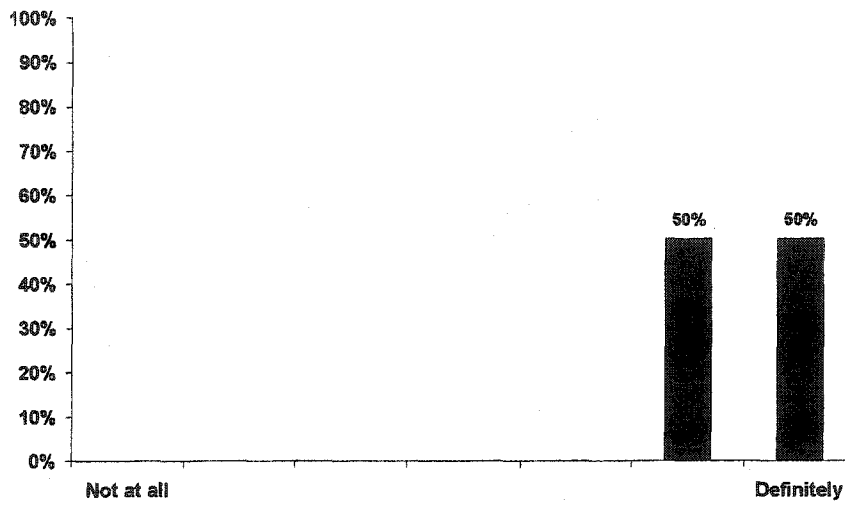
How motivated was the instructor to teach you the course?



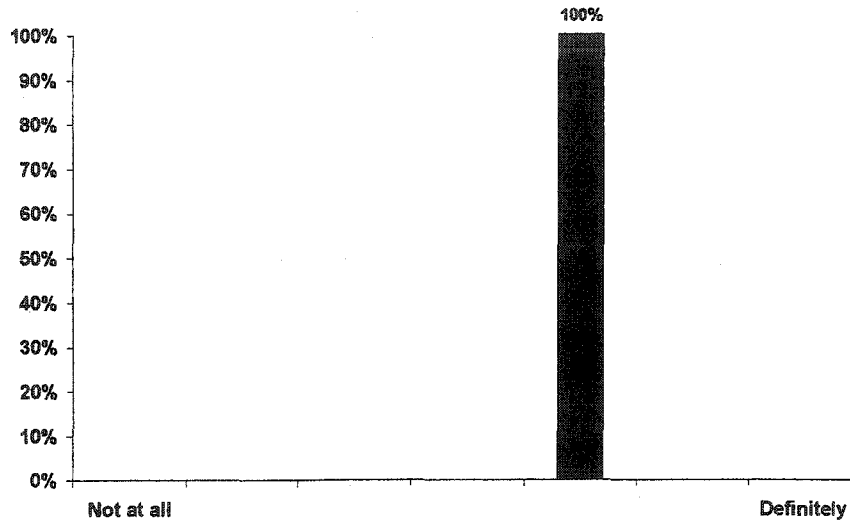
Was the course what you expected?



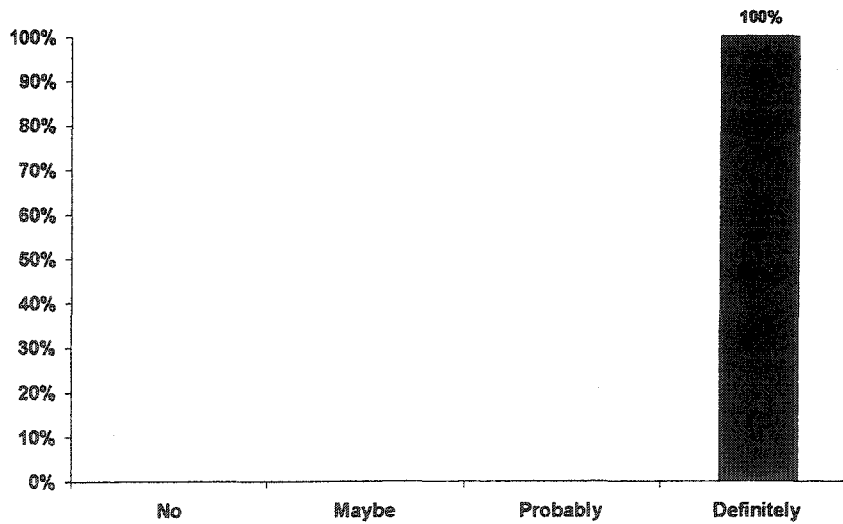
Was it worth taking the time to attend the course?



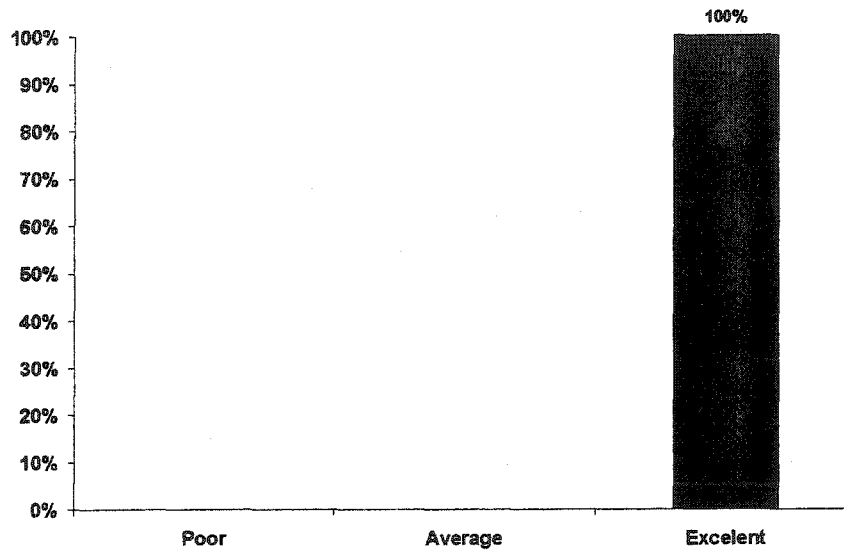
Did your confidence grow?



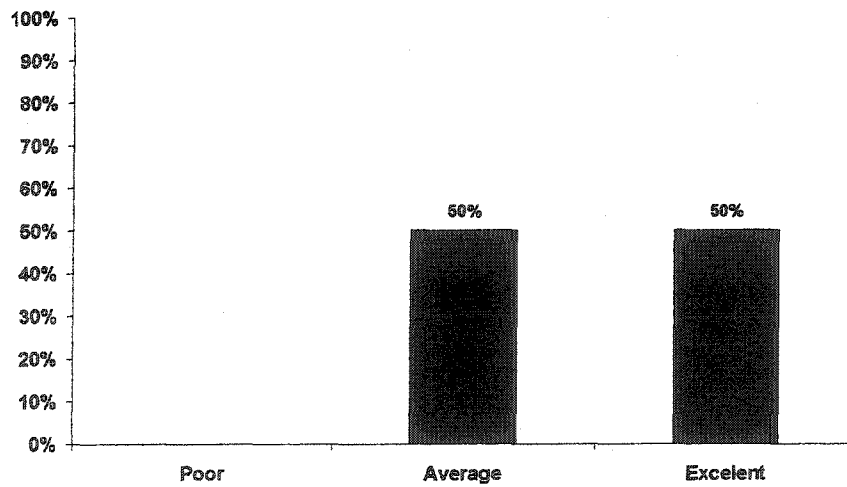
Would you recommend this course to others?



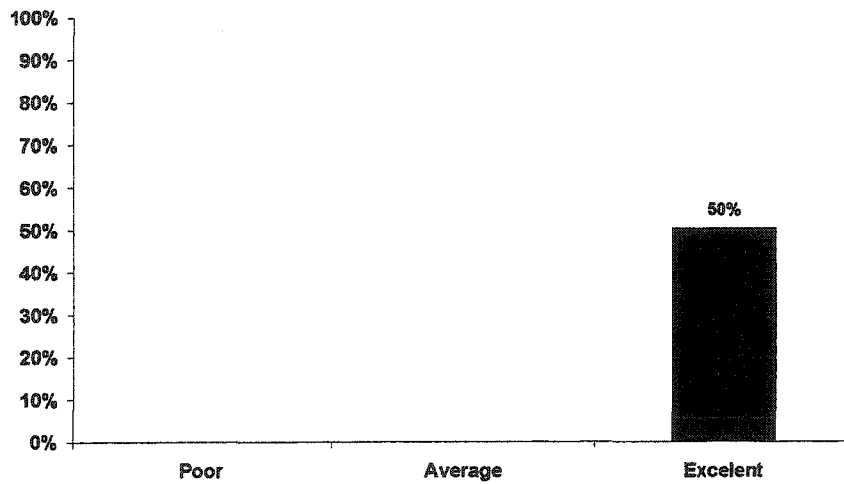
How would you qualify the workbooks?



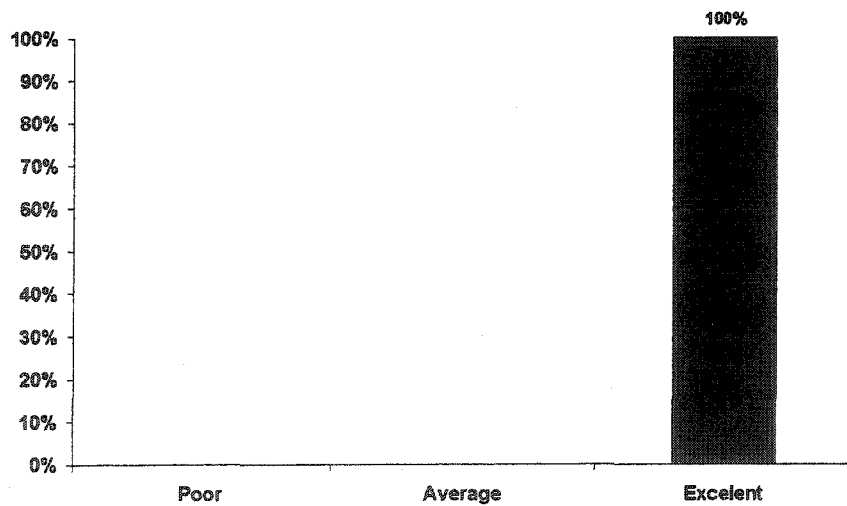
How complete was the content of the workbooks?



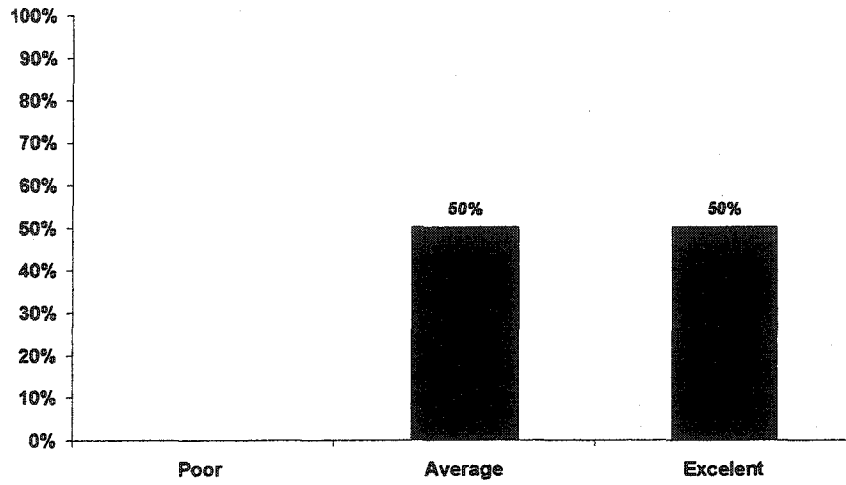
Where the workbooks accurate?



How useful were the course activities?

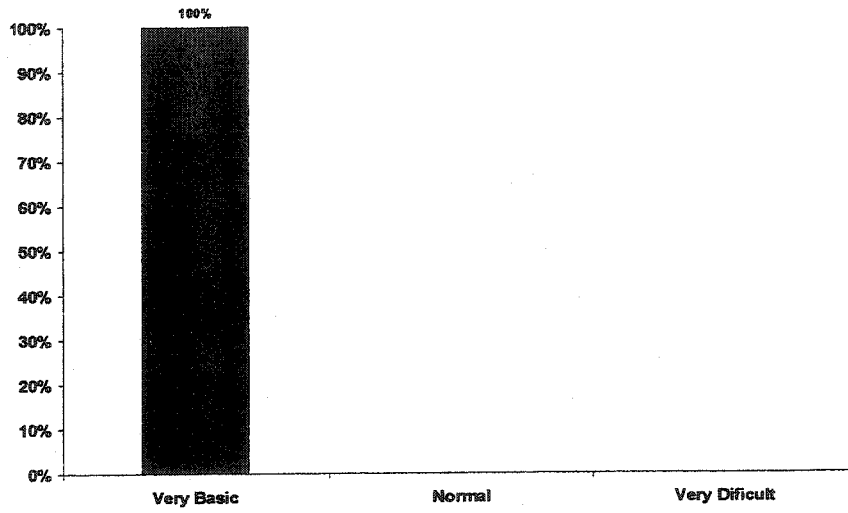


How would you qualify the classroom setting and equipment?

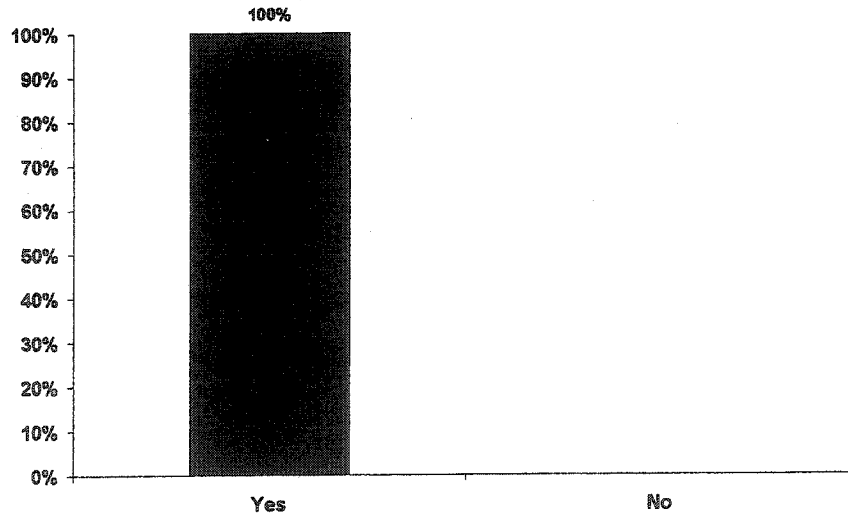


STEPPING UP TO SUPERVISOR

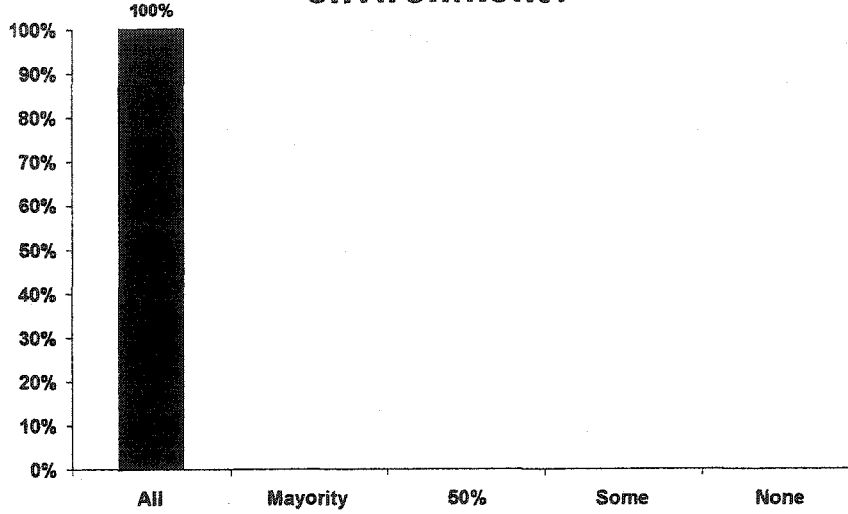
Course Content



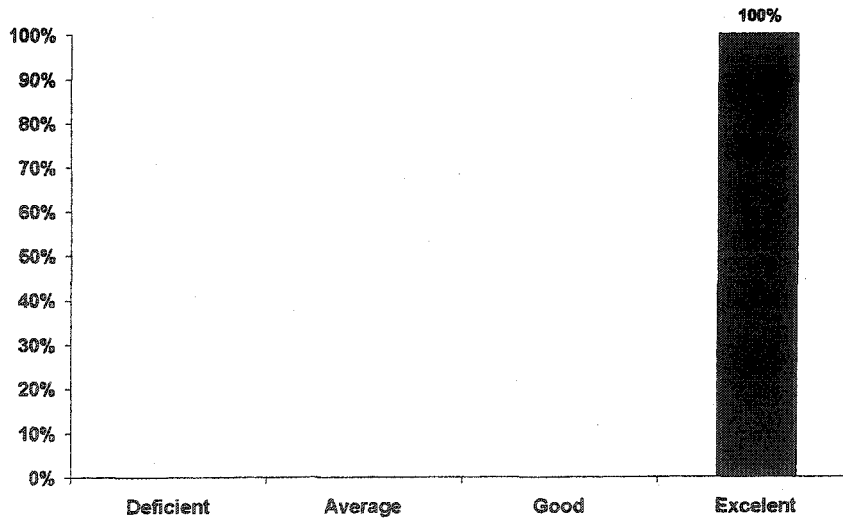
Was the course easy to follow?



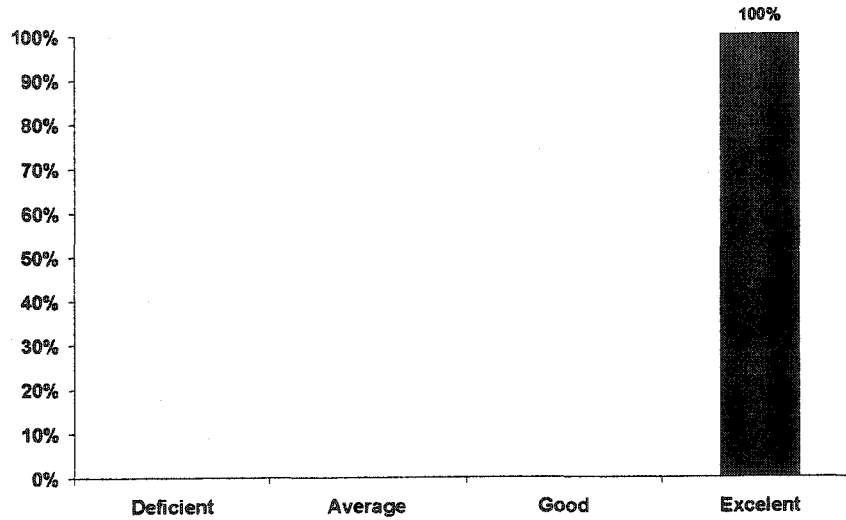
How much of the information provided is going to be useful in your working environment?



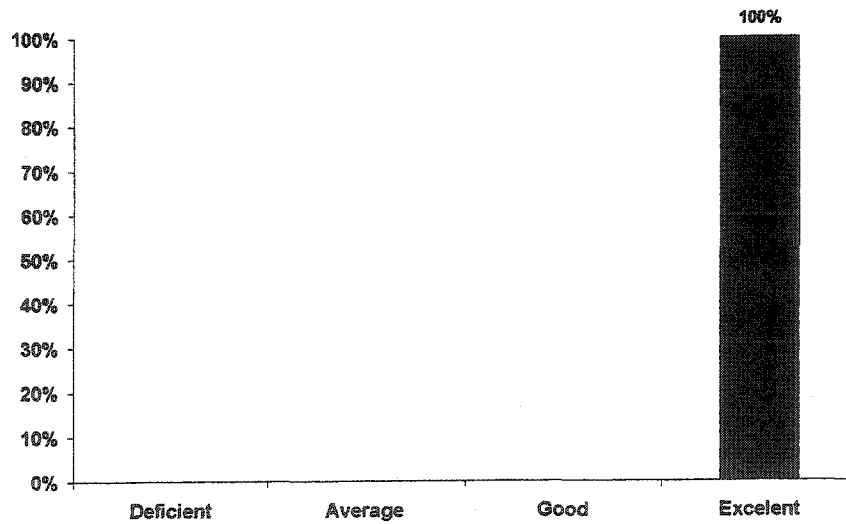
Did the instructor had knowledge of the subjects discussed during the course?



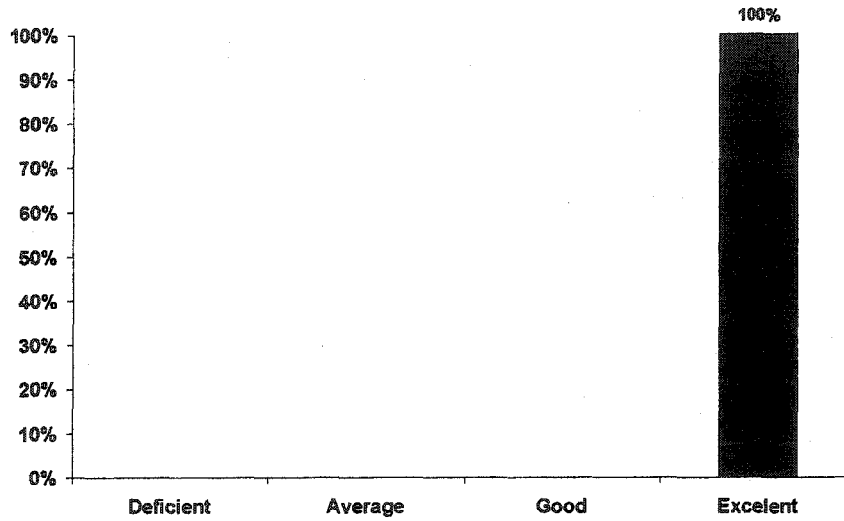
Was the instructor communicating clearly?



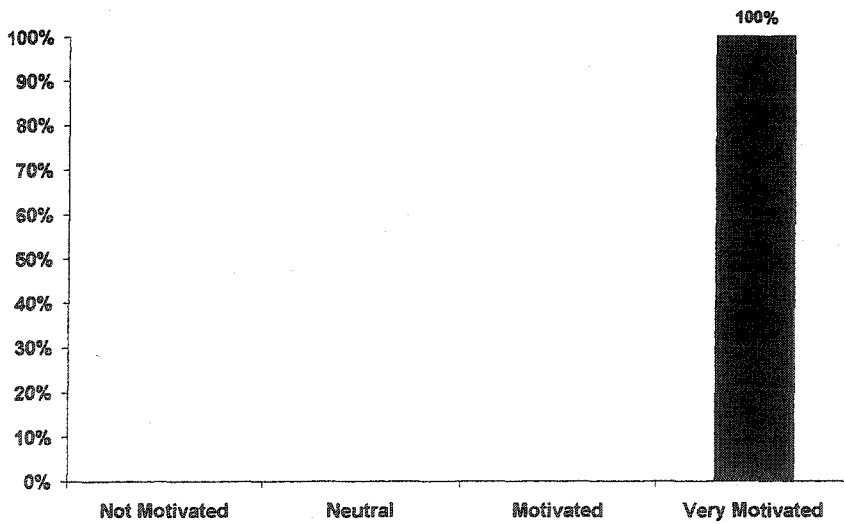
How good were the teaching aids used for this course?



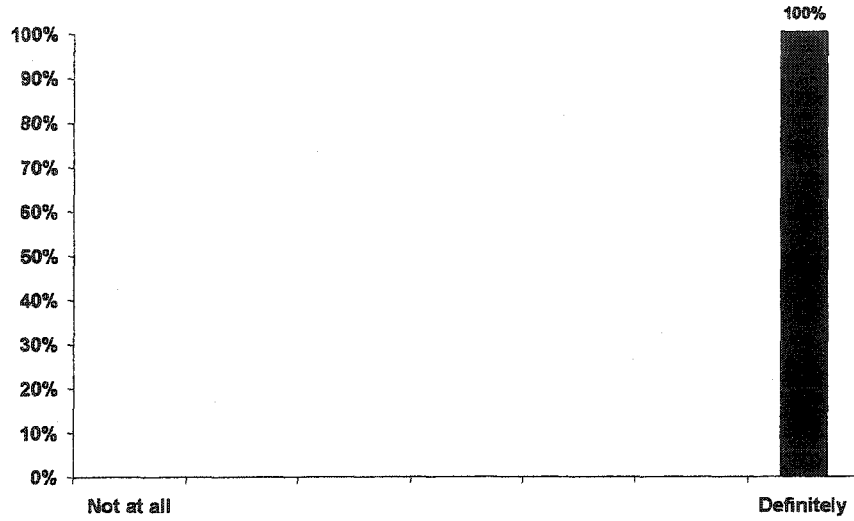
Were all questions addressed to the instructor answered appropriately?



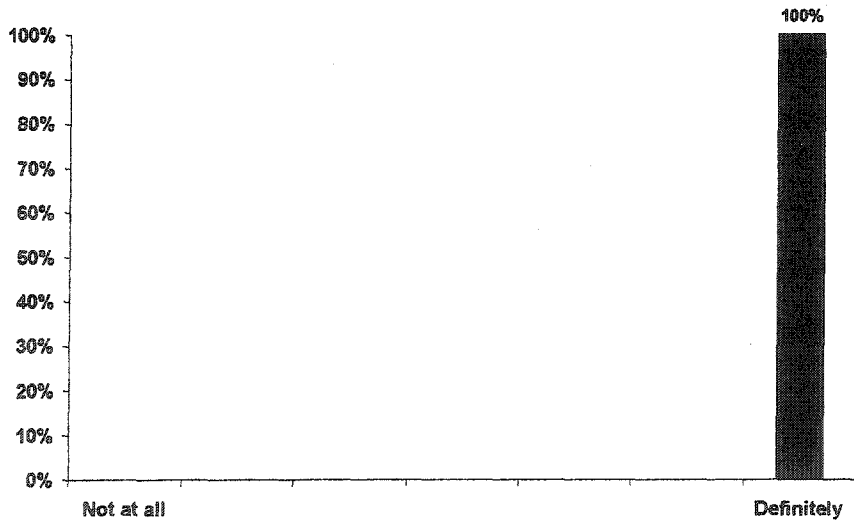
How motivated was the instructor to teach you the course?



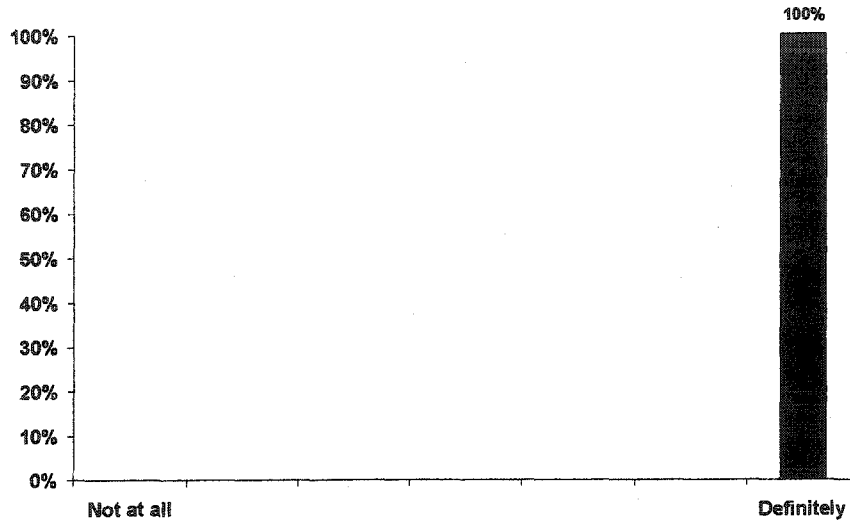
Was the course what you expected?



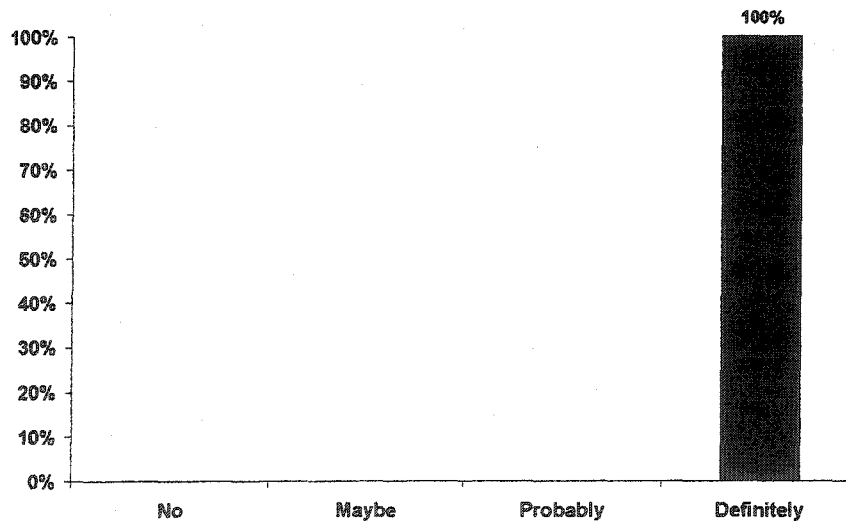
Was it worth taking the time to attend the course?



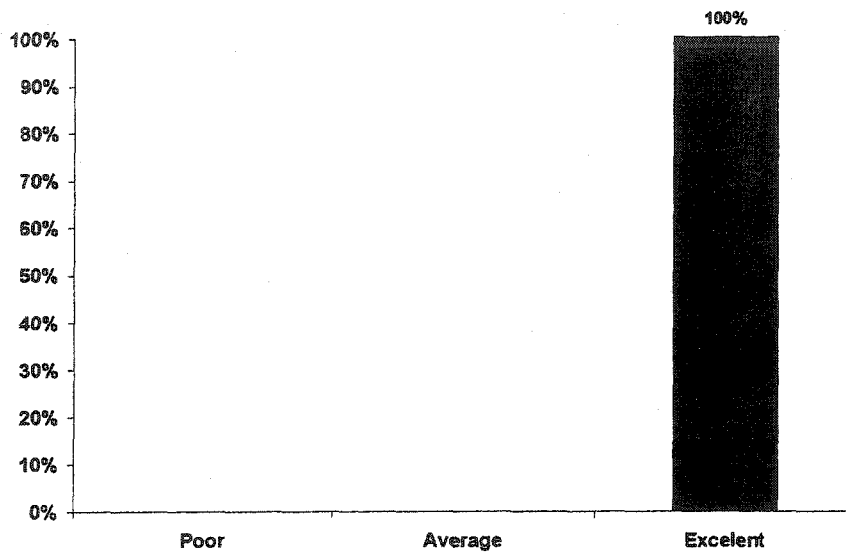
Did your confidence grow?



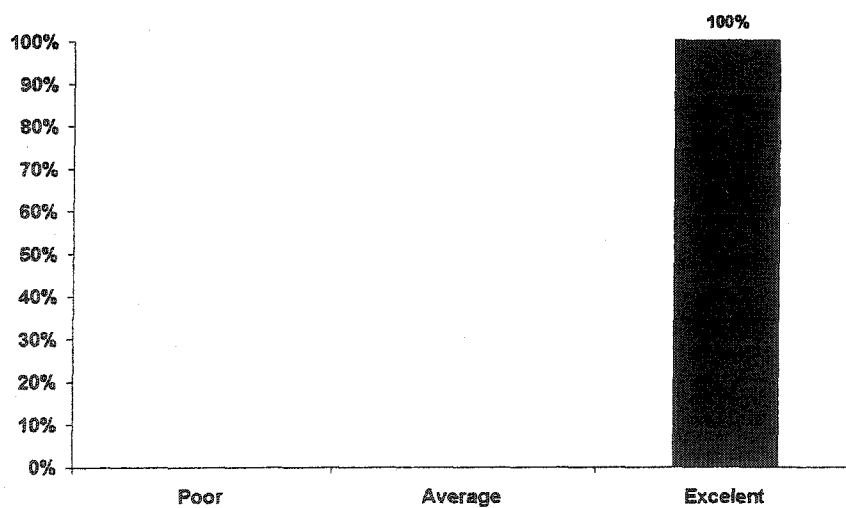
Would you recommend this course to others?



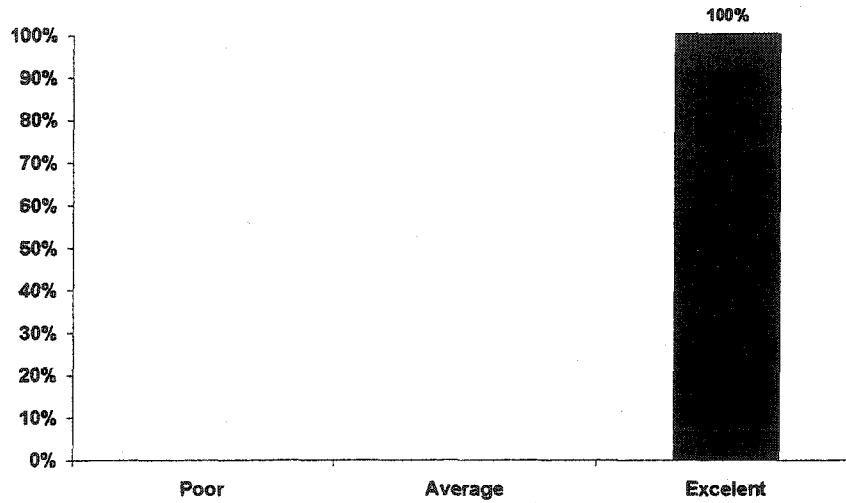
How would you qualify the workbooks?



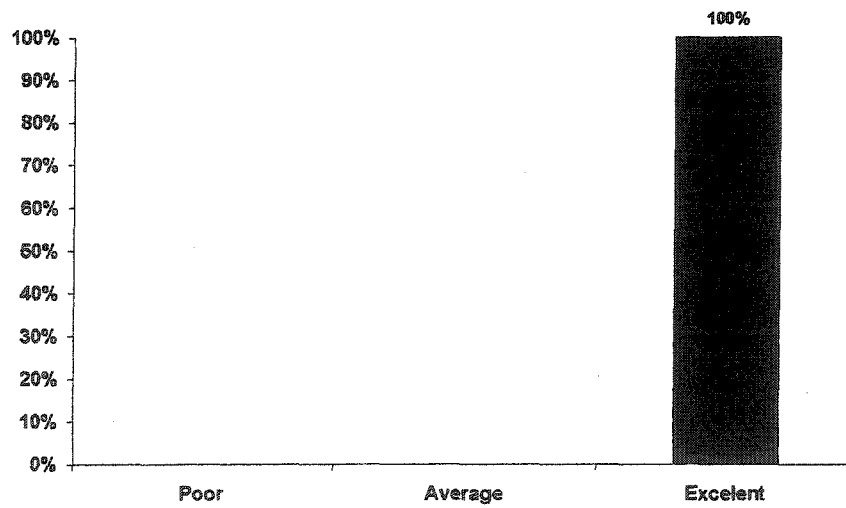
How complete was the content of the workbooks?



Where the workbooks specific enough?



How useful were the course activities?



How would you qualify the classroom setting and equipment?

