



**CPWR - The Center for Construction Research and Training  
Final Report**

**Workplace Safety Climate Surveys for City Center and Cosmopolitan  
Construction Projects,  
Las Vegas, Nevada  
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Submitted by

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# CPWR – The Center for Construction Research and Training Worksite Assessment Team- Final Report on the Workplace Safety Climate Surveys

## A. INTRODUCTION

In June of 2008, the Perini Building Corporation and Nevada Building Trades negotiated a Memorandum of Understanding (MOU) specifying that CPWR - The Center for Construction Research and Training (CPWR) would provide training and a worksite assessment of the City Center and Cosmopolitan construction projects. After an initial site visit in June 2008, the CPWR's Worksite Assessment Team determined that its assessment would include the following six components:

- Safety climate survey of Perini senior management, superintendents, foremen and craft workers to assess perceptions and attitudes about safety on the sites. The analysis includes descriptive and psychometric analyses; mean comparisons on safety climate surveys by organizational levels and other key background characteristics; and multiple regression analyses to identify important factors associated with safety performance. The preliminary analyses were completed in December 2008 based on 1,600 workers. The final analyses were completed in January 2009 based on 3,500 workers, 134 Foremen, 61 Superintendents, and 17 Top Management Executives.
- Observations and Recommendations on Perini's Safety Orientation Training Program; (Completed November 2008)
- Observations and Recommendations on Perini's safety staff by accompanying Perini personnel and observing interactions with personnel on-site (Completed November 2008) ;
- Observations and Recommendation on Perini's safety management programs and practices (Completed November 2008);
- Observations and Recommendations based on face - to - face interviews with selected personnel on both City Center and Cosmopolitan projects (Completed November 2008);
- A fall hazard identification and control audit of selected buildings on-site (Aria and Mandarin). Completed September, 2008.

***Safety Climate Survey*** Four safety climate surveys, developed by a team of occupational and safety and health experts, were designed to gauge perceptions of workers, foremen, superintendents, and top management executives as to the "climate/temperature" of safety practices on both the City Center and Cosmopolitan job sites. The rationale for measuring the temperature was to assess perceived attitudes, knowledge and beliefs about safety practices on both sites, which could lead to the development of preventive strategies to improve communication and safe work practices. Overall, this knowledge and changes in work practices may lead to increased productivity and profits by reducing costs associated with lost work-days, work stoppages and work-related injuries and illness. The indirect costs associated with work injuries and illness, which include compromised organizational image, quality of work, workplace morale, and the likelihood of success in future bidding on projects, can be affected by identifying areas for improvement based on the results of this survey. Both the Perini Building Company and the Southern Nevada Building Trades Council indicated to CPWR that an assessment of the safety climate on the projects would be beneficial and should be a key component of CPWR's overall assessment activities.

## B. METHODS

Four separate safety climate surveys were developed for administration on the City Center and Cosmopolitan construction projects. The climate surveys were created, in English and Spanish, containing 37 safety-related questions about perceptions about the General Contractor (Perini), about employers (sub-contractors), and about individuals' perceptions of safety on the job. Workers, foremen, superintendents and top management executives who volunteered for the survey were given the option of completing either the English or Spanish version of the survey. Of the 1,035 workers who described themselves as Hispanic 730 (70%) completed the English version of the survey, compared with 305 (30%) who completed the Spanish version.

Each of the 37 questions has a 6-point Likert scale response ranging from strongly disagree to strongly agree. Demographic questions such age, years worked in construction, work status (apprentice or journeymen), trade, and city / home local, and ethnicity were included in the survey. There is also an open-ended question where persons responding to the survey can provide additional comments about the job and actions that could be taken to improve safety. The survey was pilot tested with workers on the site for two weeks to evaluate the specificity and sensitivity of the questions and the viability of the protocol for integration into the Smart Mark/OSHA 10 hour training classes.

The safety climate surveys were distributed during the OSHA 10 hour classes managed by CPWR as specified in the MOU between Perini and the Southern Nevada Building Trades Council. The worker and superintendent surveys were explained and administered to workers by CPWR trainer/coordinators and at weekly superintendent meetings, respectively. A separate schedule for administering the survey was established for foremen and top management executives. Foremen received the survey during a safety culture training session, and top management executives were directly provided the survey and a self-addressed mailing envelope to return to CPWR. *Appendices 1-1 to 1-4* contain the final version of the climate surveys used for workers (both in English and in Spanish), foremen, superintendents, and top management executives. All four surveys contained 24 comparable questions on demographics, questions about the general contractor (Perini), questions about the subcontractor, and questions about individual perceptions about jobsite safety. *Appendix 1-5* contains the mapping of questions across the surveys to standardize the data analysis. These surveys were shared with Perini and the head of the Southern Nevada Building Trades Council as part of the participatory process to evaluate the safety climate of the City Center and Cosmopolitan construction site.

The protocol for administering the surveys was as follows. First, a CPWR trainer/training coordinator provided background information describing the purpose of the survey to collect information about safety on the site and the voluntary nature of the survey. There was no individual information (personal identifiers) collected. Second, participants were provided the survey and asked to complete it in ten minutes. Once completed, the survey was collected by the trainer/coordinator and put in a sealed self-addressed envelope and sent directly back to CPWR for data entry and analysis.

Between the dates of July 8 and October 21, 2008, a total of 3,781 individuals completed the survey, 3,482 of whom were craft workers attending the OSHA 10 hour training classes at either

the City Center or Cosmopolitan sites. Of those attending the training, 3,035 (87%) of the workers completed the safety climate survey. One hundred and thirty-four foremen (96%) (hired by Perini) completed the survey, sixty-one (43%) (hired by Perini) superintendents completed the survey, and 17 (100%) top management executives completed the survey. The overall response rate for the four groups was 86%. Once the surveys were completed and received by CPWR, individual surveys were given a unique identifier and sent to BizCore, Langhorne, PA. for data entry. Survey data were entered into an excel database and were reviewed for quality control by CPWR. Data analysis was performed by CPWR and collaborators at Colorado State University and Illinois Institute of Technology.

### Statistical Analysis

There are three components to the analysis of the safety climate survey data. First, we provide a descriptive analysis which examines the demographic characteristics of the people who responded to the survey, and the aggregate/collective responses to each of the questions. Second, a set of psychometric analyses were conducted to identify factors which stand out as important indicators of the safety climate and other related safety issues. Finally, a series of inferential statistics were used to examine mean differences of these factors and to identify important contributing factors of safety performance.

### Descriptive Analysis

Numerical values were assigned to each of the survey responses, so that strongly disagree = 1, disagree = 2, somewhat disagree = 3, somewhat agree = 4, agree = 5, and strongly agree = 6. Lower means scores indicate stronger disagreement whereas higher mean scores indicate stronger agreement for each of the 37 questions. Data are presented as percentages and mean  $\pm$  standard deviation (STD). The student t-test was used to compare means between two groups. The analysis of variance (ANOVA) method was used when comparing means of more than two groups (Howell, 2007)<sup>1</sup> All statistical analysis was performed using SAS for Windows Version 9.1 (SAS Institute Inc., 2003).

### Psychometric Analysis

As shown in Appendix 1, each survey consists of a set of specific questions targeted to each surveyed group. To facilitate the analysis and discussion of the survey results, and to also provide a clearer view of the big picture, it is common to empirically identify a small set of underlying themes based on the larger number of survey items by means of a factor analysis technique (Gorsuch, 1983)<sup>2</sup>. These underlying themes or factors (as a statistical term) can be considered as indices of meaningful concepts. Specifically, we used factor analysis to identify the structure of the relationships among the survey items based on data, which was collected from four surveys designed for workers, foremen, superintendents/assistant superintendents/project managers, and Perini management executives. The structures of these survey items were further verified by two additional statistical methods (parallel analysis and

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<sup>1</sup> Howell, D. C. (2007). *Fundamental Statistics for the Behavioral Sciences*, (6th ed.)

<sup>2</sup> Gorsuch, R. L. (1983). *Factor analysis* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.

item analysis). Parallel analysis is a statistical technique which provides an empirical criterion to evaluate the factor analysis results (Horn, 1965)<sup>3</sup> and to assist us determine the number of factors that should be retained based on the survey items. Item analysis is an empirical method to analyze to what extent a survey item is related to its correspondent factor (Allyn & Yen, 2001)<sup>4</sup>. After that, survey items, which correlated strongly with each other and at the same time did not correlate strongly with other items, were grouped together into factors. Some of these factors included multiple items, while others had a single item. The sum of the grouped item scores represents the score of the factor of interest (e.g., Perini safety climate score).

Based on the above analyses, 16 factors, 15 factors, 13 factors, and 12 factors were identified for the worker, foremen, superintendent, and the executive surveys, respectively. Definitions of the factors in the four surveys are provided in Appendix 2-5. In addition, the correspondent survey items of each factor for the surveys, and descriptive statistics (alpha coefficient, possible range, observed range, mean, standard deviation, and number of respondents) are reported in Tables 2, 4, 6, and 8, respectively. Alpha coefficients range from 0 to 1, with values closer to 1 indicating that the set of items measures well a common underlying theme (i.e., factor). Calculation of an alpha coefficient involves correlations among items. As a result, alpha coefficients cannot be computed for factors consisting of a single survey question. The mean of each factor is calculated by summing the individual responses to the set of items for each factor and computing their arithmetic average. For example, the average Perini Safety Climate score based on the 2,817 workers who responded to all seven items is 29.7, as shown in Table 2 below. The standard deviation of each factor score is an index that shows how widely the respondents' scores differ from the mean. When the distribution of respondents' scores exhibits a bell-shape curve, as a rule, about 2/3 of these scores are expected to fall within the range of the mean score minus one standard deviation and the mean score plus one standard deviation. For instance we can estimate that approximately 2/3 of all scores on the Perini Safety Climate falls between 22.2 (i.e.,  $29.7 - 7.5$ ) and 37.2 (i.e.,  $29.7 + 7.5$ ), assuming the distribution of Perini Safety Climate scores exhibits a bell-shape curve. Finally, sample size is the number of respondents who respond to all items in a given factor. Thus, it varies from one factor to another. For example, 2,817 workers responded to all seven items comprising Perini Safety Climate, while 2,843 workers responded to all eight items comprising Foreman Safety Management, as shown in Table 2.

### Limitations

This report documents our final examination of the climate survey data. Of the 9,300 workers on the two sites (as of December 19, 2008) it was initially estimated that seventy percent had not received OSHA 10 hour training. This survey was only provided to those workers who had not previously received OSHA 10 hour training.

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<sup>3</sup> Horn, J. L. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika*, 32, 179-185.

<sup>4</sup> Allyn, M. J., & Yen, W. (2001). *Introduction to Measurement Theory*. Waveland Press.

## C. RESULTS

### 1. Construction Workers

#### 1-1. Descriptive Analysis

##### 1-1-a. Demographics

The final analysis of the worker safety climate surveys consists of responses from a total of 3,035 workers. The surveys were conducted during OSHA 10 hour training between July and October, 2008. Of the workers completing the survey 2,716 (89%) completed the English version and 319 (11%) completed the Spanish version. One thousand six hundred and twenty nine surveys (54%) were completed by workers at City Center and 1,406 (46%) were completed by workers at Cosmopolitan. Figure 1 below shows the distribution of workers by age, ranging from fourteen years of age to eighty-seven years of age. The average age of those who responded was 38.9 years (SD=11.3 years). We were unable to identify the trade or employer of the 14 year old apprentice who works for a subcontractor. The 87 year old was a journeyman plumber with 50 years of experience in the construction industry.

**Figure 1. Distribution of Construction Workers by Age**

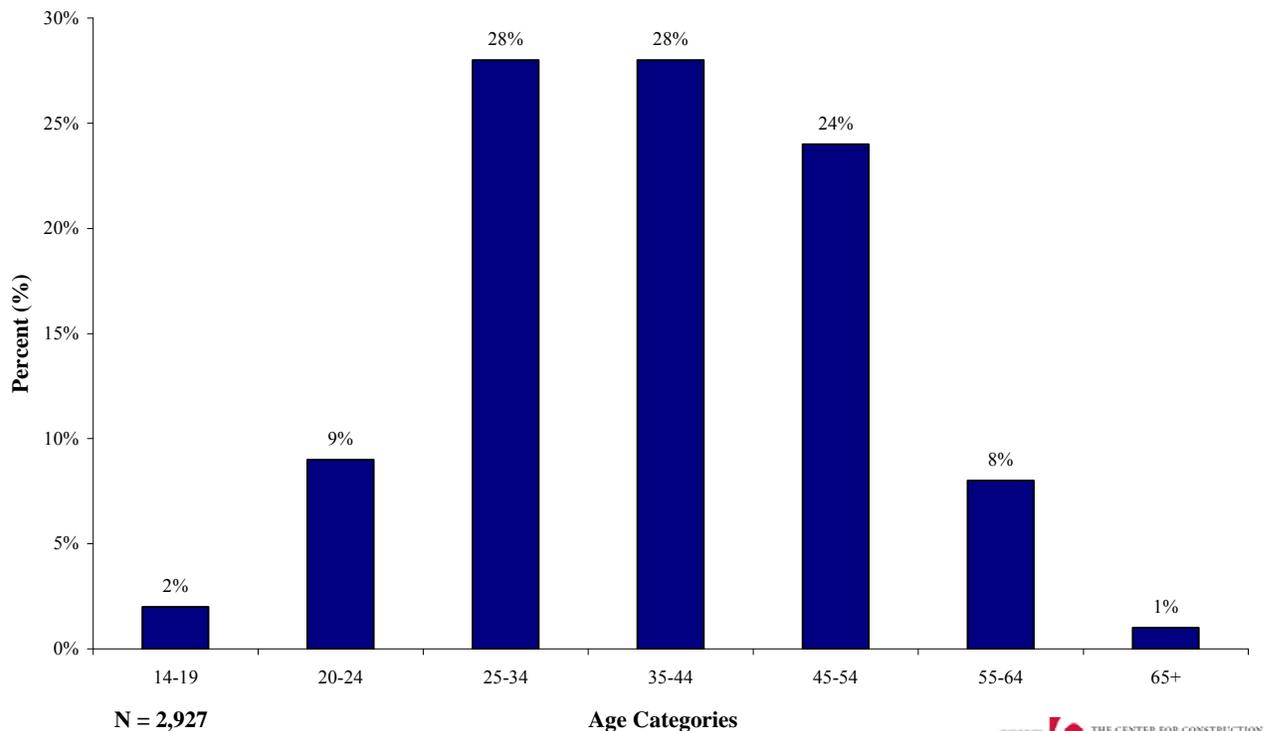


Figure 2 shows the distribution of workers by trade for both the City Center and Cosmopolitan sites who participated in the climate survey. Carpenters, plumbers and pipe fitters, electricians, sheet metal workers, and laborers represented the highest percentages of participation. They represented 78% of the trades who participated in the survey.

**Figure 2. Distribution of Construction Workers by Trade**

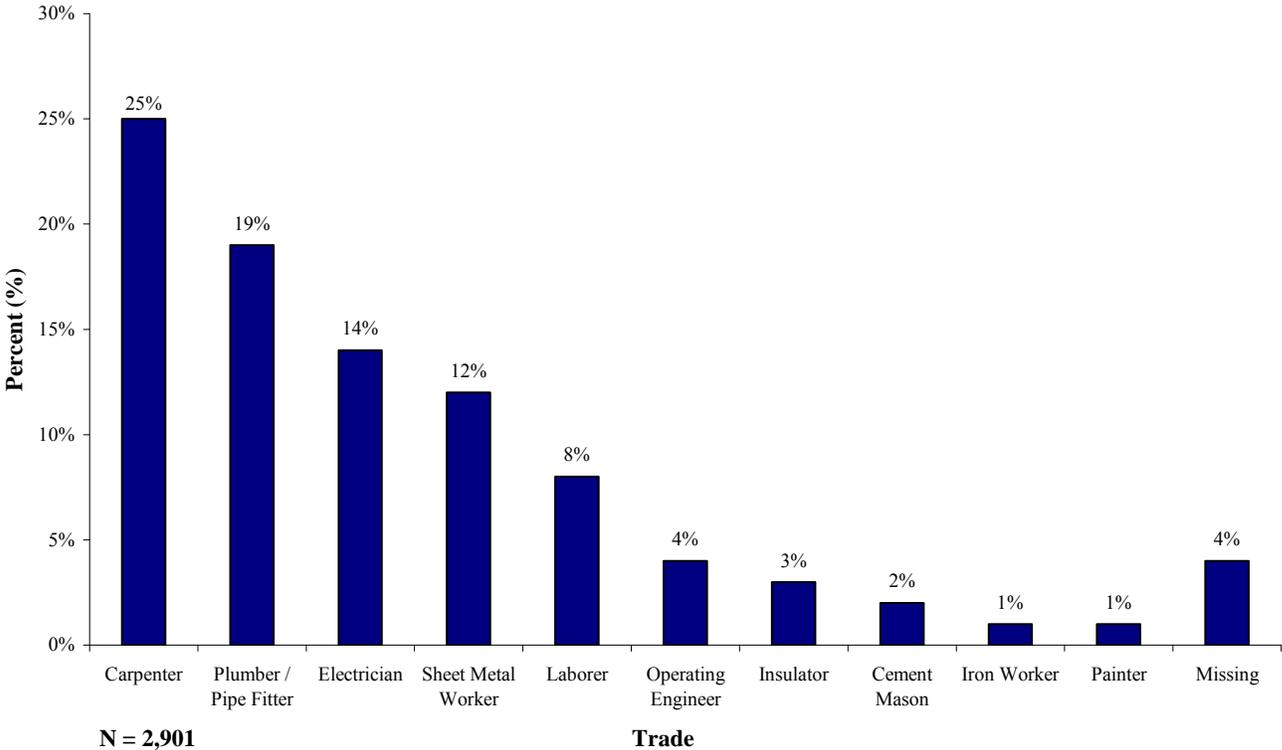


Figure 3 illustrates the geographic spread of workers' home locals. Workers on the two sites come from states across the country with the majority of workers coming from NV, CA, AZ, MI, TX, FL, and IL.

**Figure 3. Distribution of Construction Workers by Home Local**

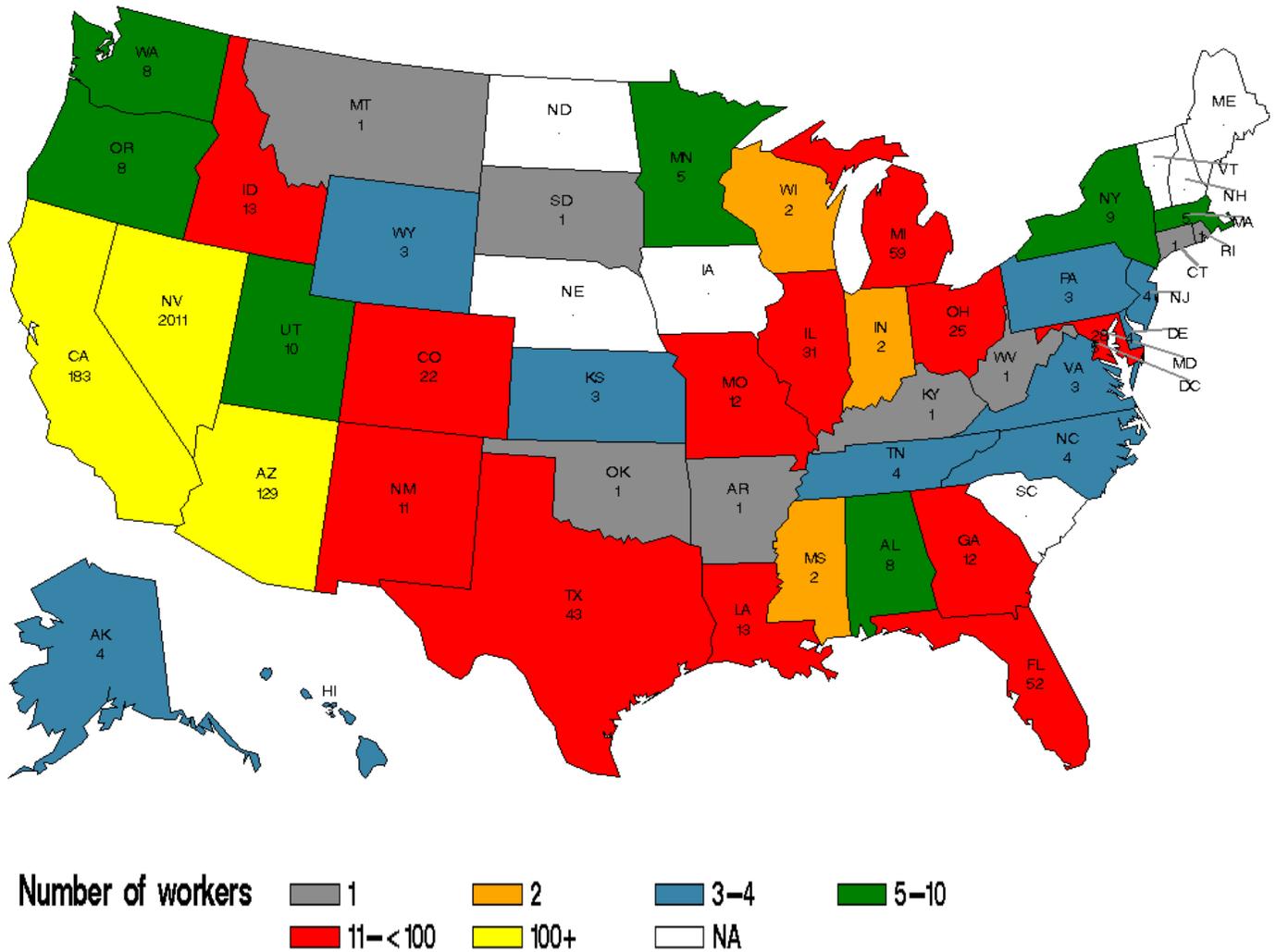


Figure 4 shows the distribution of workers by race. Forty-five percent were Caucasian, a third (34%) were Hispanic, 7% were African American, and 3% were Native American.

**Figure 4. Distribution of Construction Workers by Race / Ethnicity**

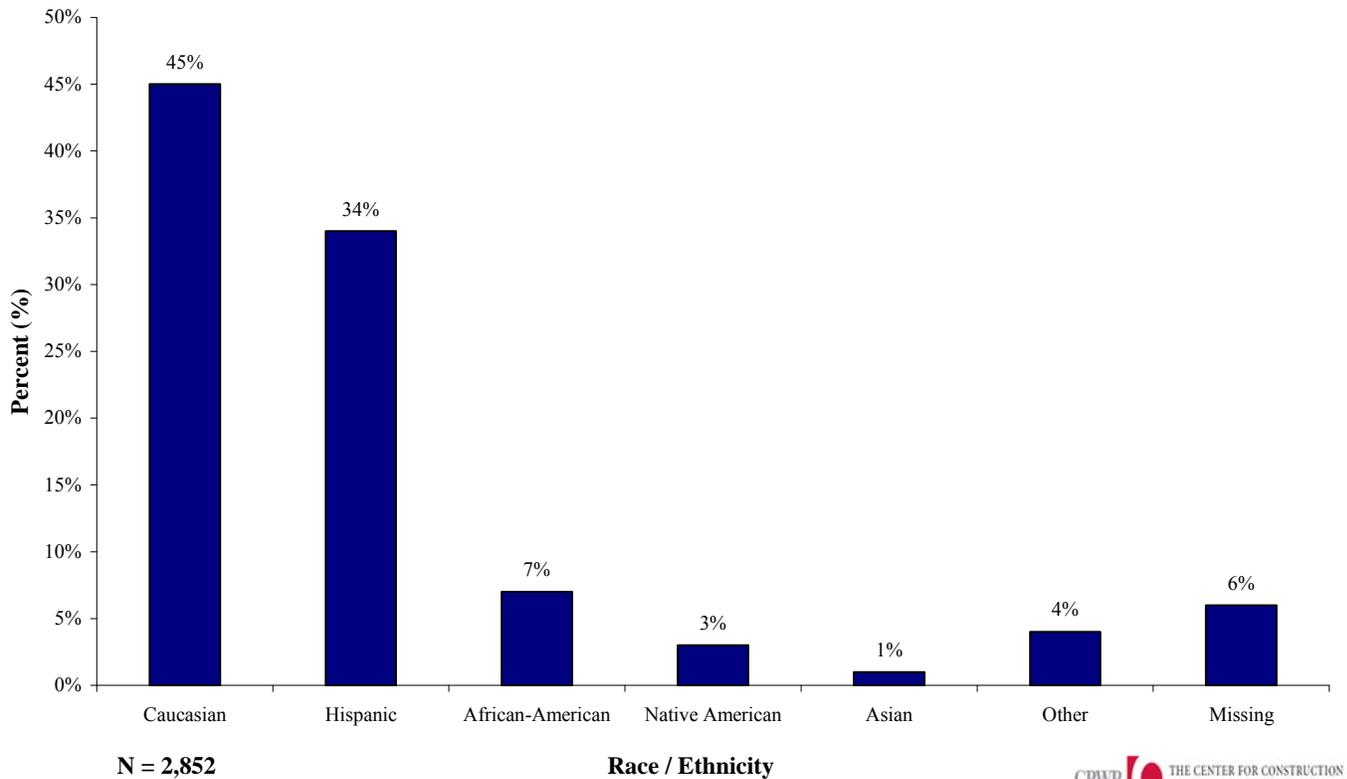


Figure 5 describes the work status of survey participants. Five hundred and seventeen workers who responded to the safety climate survey were Apprentices (17%) and 2,337(77%) were Journeymen.

**Figure 5. Distribution of Construction Workers by Work Status**

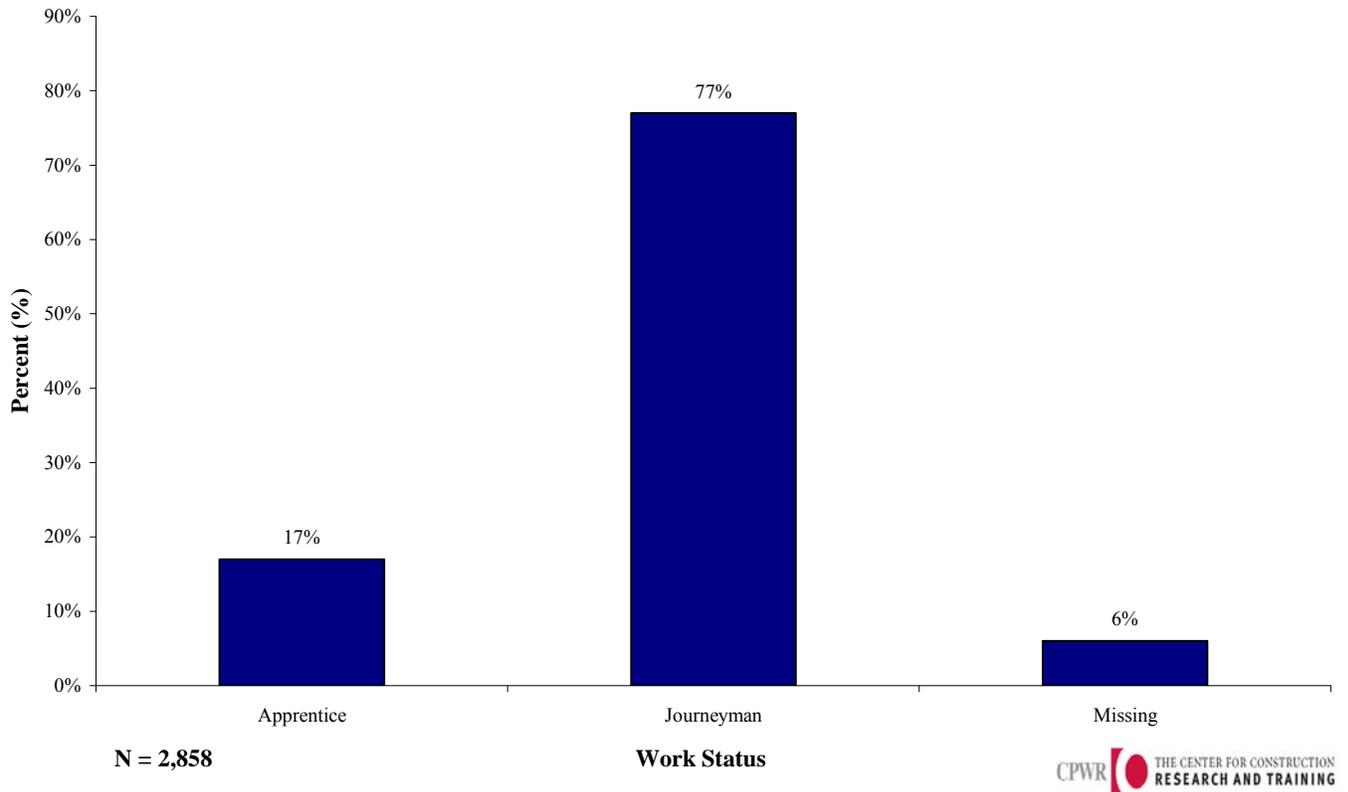


Figure 6 shows the number of months worked at City Center or Cosmopolitan worksites at the time workers completed the survey. Nine hundred and five (30%) were on the job less than three months and 1,925 (63%) were on-site for three months or more. The average number of months on the job was 5.8 months (SD = 5.4 months). Of the 3,035 workers, 17 reported they worked >30 months on the job. We categorized these individuals as having worked 30 months instead of excluding them from the analysis.

**Figure 6. Months Worked at City Center or Cosmopolitan Projects by Workers**

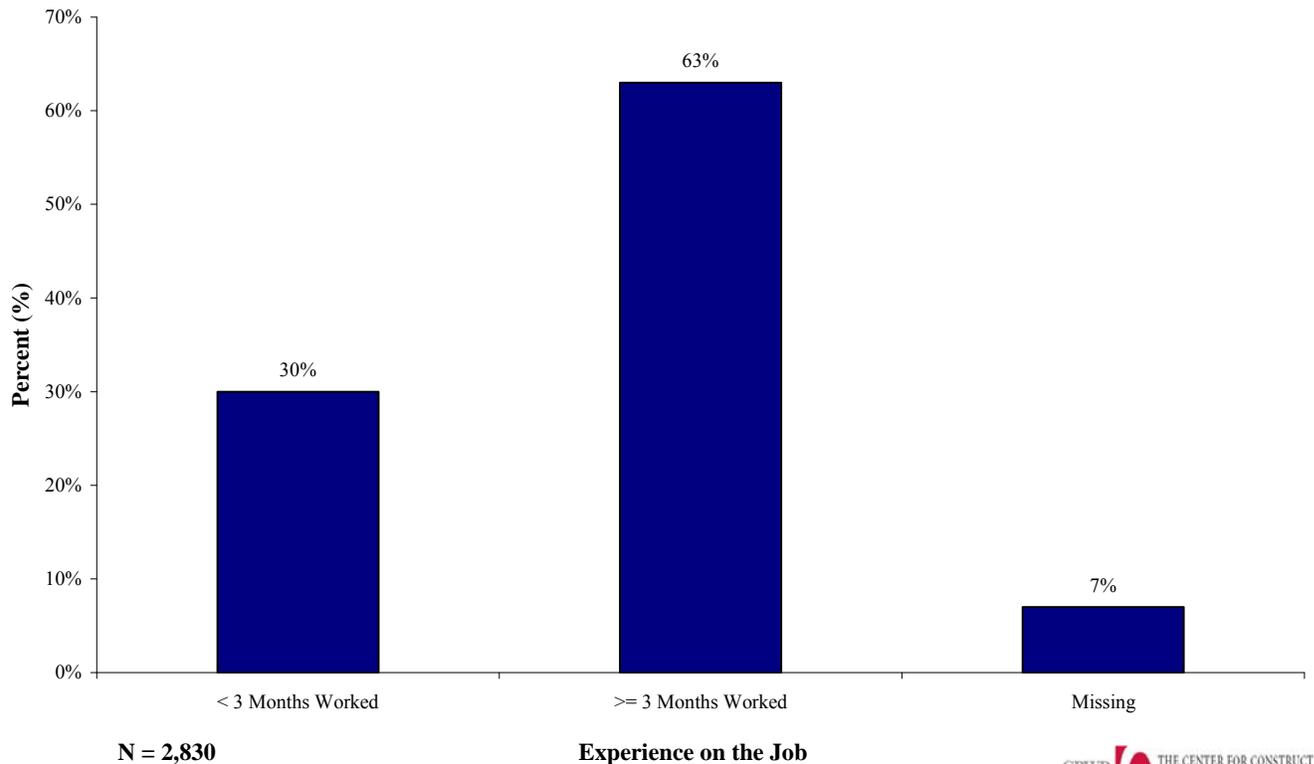
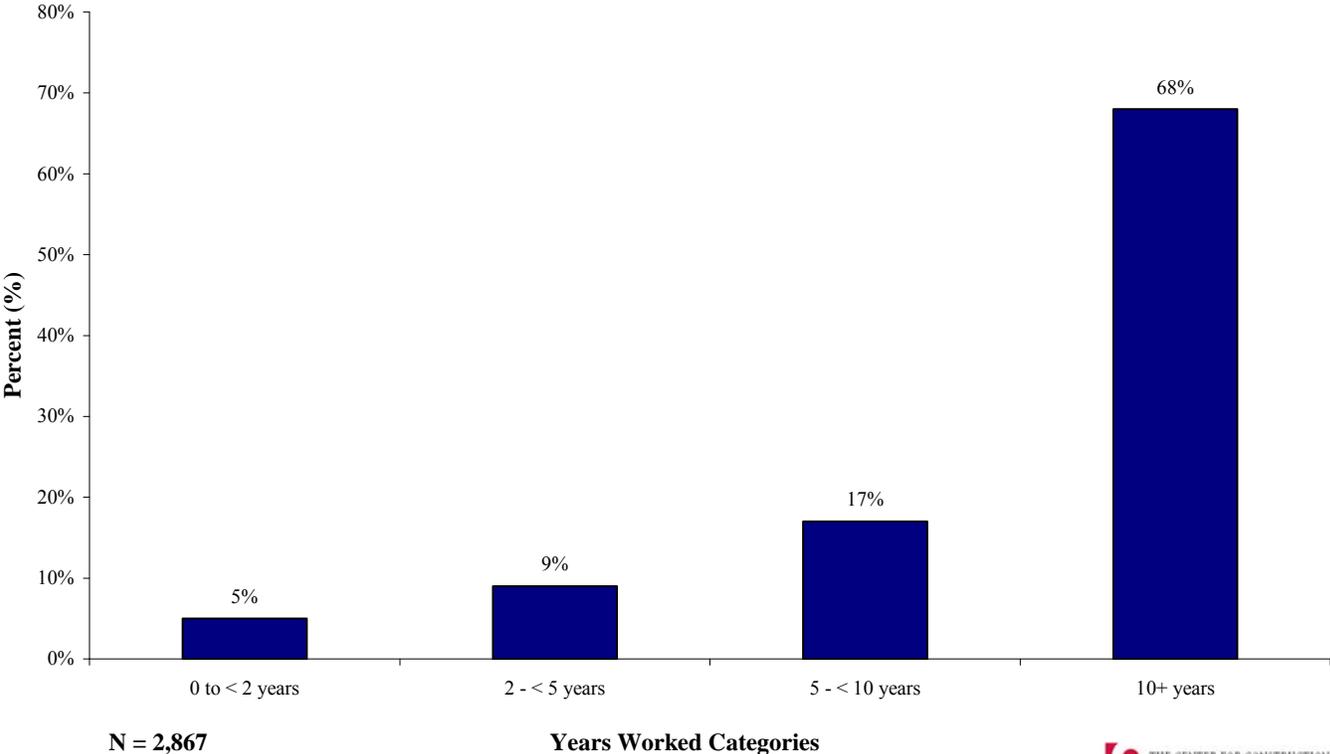


Figure 7 shows the distribution of self-reported years worked in the construction industry by workers who completed the survey. The average number of years worked was 16.0 years (SD=11.0 years). The number of years worked ranged from 0 to 57.

**Figure 7. Distribution of Years Worked in the Construction Industry by Workers**



**1-1-b. Item-Specific Responses**

Table 1 describes the frequency of responses for each category of the 6 point likert scale for each of the climate survey questions answered by workers. Selected highlights are presented at the end of Table 1.

**Table 1. Item-Specific Responses to Safety Climate Survey Questions-Worker Responses**

Questions	Strongly Disagree	Disagree	Somewhat Disagree	Somewh at Agree	Agree	Strongly Agree	Missing	Mean
1. Safety is visible on this job – for example, I have seen safety personnel or site supervisors or site management doing daily safety checks	108 (4%)	163 (5%)	200 (7%)	578 (19%)	1,271 (42%)	575 (19%)	140 (5%)	4.54 ± 1.25
2. The General Contractor (Perini) thinks that job site safety is more important than job schedules and deadlines	202 (7%)	268 (9%)	338 (11%)	728 (24%)	902 (30%)	450 (15%)	147 (5%)	4.11 ± 1.43
3. Perini safety personnel step in to stop unsafe operations	122 (4%)	203 (7%)	253 (8%)	683 (23%)	1,118 (37%)	486 (16%)	170 (6%)	4.37 ± 1.30
4. Perini thinks that safety is more important than productivity	158 (5%)	275 (9%)	355 (12%)	821 (27%)	825 (27%)	419 (14%)	182 (6%)	4.10 ± 1.37
5. The Perini safety staff follows up when there is a problem - it gets fixed right away and stays that way	146 (5%)	212 (7%)	344 (11%)	912 (30%)	867 (29%)	348 (11%)	206 (7%)	4.13 ± 1.29
6. Perini likes to get safety reports/feedback from workers like me	239 (8%)	330 (11%)	369 (12%)	722 (24%)	828 (27%)	328 (11%)	219 (7%)	3.91 ± 1.45
7. My subcontractor's safety program works well together with Perini – it is clear to me who is responsible for what	147 (5%)	249 (8%)	329 (11%)	738 (24%)	965 (32%)	380 (13%)	227 (7%)	4.16 ± 1.34
8. Perini believes that schedule is the most important issue on this project	169 (6%)	391 (13%)	444 (15%)	745 (25%)	707 (23%)	329 (11%)	250 (8%)	3.87 ± 1.41
9. Perini cares for my safety on this job	115 (4%)	129 (4%)	214 (7%)	711 (23%)	1,055 (35%)	639 (21%)	172 (6%)	4.53 ± 1.26
10. Safety is important to the subcontractor I currently work for – he or she mentions it often when talking to crews on site	72 (2%)	108 (4%)	146 (5%)	520 (17%)	1,159 (38%)	834 (27%)	196 (6%)	4.79 ± 1.18
11. My foreman has the safety knowledge needed for the hazards we face on this job	73 (2%)	85 (3%)	106 (3%)	429 (14%)	1,200 (40%)	978 (32%)	164 (5%)	4.93 ± 1.14
12. My foreman makes sure we follow site safety rules and procedures very closely	66 (2%)	79 (3%)	123 (4%)	408 (13%)	1,171 (39%)	1,032 (34%)	156 (5%)	4.96 ± 1.13

(Cont'd)

13. My foreman wants us to inform him/her of any safety problems so they can get them fixed or reported to others	51 (2%)	62 (2%)	84 (3%)	322 (11%)	1,238 (41%)	1,121 (37%)	157 (5%)	5.08 ± 1.04
14. If my foreman is unsure of a safety question, he or she always calls in a safety specialist	95 (3%)	148 (5%)	118 (4%)	458 (15%)	1,220 (40%)	806 (27%)	190 (6%)	4.75 ± 1.25
15. My foreman thinks that safety is more important than productivity	89 (3%)	131 (4%)	157 (5%)	488 (16%)	1,127 (37%)	852 (28%)	191 (6%)	4.75 ± 1.24
16. My foreman thinks that productivity is more important than safety	651 (21%)	831 (27%)	425 (14%)	413 (14%)	300 (10%)	174 (6%)	241 (8%)	2.79 ± 1.52
17. My subcontractor's safety program works well together with other subcontractor's safety programs	68 (2%)	119 (4%)	175 (6%)	700 (23%)	1,215 (40%)	506 (17%)	252 (8%)	4.58 ± 1.13
18. My foreman stops work if working conditions are unsafe, even if we have a deadline	83 (3%)	156 (5%)	160 (5%)	418 (14%)	1,153 (38%)	841 (28%)	224 (7%)	4.75 ± 1.26
19. I work too many hours per week on this job	1,074 (35%)	1,067 (35%)	261 (9%)	197 (6%)	147 (5%)	75 (2%)	214 (7%)	2.11 ± 1.28
20. Fatigue is an issue for me – I have caught myself making mistakes on the job when I was tired	951 (31%)	999 (33%)	266 (9%)	266 (9%)	234 (8%)	117 (4%)	202 (7%)	2.36 ± 1.44
21. Doing the work safely on this job has definite priority over getting it done on schedule	129 (4%)	164 (5%)	232 (8%)	454 (15%)	984 (32%)	865 (29%)	207 (7%)	4.62 ± 1.38
22. Sometimes I don't report a hazard because there isn't time to stop work or the work task is of too short a duration, so I work around the hazard	912 (30%)	1,002 (33%)	289 (10%)	290 (10%)	230 (8%)	119 (4%)	193 (6%)	2.40 ± 1.44
23. Sometimes I can't do my job safely because other trades are in my way	346 (11%)	573 (19%)	260 (9%)	564 (19%)	684 (23%)	395 (13%)	213 (7%)	3.66 ± 1.64
24. There is always enough personal protective equipment available to allow work to be done safely	135 (4%)	169 (6%)	195 (6%)	415 (14%)	1,163 (38%)	756 (25%)	202 (7%)	4.61 ± 1.36
25. I have received enough training to do my work safely	49 (2%)	71 (2%)	99 (3%)	306 (10%)	1,305 (43%)	1,024 (34%)	181 (6%)	5.04 ± 1.05
26. I always get enough site-specific information about a job to do it safely	70 (2%)	109 (4%)	202 (7%)	515 (17%)	1,224 (40%)	701 (23%)	214 (7%)	4.71 ± 1.17
27. I know what my safety responsibilities are at work	35 (1%)	33 (1%)	51 (2%)	231 (8%)	1,304 (43%)	1,157 (38%)	224 (7%)	5.21 ± 0.91

Cont'd

28. Sometimes I ignore a safety rule or policy in order to carry out an assignment to meet the schedule	863 (28%)	853 (28%)	284 (9%)	345 (11%)	338 (11%)	119 (4%)	233 (8%)	2.57 ± 1.53
29. I always report safety hazards that I see	80 (3%)	122 (4%)	162 (5%)	447 (15%)	1,203 (40%)	815 (27%)	206 (7%)	4.77 ± 1.21
30. I know who to report a hazard to when I see one on the job	67 (2%)	69 (2%)	77 (3%)	230 (8%)	1,349 (44%)	1,021 (34%)	222 (7%)	5.06 ± 1.07
31. I assist others to make sure they perform their work safely	49 (2%)	55 (2%)	72 (2%)	426 (14%)	1,358 (45%)	845 (28%)	230 (8%)	4.97 ± 1.01
32. Toolbox talks about safety are given regularly	105 (3%)	106 (3%)	104 (3%)	249 (8%)	1,146 (38%)	1,086 (36%)	239 (8%)	4.96 ± 1.25
33. Toolbox talks are helpful to me	68 (2%)	85 (3%)	127 (4%)	438 (14%)	1,168 (38%)	898 (30%)	251 (8%)	4.88 ± 1.15
34. Other workers care about my safety, and I care about theirs	75 (2%)	80 (3%)	123 (4%)	443 (15%)	1,149 (38%)	928 (31%)	237 (8%)	4.89 ± 1.16
35. I believe that safety committees for the project would be very beneficial	55 (2%)	68 (2%)	94 (3%)	473 (16%)	1,104 (36%)	1,002 (33%)	239 (8%)	4.97 ± 1.09
36. I'm confident I will not suffer a lost-time injury on my job here	132 (4%)	158 (5%)	198 (7%)	550 (18%)	996 (33%)	762 (25%)	239 (8%)	4.58 ± 1.36
37. Media attention has portrayed safety on the site accurately	143 (10%)	154 (11%)	197 (14%)	284 (20%)	296 (21%)	144 (10%)	210 (15%)	3.71 ± 1.54

Note – Only 1,428 (47%) workers responded to Q37, since Q37 was added to the survey in September, 2008.

### Selected “Positive” Findings from Table 1-Worker Responses

- 89% of workers agree their foreman wants workers to inform him/her of any safety problems so they can get them fixed or reported to others
- 89% of workers agree they know their safety responsibilities at work
- 87% of workers agree they have received enough safety training to do their work safely
- 87% of workers agree they assist others to make sure they perform their work safely
- 86% of workers agree their foremen has the safety knowledge needed for the hazards faced on the job
- 86% of workers agree their foremen follows site safety rules and procedures closely
- 85% of workers agree that safety committees for the project would be beneficial
- 84% of workers agree they know who to report a hazard to when they see one on the job
- 84% of workers agree that other workers care about their safety and they care about theirs
- 82% of workers agree they always report safety hazards they see

### Selected “Negative” Findings from Table 1 –Worker Responses

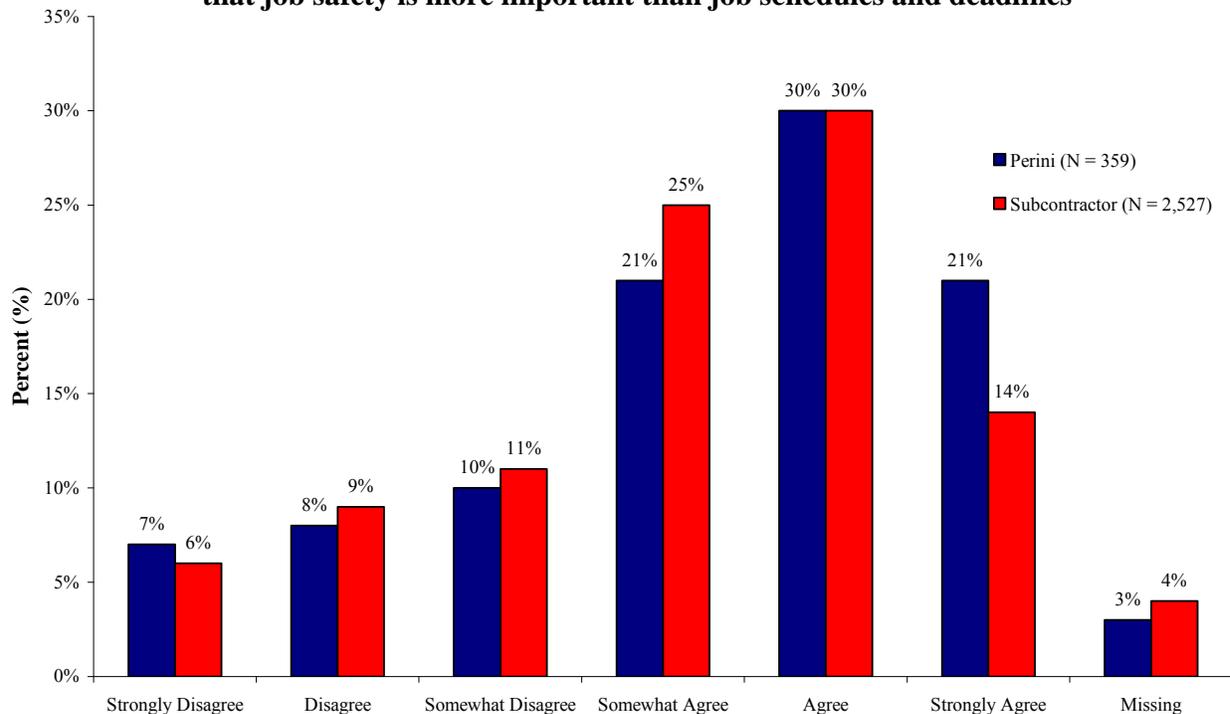
- 55% of workers agree that sometimes they can’t do their job safely because other trades are in their way (39% disagree)
- 34% of workers disagree that Perini thinks that job site safety is more important than job schedules and deadlines (59% agree)
- 35% of workers disagree the media has portrayed safety on the site accurately (51% agree)
- 30% of workers agree their foremen thinks that productivity is more important than safety (62% disagree)
- 27% of workers disagree the GC thinks that job site safety is more important than job schedules and deadlines (69% agree)
- 25% of workers agree that sometimes they ignore a safety rule or policy in order to carry out an assignment or meet the schedule (65% disagree)
- 22% of workers agree they sometimes do not report a hazard because there isn’t time to stop work or the work task is of short duration so they work around the hazard (73% disagree)
- 21% of workers agree that fatigue is an issue for them – they have caught themselves making mistakes on the job when they are tired (73% disagree)
- 17% of workers disagree that doing the work safely on the job has definite priority over getting it done on schedule (78% agree)
- 76% of workers agree they are confident they will not suffer a lost time injury on the job site (16% disagree)

### 1-1-c. Frequency Comparisons within the Worker Survey

#### 1-1-c1. Comparisons between Perini and Subcontractor Workers

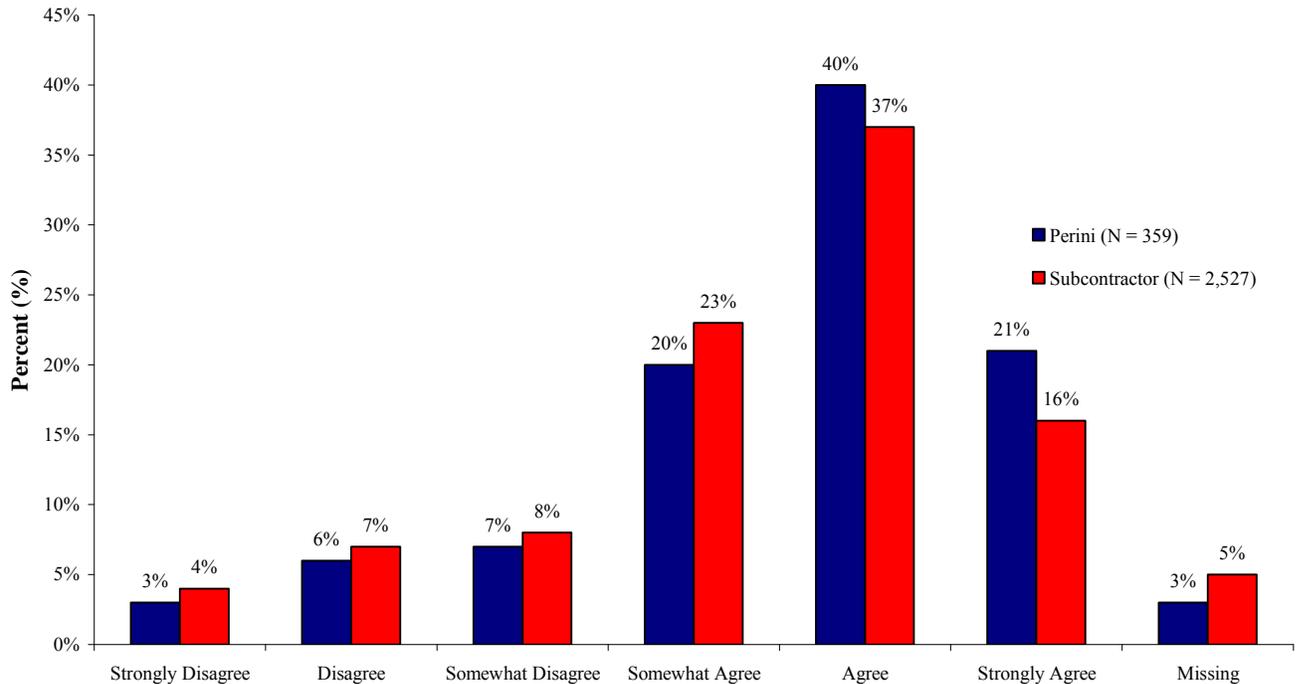
First, we examined the responses to the safety climate survey by comparing Perini workers (N=359) to all of the subcontractors' workers (N=2,527) on both City Center and Cosmopolitan sites combined. Overall, eighteen out of 37 questions (2, 3, 5, 6, 7, 9, 14, 15, 16, 17, 18, 19, 21, 23, 24, 32, 36, and 37) showed significant differences between Perini and subcontractor worker responses. Figures 8 through 11b represent selected questions for which there were significant differences between the two groups. Figure 8 shows a comparison of responses between Perini and all subcontractor workers to question number 2; *the General Contractor (Perini) thinks that job site safety is more important than job schedules and deadlines*. Over two-thirds of the subcontractor and Perini workers agreed that Perini prioritizes safety over schedules and deadlines. It is noteworthy that one-quarter of both Perini and subcontractor workers disagreed. Also, Perini workers strongly agree (21%) their employer (Perini) thinks job safety is more important than schedules and deadlines compared with subcontractor workers (14%).

**Figure 8. Worker Responses to Q. 2: The General Contractor (Perini) thinks that job safety is more important than job schedules and deadlines**



In response to Q.3 *Perini safety personnel step in to stop unsafe operations*, the distribution of responses was again significantly different between Perini workers and subcontractor workers as shown in (Figure 9). The majority of Perini workers (81%) agree with this statement compared with 76% percent of subcontractor workers.

**Figure 9. Worker Responses to Q. 3: Perini safety personnel step in to stop unsafe operations**



In response to Q. 8: *My subcontractor's safety program works well together with Perini-it is clear to me who is responsible for what*-Perini worker responses were significantly different from subcontractor workers (Figure 10). Three-quarters of Perini workers agreed with the statement (74%) whereas 68% of subcontractors agreed. Nearly a quarter of both Perini and subcontractor workers disagreed.

**Figure 10. Worker Responses to Q. 7: Perini's safety program works well together with other subcontractor safety programs -- it is clear to me who is responsible for what**

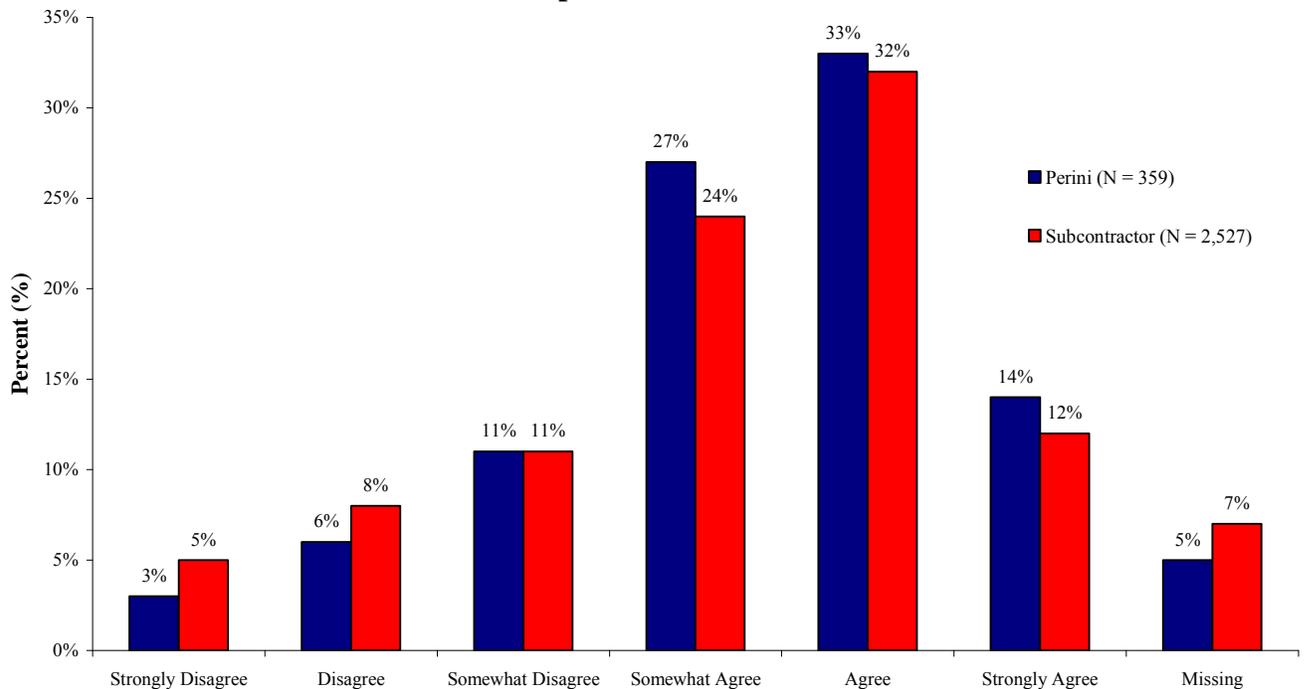
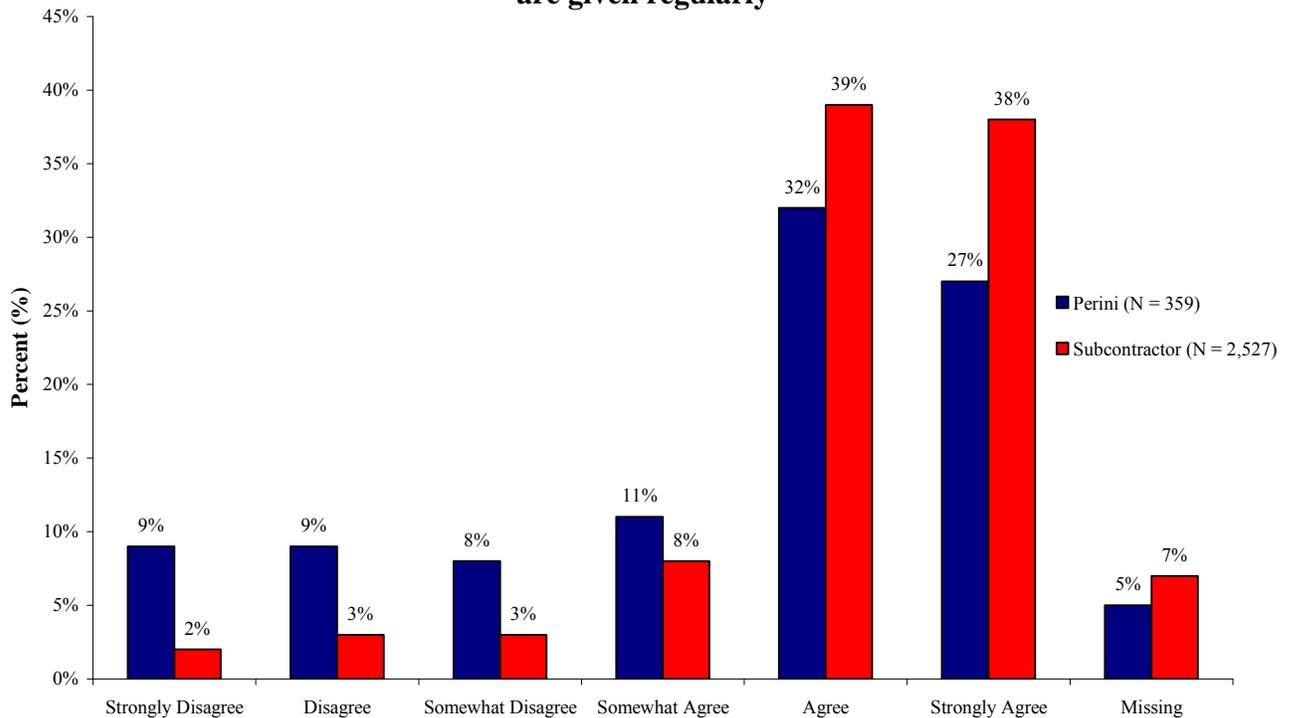
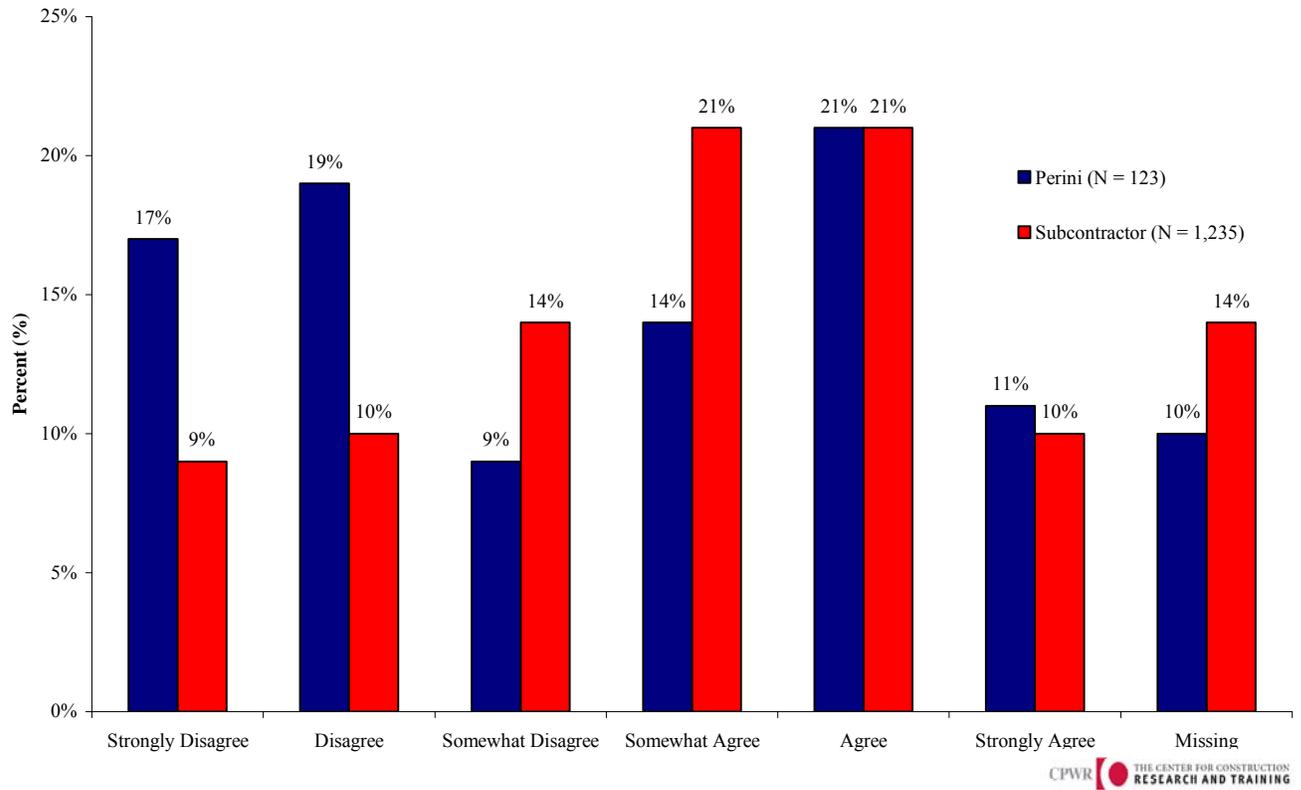


Figure 11a shows responses to question 32 asking *whether workers thought toolbox talks about safety topics were given on a regular basis*. Fewer Perini workers agreed (70%) than subcontractor workers (85%). Twenty-six percent of Perini workers disagreed compared with 8% of subcontractor workers. Figure 11b describes question 37 which addresses the accuracy of media attention on site safety. Forty-five percent of Perini workers disagreed that media attention was portrayed accurately compared with 33% of subcontractor workers.

**Figure 11a. Worker Responses to Q. 32: Toolbox talks about safety are given regularly**



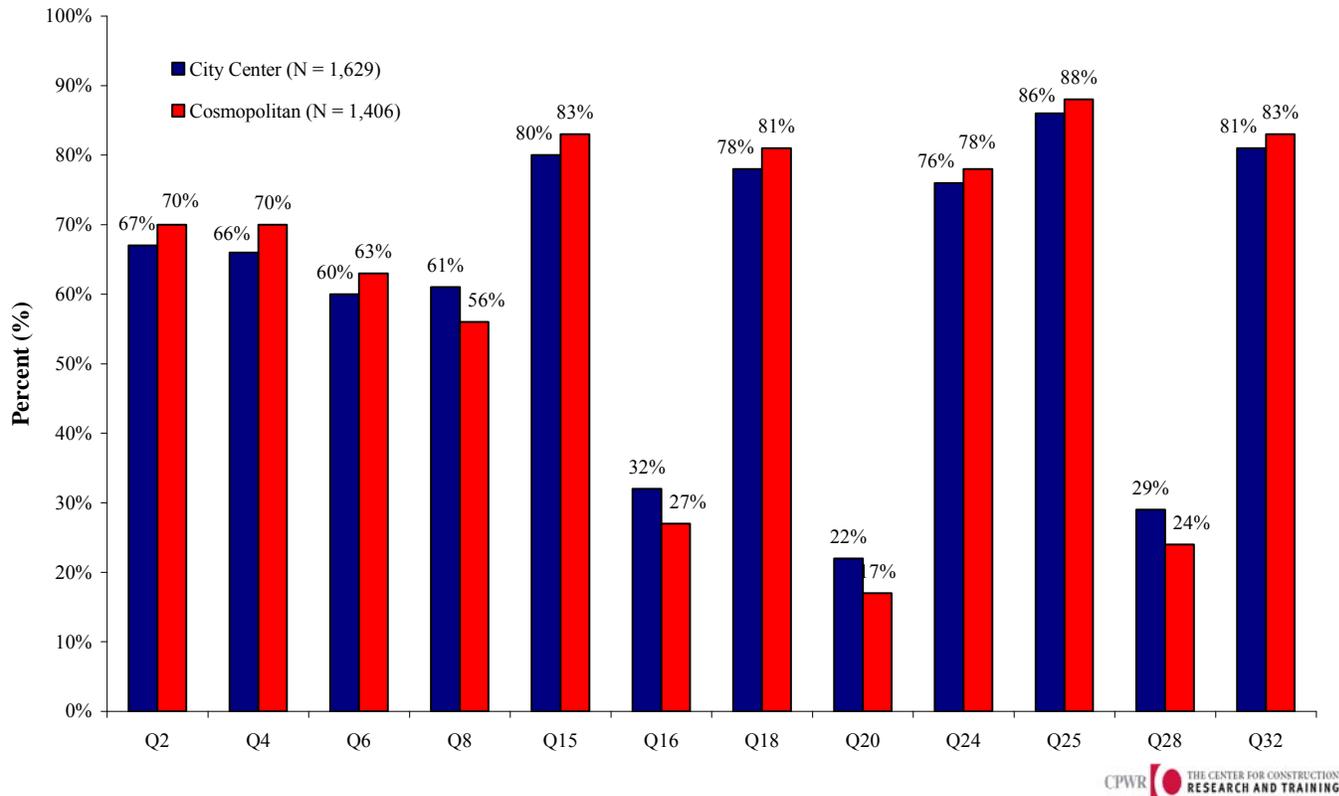
**Figure 11b. Worker Responses to Q. 37: Media attention has portrayed safety on the site accurately**



### *1-1-c2. Comparisons between City Center and Cosmopolitan Site Workers*

Next, we compared responses from workers on the City Center site to those on the Cosmopolitan site. Figure 12 displays all the questions for which responses between workers at the two sites were significantly different. The distribution of percents of agreement is presented for these specific questions. Responses to questions one through nine focused on worker perceptions about Perini. Workers at the Cosmopolitan site tended to agree in significantly higher percentages than the City Center workers. For questions 8, 16, 20, and 28 workers at the Cosmopolitan site responded in significantly lower percentages than workers at the City Center site. It appears that for question 1-10 regarding questions about Perini, Cosmopolitan workers have a more favorable perception of Perini safety than City Center workers. Similarly, for questions 11-18, regarding perceptions about their employer (either Perini or subcontractor foremen) Cosmopolitan workers are more positive. In regard to questions about individuals' perceptions about their safety and safety on the site, questions 24, 25 and 32, workers at the Cosmopolitan site agreed they had more PPE than City Center workers, more training, and more regular tool box talks. On the other hand, for questions 20 and 28, regarding fatigue and ignoring safety rules and policy, workers at City Center agreed they experienced more fatigue and ignored more safety rules and policy than Cosmopolitan site workers.

**Figure 12. Percent of Agreement (somewhat agree, agree and strongly agree) on climate survey questions between City Center and Cosmopolitan Workers**



**Survey questions included in Figure 12:-**

- Q2.** The General Contractor (Perini) thinks that job site safety is more important than job schedules and deadlines
- Q4.** Perini thinks that safety is more important than productivity
- Q6.** Perini likes to get safety reports/feedback from workers like me
- Q8.** Perini believes that schedule is the most important issue on this project
- Q15.** My foreman thinks that safety is more important than productivity
- Q16.** My foreman thinks that productivity is more important than safety
- Q18.** My foreman stops work if working conditions are unsafe, even if we have a deadline
- Q20.** Fatigue is an issue for me – I have caught myself making mistakes on the job when I was tired
- Q24.** There is always enough personal protective equipment available to allow work to be done safely
- Q25.** I have received enough training to do my work safely
- Q28.** Sometimes I ignore a safety rule or policy in order to carry out an assignment to meet the schedule
- Q32.** Toolbox talks about safety are given regularly

### 1-1-c3. Comparisons based on Months Worked

The third set of descriptive analyses examined workers' perceptions of safety climate by experience on the job < three months and  $\geq$  3 months. Figure 13 compares perceptions about safety and scheduling/deadlines. This figure shows significant differences among workers employed  $\geq$  3 months with those working less than three months. Those who were on the job < 3 months perceived Perini to be focused more on safety than scheduling (74% agree) compared with those who worked greater than or equal to three months (67% agree).

**Figure 13. Worker Responses to Q. 2: The General Contractor (Perini) thinks that job safety is more important than job schedules and deadlines**

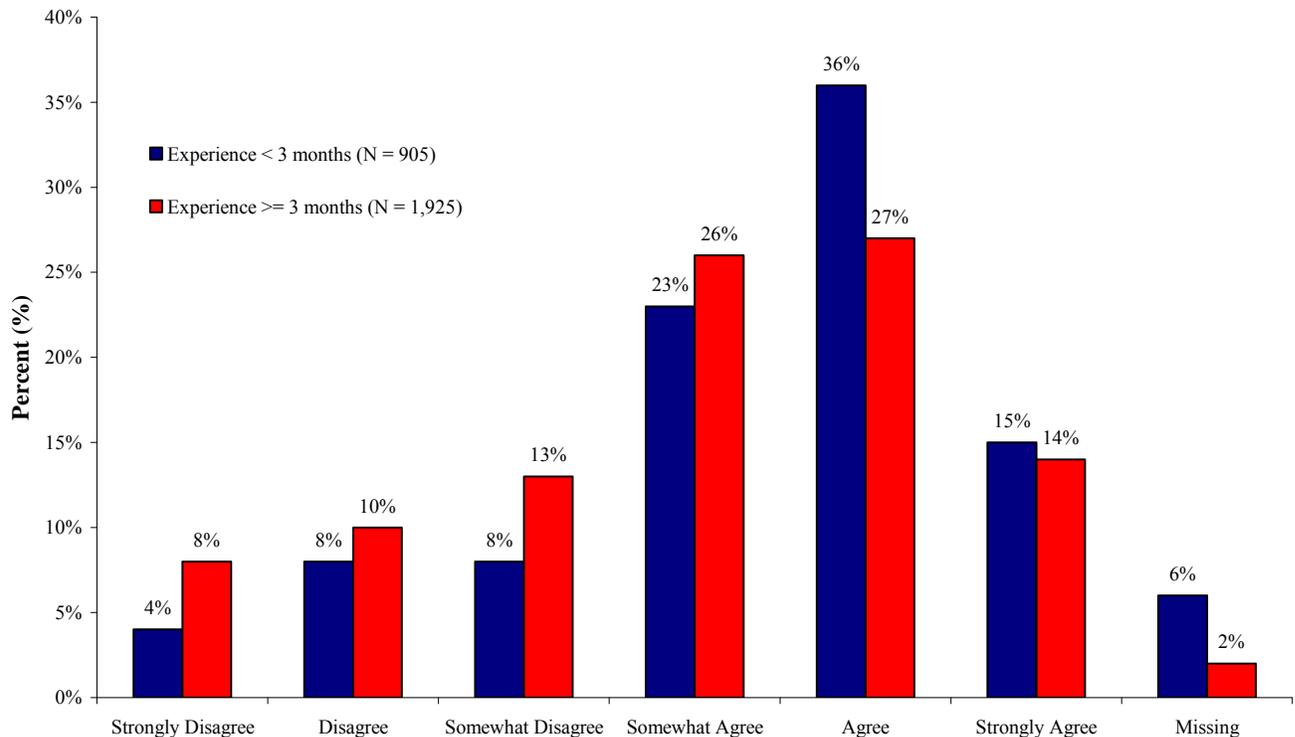
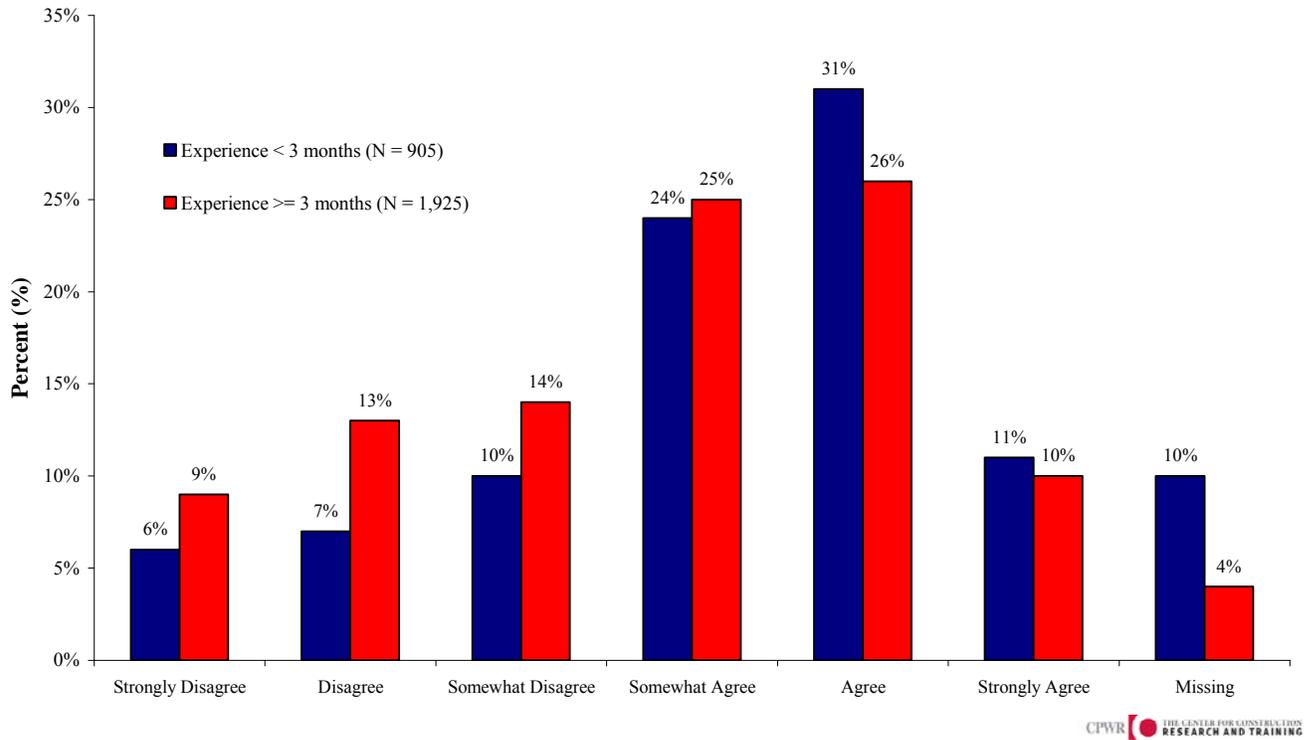


Figure 14 shows responses to question 6: *Perini likes to get reports/feedback from workers like me*. In this case, workers with more experience disagreed significantly more (36%) than those workers who had less experience (23%).

**Figure 14. Worker Responses to Q. 6: Perini likes to get safety report / feedback from workers like me**



## 1-2. Psychometric Analysis

### 1-2-a. Factors and Corresponding Survey Items for the Worker Survey

Based on a series of factor analyses, parallel analyses, and item analyses described above, 16 factors were identified for the worker survey. Factors and corresponding survey items, as well as descriptive statistics (alpha coefficients, possible range of scores, observed range of scores, mean, standard deviation, and number of respondents) of each factor are described in Tables 2. See Appendix 2 for definitions of the 16 factors.

**Table 2. Factors and Corresponding Survey Items for the Worker Survey**

<b>Factors with corresponding survey items</b>	<b>Alpha</b>	<b>PR</b>	<b>OR</b>	<b>Mean</b>	<b>SD</b>	<b>N</b>
<b>Perini Safety Climate</b>	.91	7-42	7-42	29.7	7.5	2817
Safety is visible on this job – for example, I have seen safety personnel or site supervisors or site management doing daily safety checks						
The General Contractor (Perini) thinks that job site safety is more important than job schedules and deadlines						
Perini safety personnel step in to stop unsafe operations						
Perini thinks that safety is more important than productivity						
The Perini safety staff follows up when there is a problem - it gets fixed right away and stays that way						
Perini likes to get safety reports/feedback from workers like me						
Perini cares for my safety on this job						
<b>Foreman Safety Management</b>	.90	8-48	8-48	38.3	7.4	2843
Safety is important to the subcontractor I currently work for – he or she mentions it often when talking to crews on site						
My foreman has the safety knowledge needed for the hazards we face on this job						
My foreman makes sure we follow site safety rules and procedures very closely						
My foreman wants us to inform him/her of any safety problems so they can get them fixed or reported to others						

If my foreman is unsure of a safety question, he or she always calls in a safety specialist						
My foreman thinks that safety is more important than productivity						
My foreman thinks that productivity is more important than safety ( <i>reverse code</i> )						
My foreman stops work if working conditions are unsafe, even if we have a deadline						
<b>Factors with corresponding survey items</b>	<b>Alpha</b>	<b>PR</b>	<b>OR</b>	<b>Mean</b>	<b>SD</b>	<b>N</b>
<b>Safety Behaviors</b>	.76	3-18	3-18	14.8	2.7	2741
I always report safety hazards that I see						
I know who to report a hazard to when I see one on the job						
I assist others to make sure they perform their work safely						
<b>Safety Practices</b>	.79	5-30	5-30	24.5	4.3	2817
There is always enough personal protective equipment available to allow work to be done safely						
I have received enough training to do my work safely						
I always get enough site-specific information about a job to do it safely						
I know what my safety responsibilities are at work						
Toolbox talks about safety are given regularly						
<b>Fatigue</b>	.67	2-12	2-12	4.5	2.4	2775
I work too many hours per week on this job						
Fatigue is an issue for me – I have caught myself making mistakes on the job when I was tired						
<b>Unsafe work due to time pressure</b>	.67	2-12	2-12	5.0	2.6	2765
Sometimes I don't report a hazard because there isn't time to stop work or the work task is of too short a duration, so I work around the hazard						
Sometimes I ignore a safety rule or policy in order to carry out an assignment to meet the schedule						
<b>Perini Safety Program</b>	N/A	1-6	1-6	4.2	1.3	2808

Perini's safety program works well together with other subcontractor safety programs – it is clear to me who is responsible for what						
<b>Subcontractor Safety Program</b>	N/A	1-6	1-6	4.6	1.4	2783
My subcontractor's safety program works well together with other subcontractor's safety programs						
<b>Importance of Scheduling</b>	N/A	1-6	1-6	3.9	1.4	2785
Perini believes that schedule is the most important issue on this project						
<b>Factors with corresponding survey items</b>	<b>Alpha</b>	<b>PR</b>	<b>OR</b>	<b>Mean</b>	<b>SD</b>	<b>N</b>
<b>Safety Priority</b>	N/A	1-6	1-6	4.6	1.4	2828
Doing the work safely on this job has definite priority over getting it done on schedule						
<b>Situational Constraints Caused by Other Trades</b>	N/A	1-6	1-6	3.7	1.6	2822
Sometimes I can't do my job safely because other trades are in my way						
<b>Toolbox Talks Evaluation</b>	N/A	1-6	1-6	4.9	1.1	2784
Toolbox talks are helpful to me						
<b>Concern for Others</b>	N/A	1-6	1-6	4.9	1.2	2798
Other workers care about my safety, and I care about theirs						
<b>Perceived Need for Safety Committee</b>	N/A	1-6	1-6	5.0	1.1	2796
I believe that safety committees for the project would be very beneficial						
<b>Injury Risk Perception</b>	N/A	1-6	1-6	2.4	1.4	2796
I'm confident I will not suffer a lost-time injury on my job here ( <i>reverse code</i> )						
<b>Media Coverage</b>	N/A	1-6	1-6	3.7	1.6	1506
Media attention has portrayed safety on the site accurately						

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*Note.* **Alpha** = alpha coefficient, which is computed only for Factors consisting of 2 or more items. It ranges from 0 to 1, with values closer to 1 indicating that the set of items measures well a single Factor. **PR** = possible range of scores. **OR** = observed range of scores. **Mean** = an arithmetic average of the sum of the individual responses to the set of items for each Factor based on the survey respondents. **SD** = standard deviation, which is a measure of how widely the respondents' scores differ from the mean score. The larger the standard deviation, the more spread are the respondents' scores. **N** = number of respondents who provide valid responses for each factor. N may differ across factors due to missing responses.

***Summary of Table 2.***

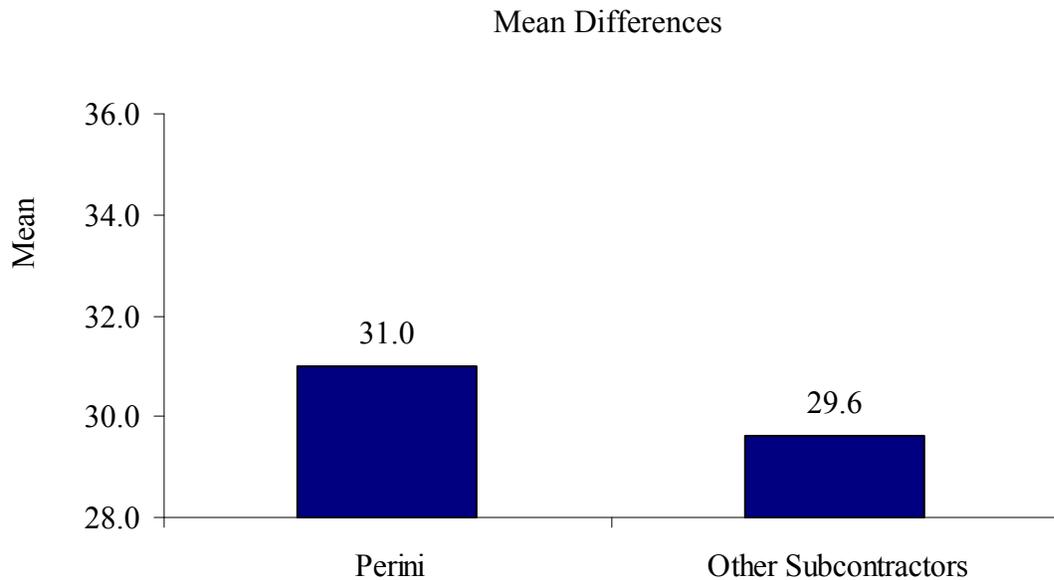
Overall, alpha coefficients ranged from 0.67 to 0.91, which were satisfactory. Both possible range of scores and observed range of scores were the same for all the factors, which indicated no or little evidence of range restriction.

**1-2-b. Mean Comparisons within the Worker Survey**

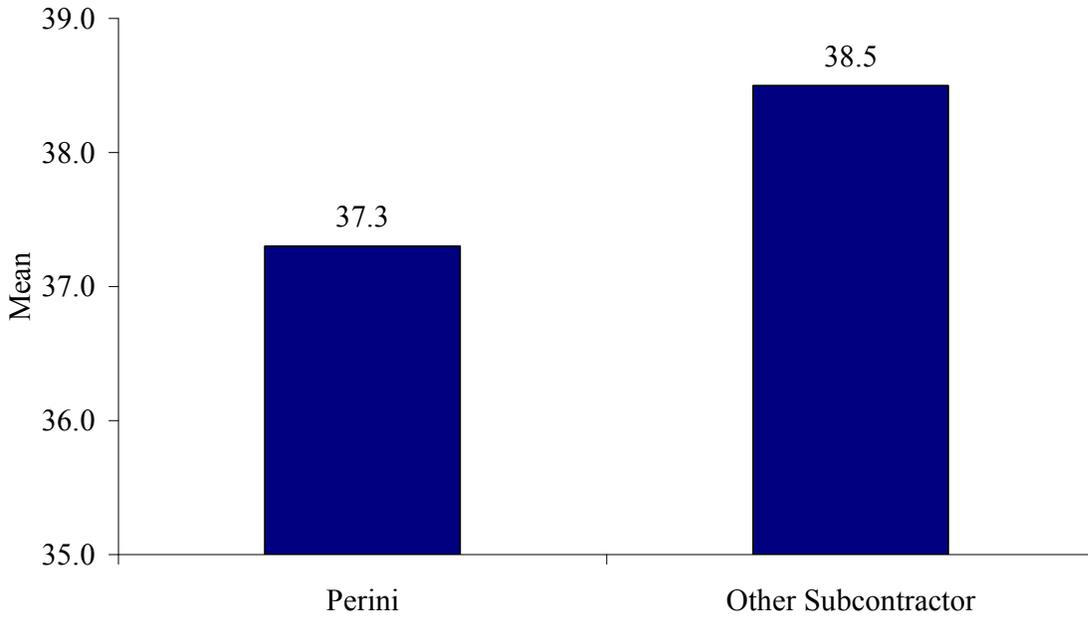
Mean comparisons of each of the 16 factors were then conducted based on the following background characteristics: (1) Perini compared with other subcontractors, (2) 10 trades (carpenter, electrician, laborer, plumber/pipefitter, sheet metal worker, operating engineer, insulator, cement mason, iron worker, and painter), (3) months worked on the job (less than 3-month vs. greater or equal to 3 months), (4) job site (City Center vs. Cosmopolitan), (5) work status (apprentice vs. journeymen), and (6) years worked in the construction industry (0-2, 2-5, 5-10, and 10 or more). Only statistically significant results are reported in Figures 15a – 17g.

**1-2-b1. Mean Comparisons between Perini and Other Subcontractors**

**Figure 15a. Perini Safety Climate**

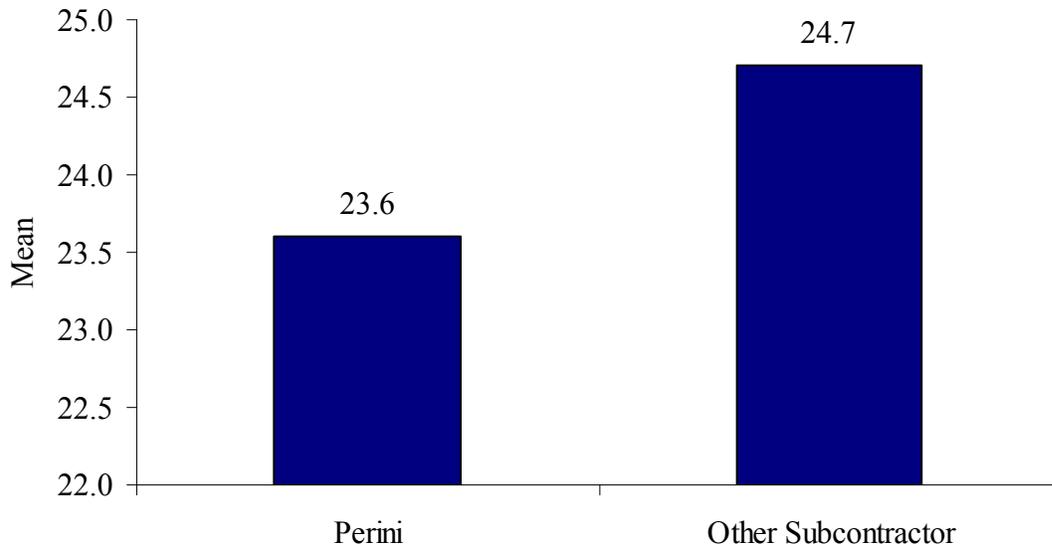


**Figure 15b. Foreman Safety Management**  
Mean Differences



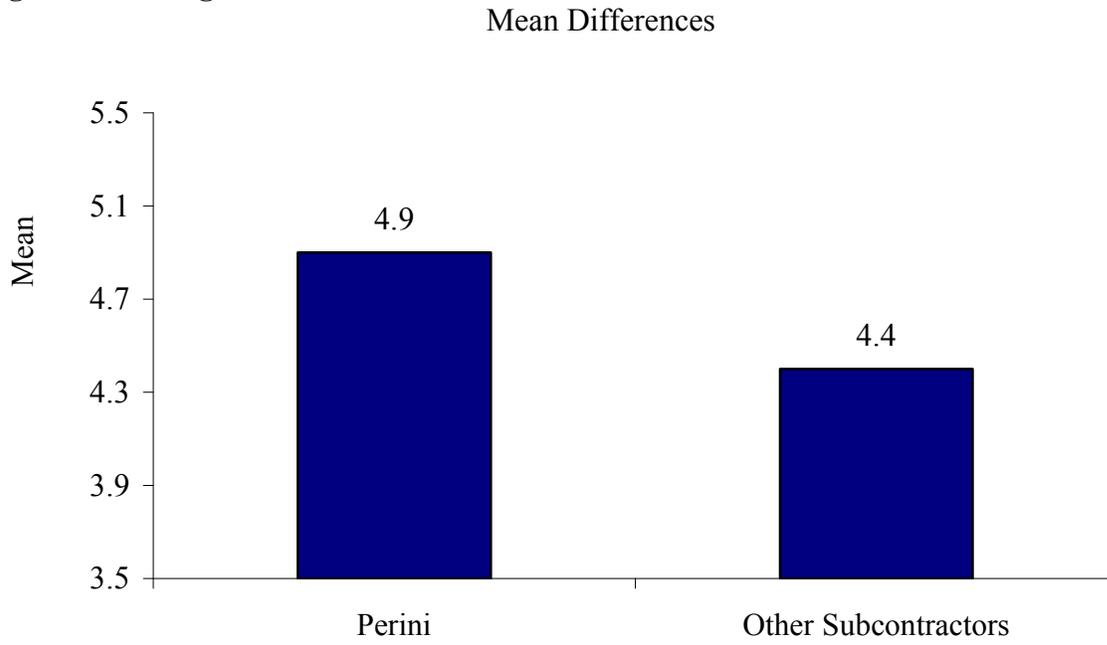
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**Figure 15c. Safety Practices**  
Mean Differences

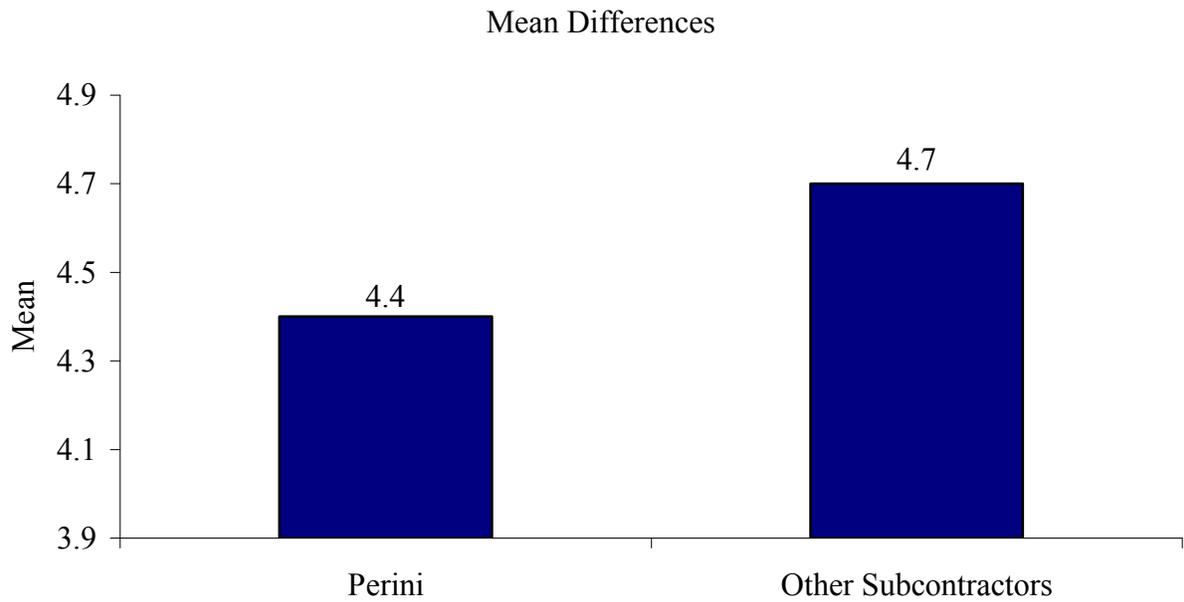


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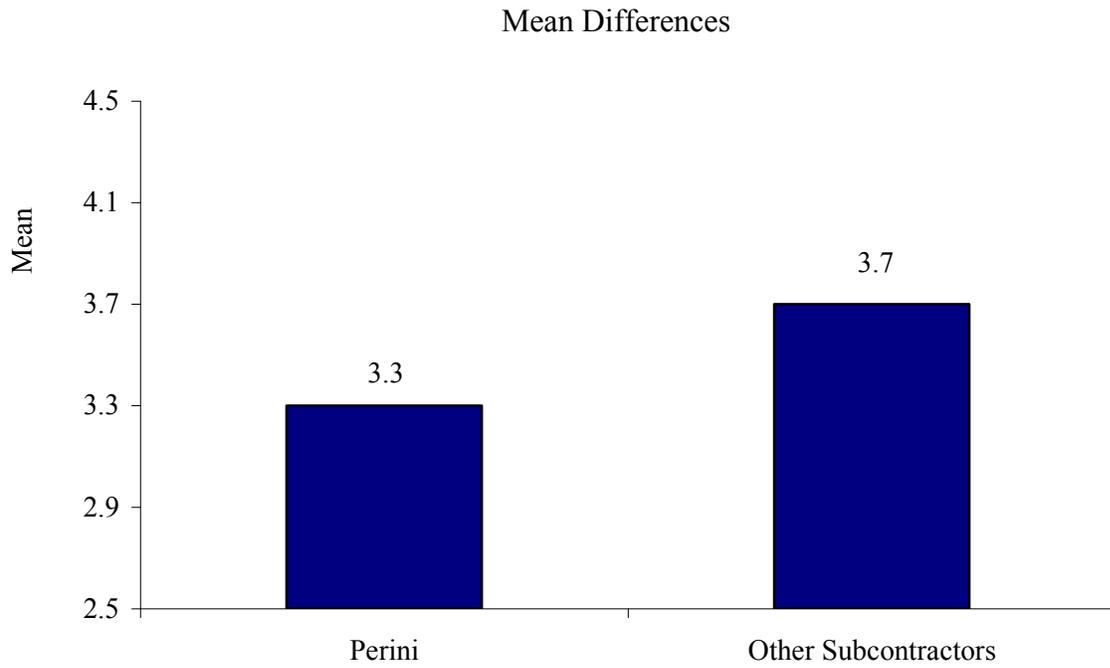
**Figure 15d. Fatigue**



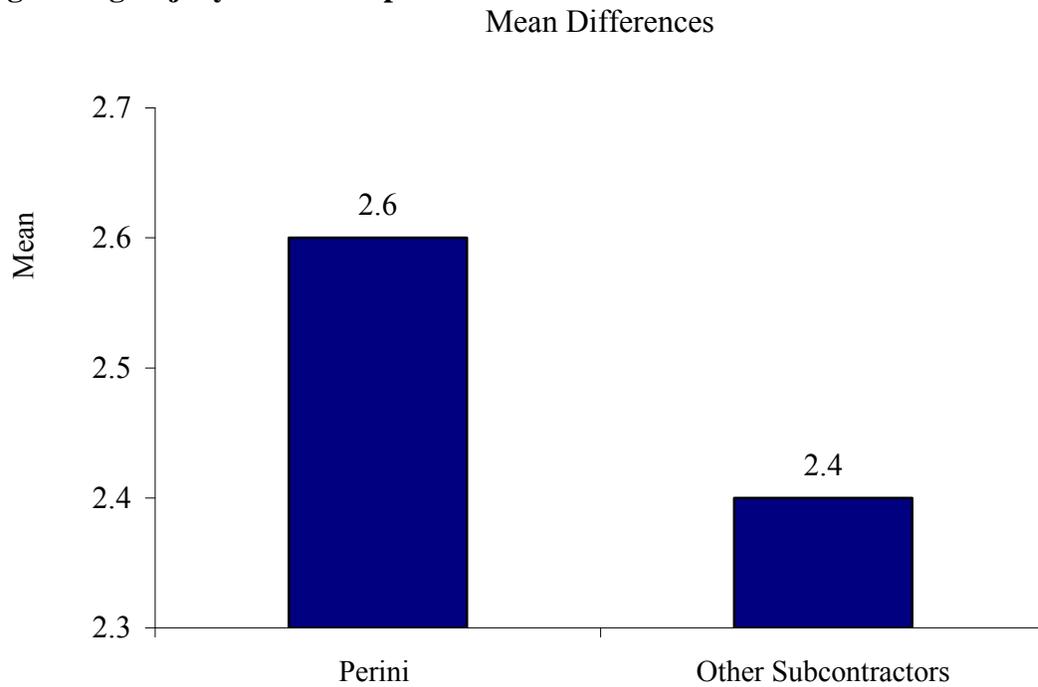
**Figure 15e. Safety Priority**



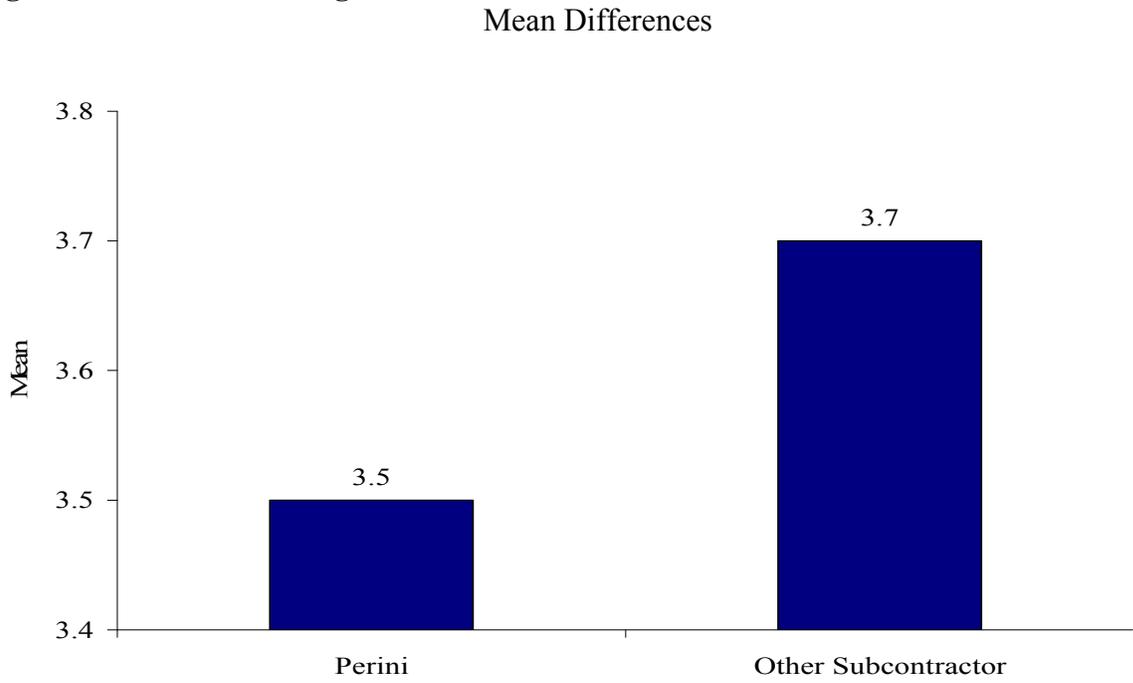
**Figure 15f. Situational Constraints Caused by Other Trades**



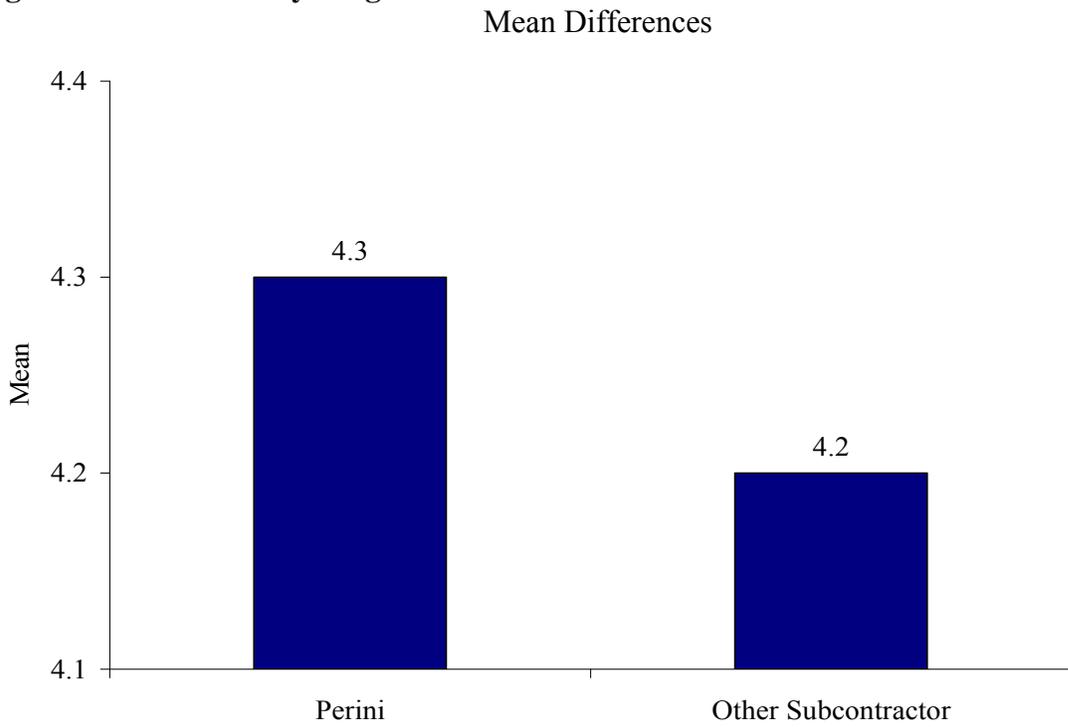
**Figure 15g. Injury Risk Perception**



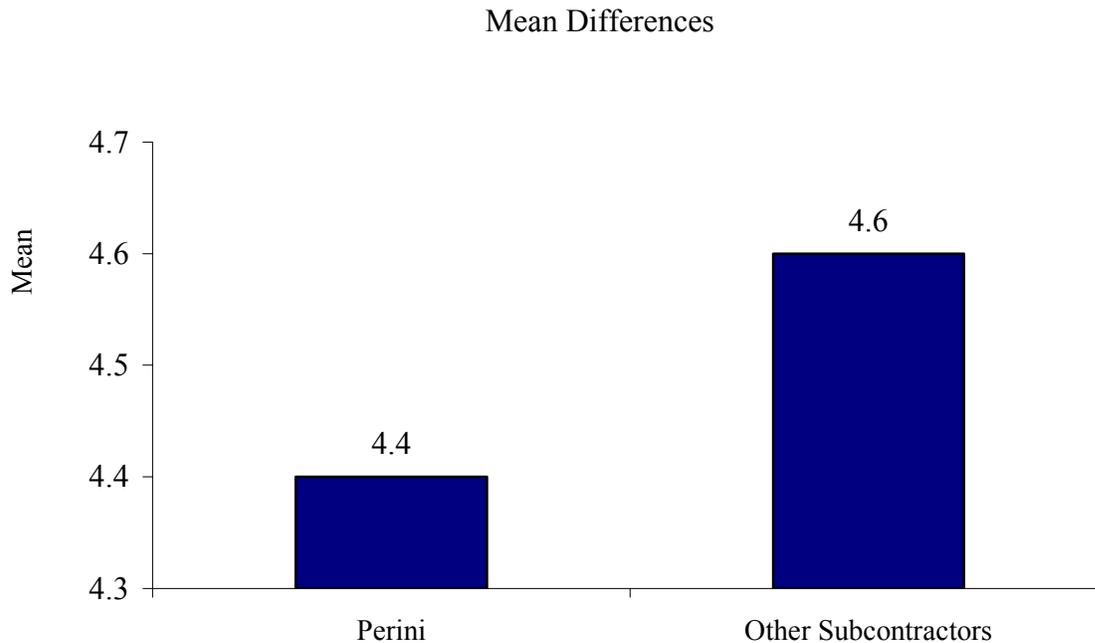
**Figure 15h. Media Coverage**



**Figure 15i. Perini Safety Program**



**Figure 15j. Subcontractor Safety Program**



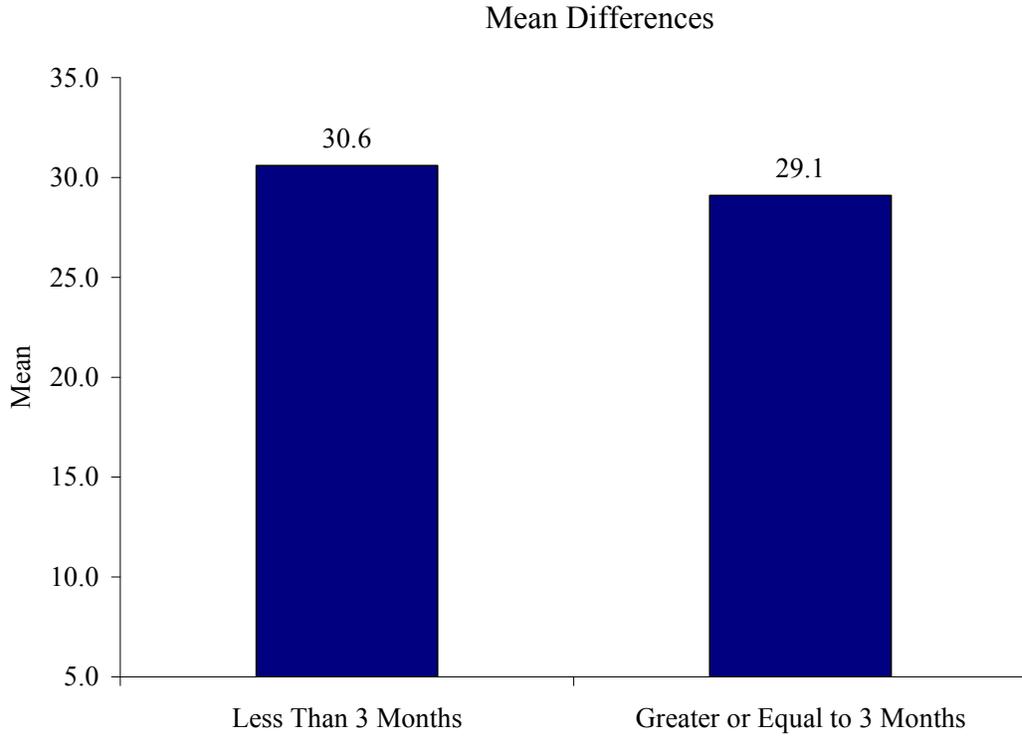
**Summary of Key Findings Based on Comparisons Between Perini and Subcontractors (Figures 15a-15j).**

In contrast to workers hired by subcontractors, workers hired by Perini

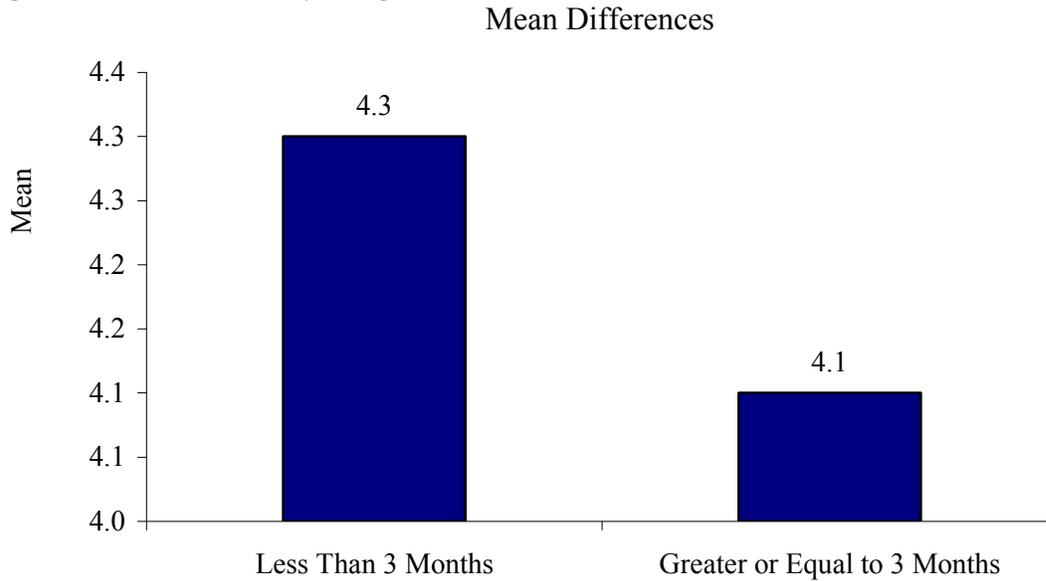
- reported more positive Perini safety climate.
- reported more positive Perini safety program (e.g., Perini’s safety program works well together with other subcontractor safety programs).
- experienced less situational constraints caused by other trades.
- reported less positive foremen safety management (e.g., considering that safety is more important than productivity).
- reported less positive safety practices (e.g., having enough personal protective equipment, as well as receiving information and training about safety).
- reported less positive safety priority.
- perceived less accurate media coverage.
- experienced more fatigue at work.
- perceived a higher risk of being injured at work.

*1-2-b2. Mean Comparisons based on Months Worked*

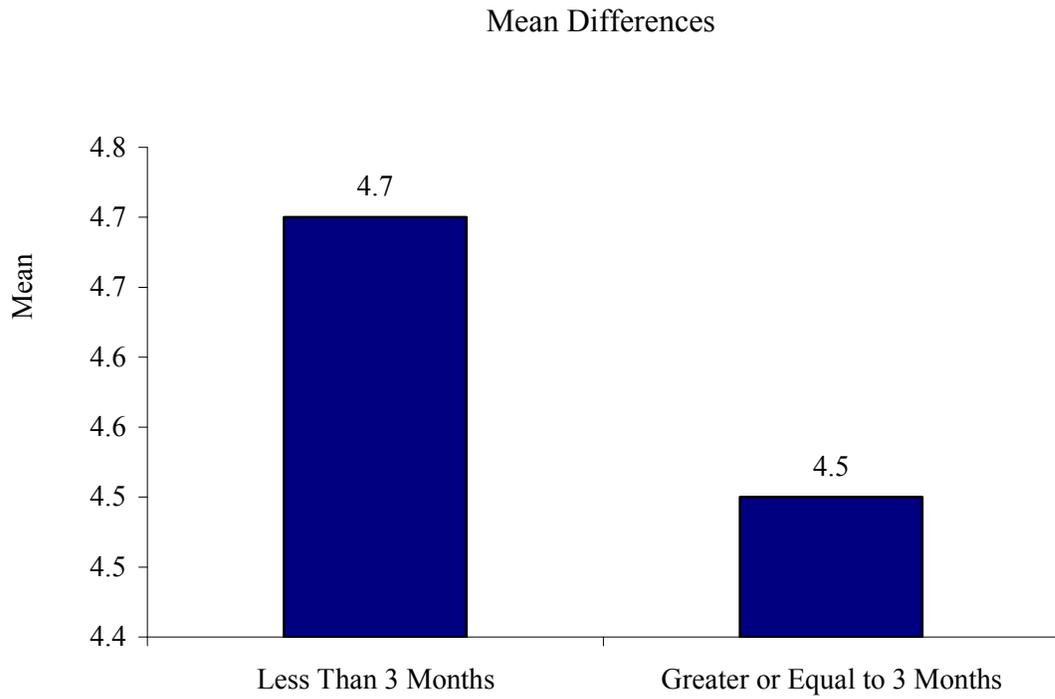
**Figure 16a. Perini Safety Climate**



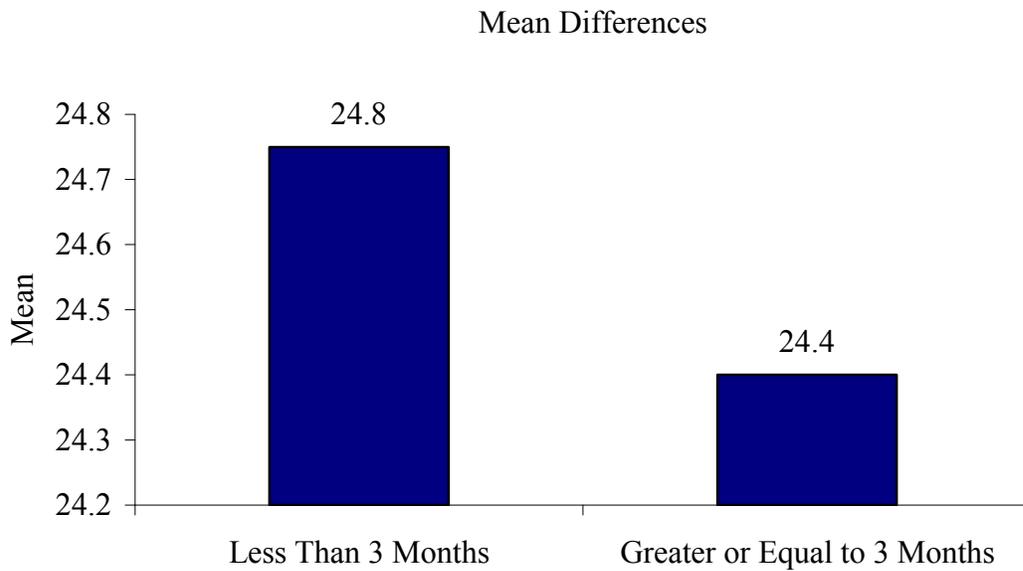
**Figure 16b. Perini Safety Program**



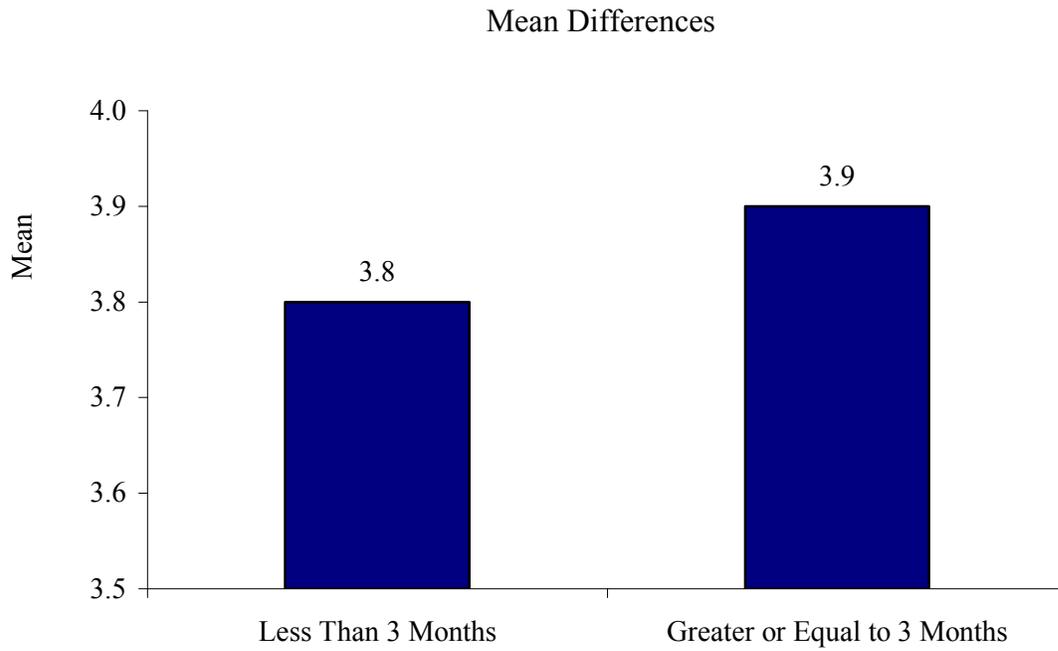
**Figure 16c. Subcontractor Safety Program**



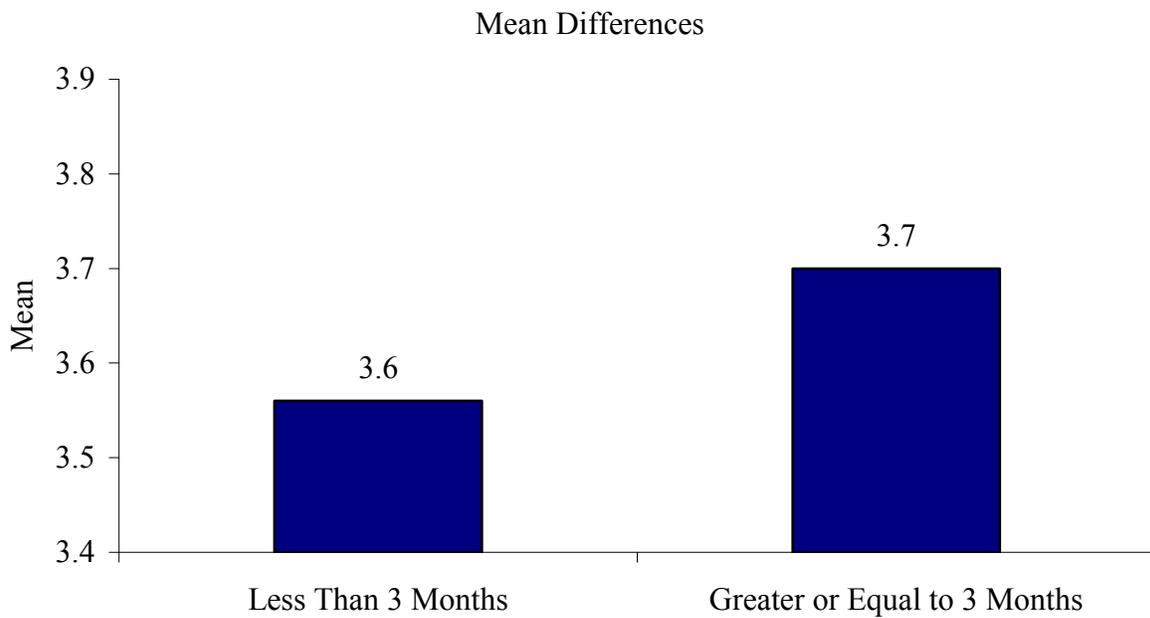
**Figure 16d. Safety Practices**



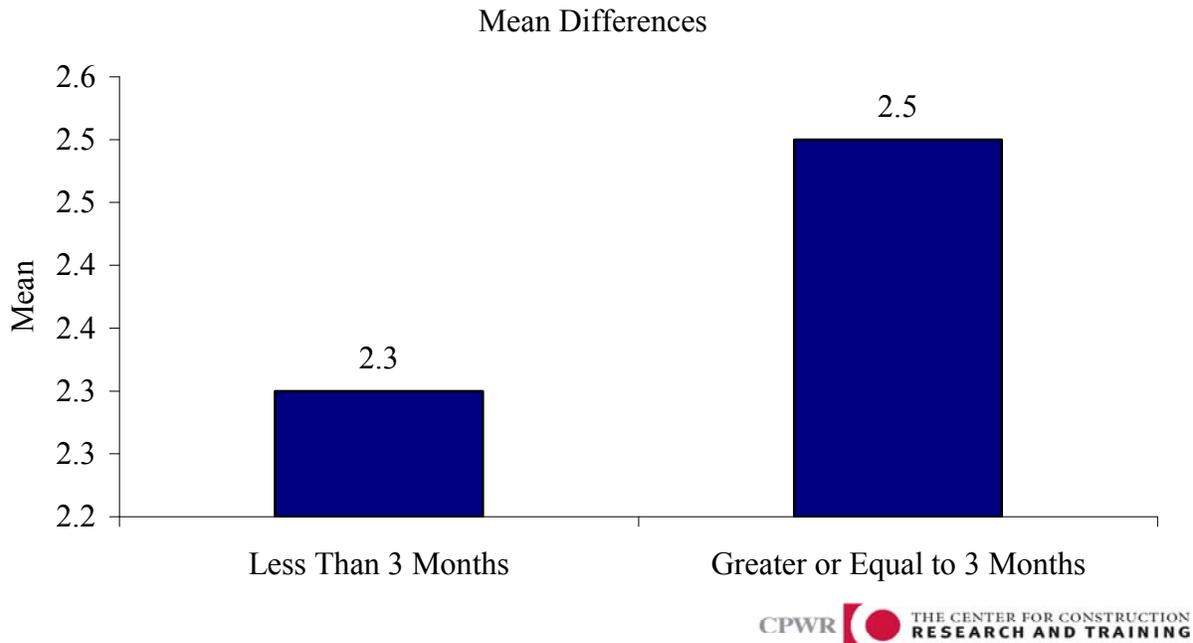
**Figure 16e. Importance of Scheduling**



**Figure 16f. Situational Constraints Caused by Other Trades**



**Figure 16g. Injury Risk Perception**



**Summary of Key Findings Based on Comparisons Between Those Who Worked < than 3 Months vs. Those Who Worked  $\geq$ 3 Months (Figures 16a-16g).**

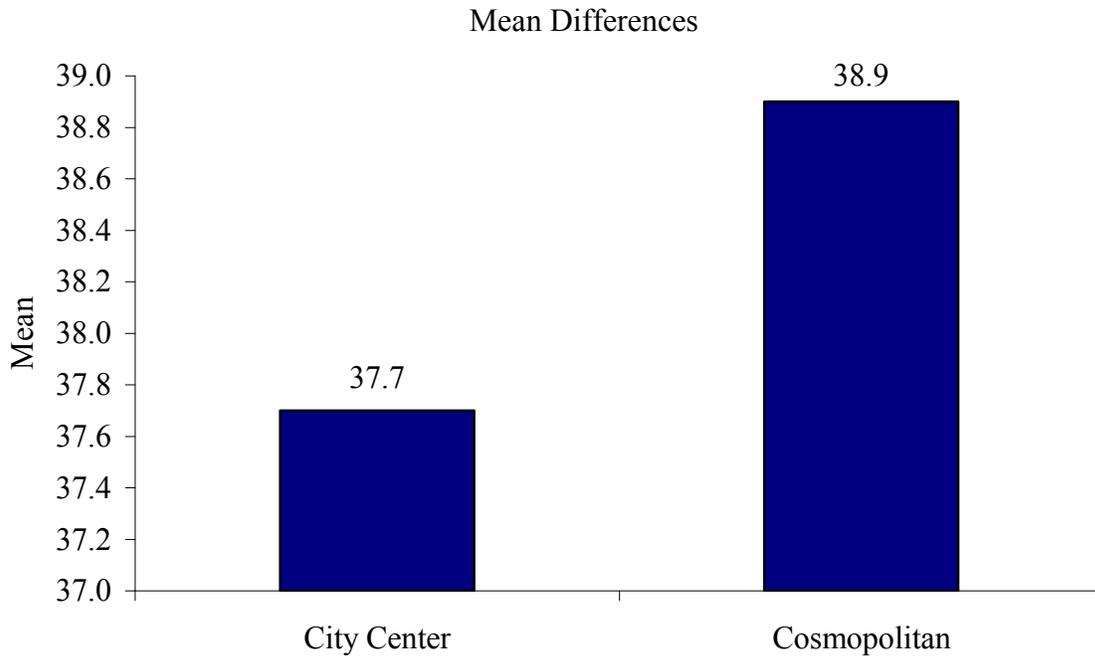
Workers who have been working on the job site for 3 months or longer, compared to workers who have been working on the job site for less than 3 months

- reported more positive Perini safety climate.
- reported more positive Perini safety program.
- reported more positive subcontractor safety program (e.g., s subcontractor's safety program works well together with other subcontractor's safety programs).
- reported more positive safety practices.
- experienced less situational constraints caused by other trades.
- perceived less risk of being injured at work.

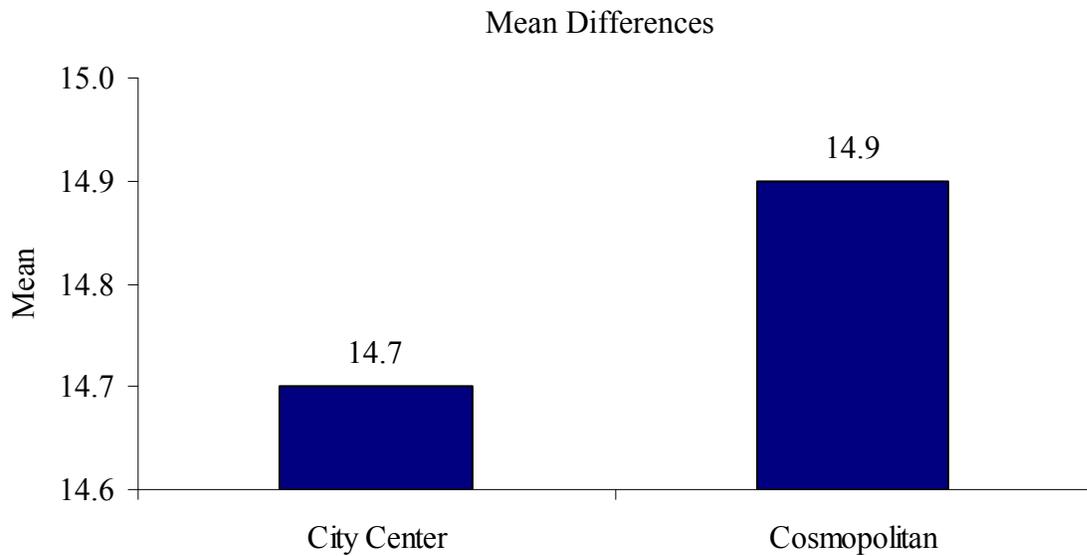
These results may indirectly suggest some improvements on safety since May/June/July 2008. It should be noted that the worker surveys were distributed beginning in July 2008 and administered throughout the course of training through October 2008.

*1-2-b3. Mean Comparisons based on Job Site (City Center vs. Cosmopolitan)*

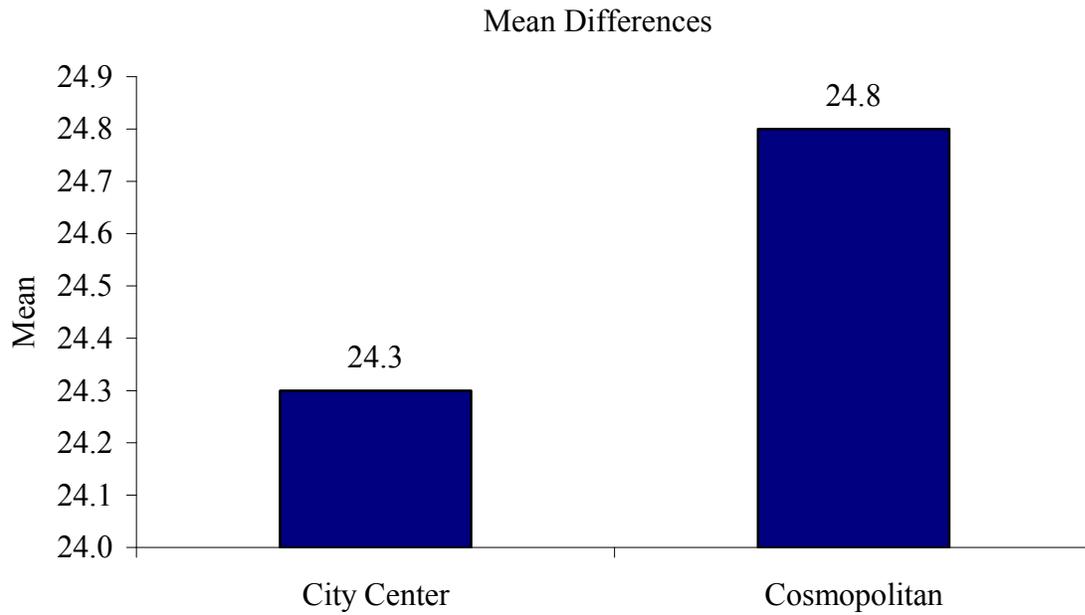
**Figure 17a. Foreman Safety Management**



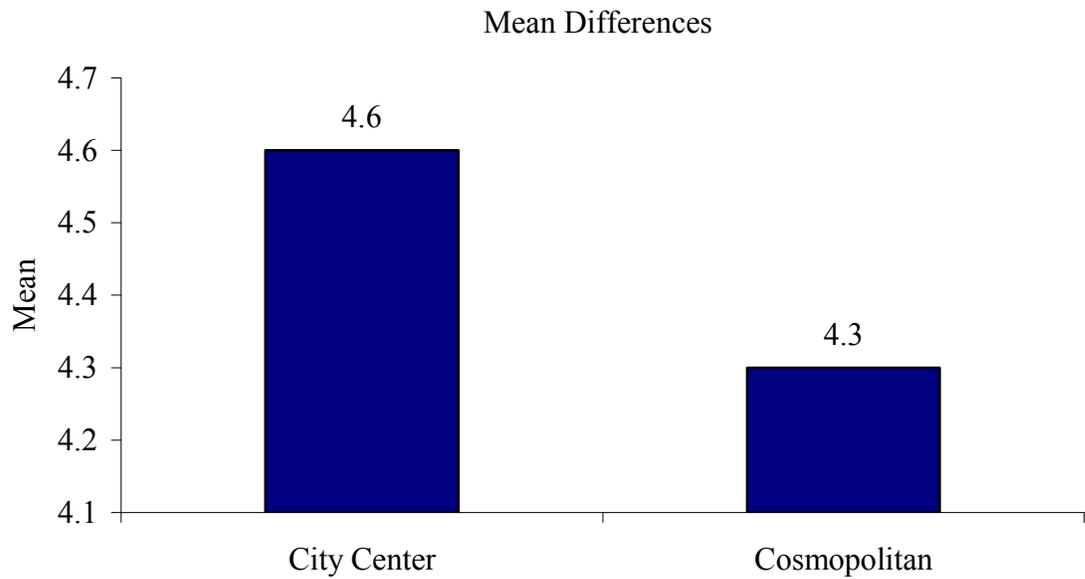
**Figure 17b. Safety Behaviors**



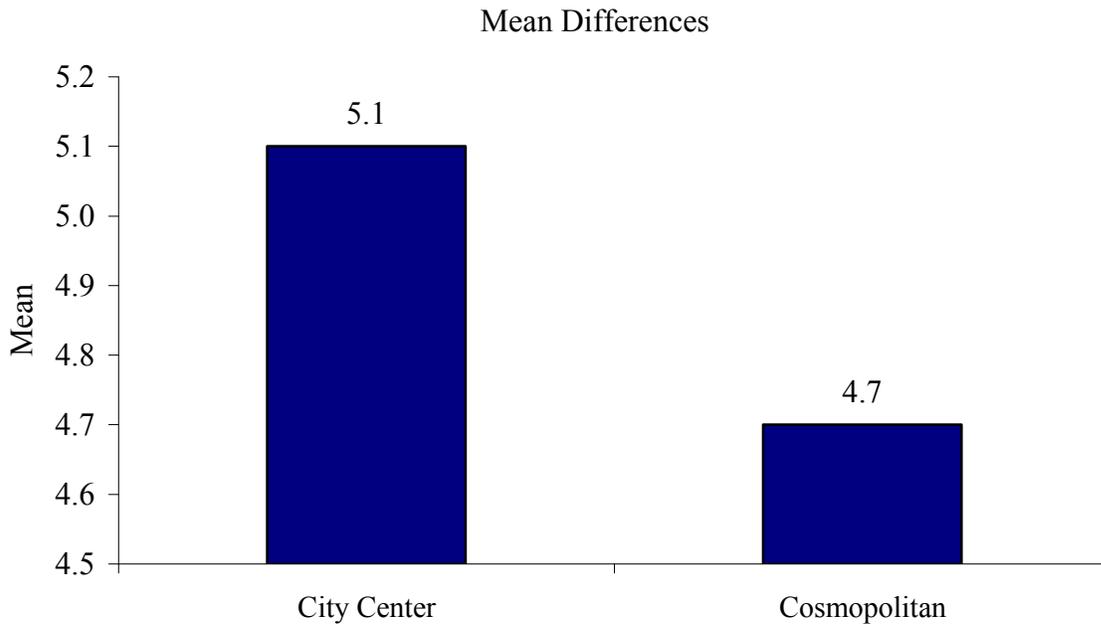
**Figure 17c. Safety Practices**



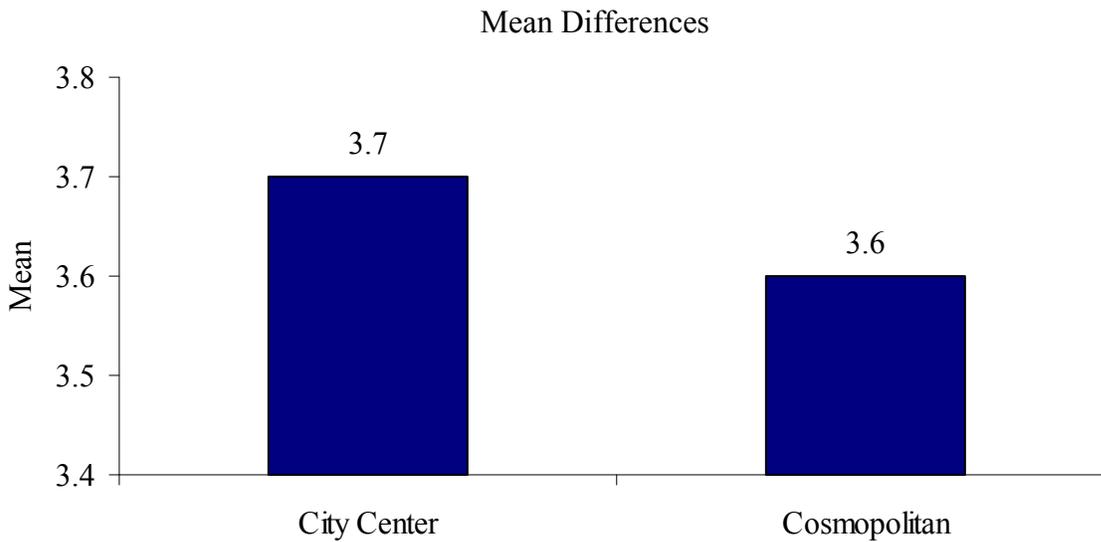
**Figure 17d. Fatigue**



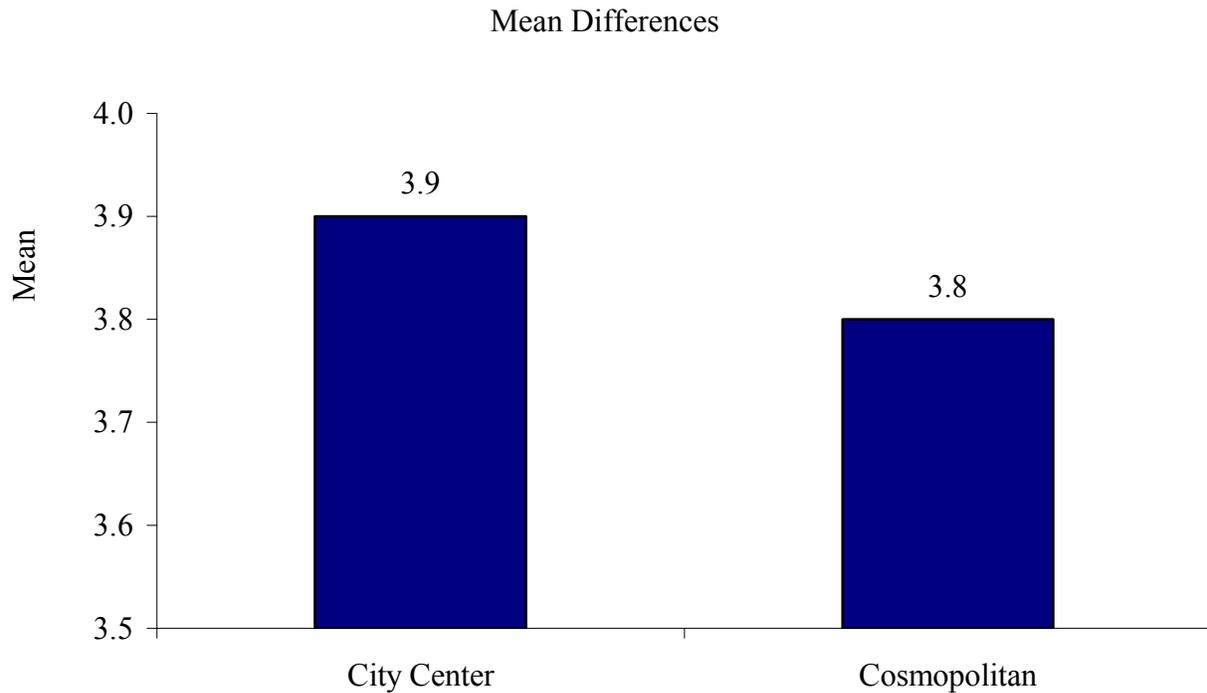
**Figure 17e. Unsafe Work due to Time Pressure**



**Figure 17f. Situational Constraints Caused by Other Trades**



**Figure 17g. Importance of Scheduling**



**Summary of Key Findings Based on Comparisons Between City Center and Cosmopolitan (Figures 17a-17g).**

Compared to workers in City Center, workers in Cosmopolitan

- reported more positive foreman safety management.
- reported more positive safety behaviors.
- reported more positive safety practices.
- engaged less in unsafe work due to time pressure.
- experienced less fatigue.
- experienced less situational constraints caused by other trades.

## 2. Foreman

### 2-1. Descriptive Analysis

#### 2-1-a. Demographics

A total of 134 Foremen completed the safety climate survey. Forty percent (n=53) work on the City Center site and 25% (n=33) work on the Cosmopolitan site. Figure 18 shows the distribution of foremen by age. The average age of foremen on the two sites is 41 years of age. Foremen ranged in age from 23 to 61 years. All of the foremen completing the survey were employees of Perini.

**Figure 18. Distribution of Construction Foremen by Age**

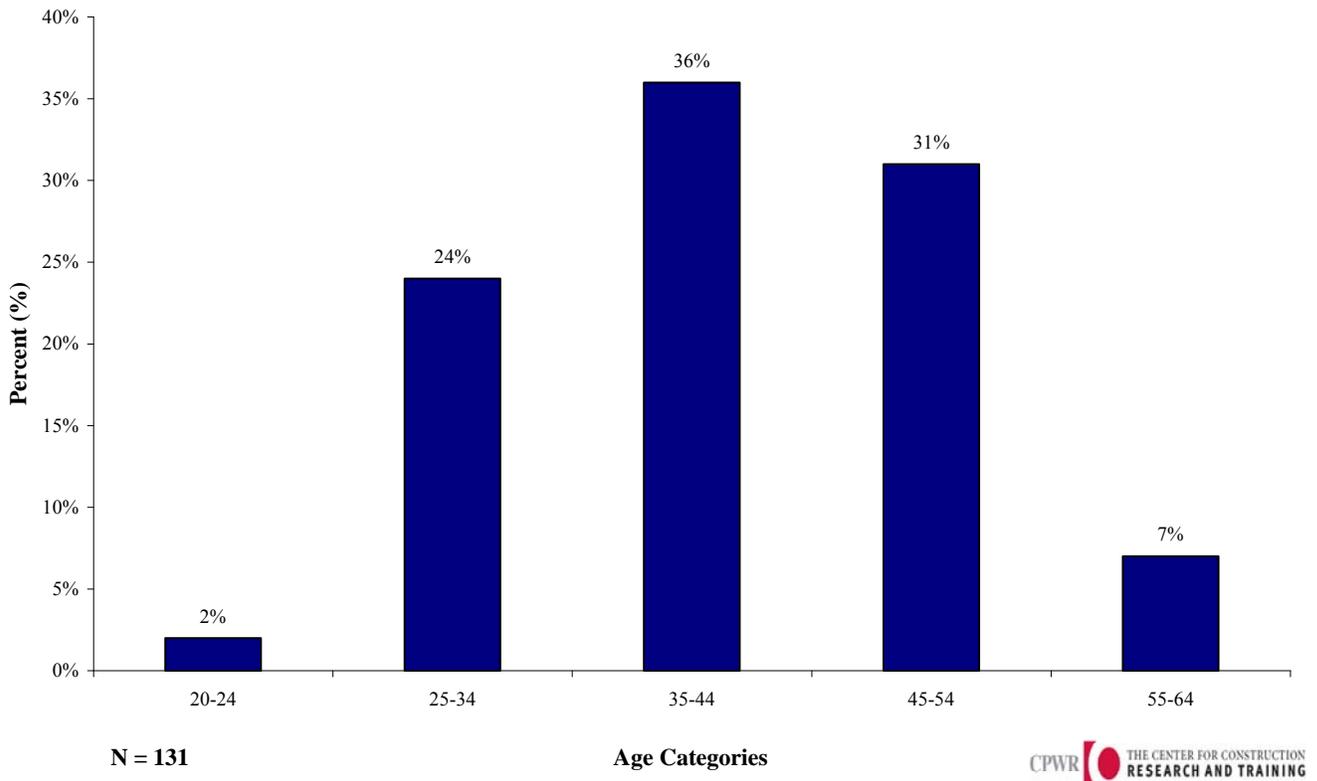


Figure 19 below shows the distribution of foremen by trade. Sixty percent of the foremen who completed the survey are carpenters, 26% are laborers, followed by (6%) cement masons, and (4%) operating engineers.

**Figure 19. Distribution of Construction Foremen by Trade**

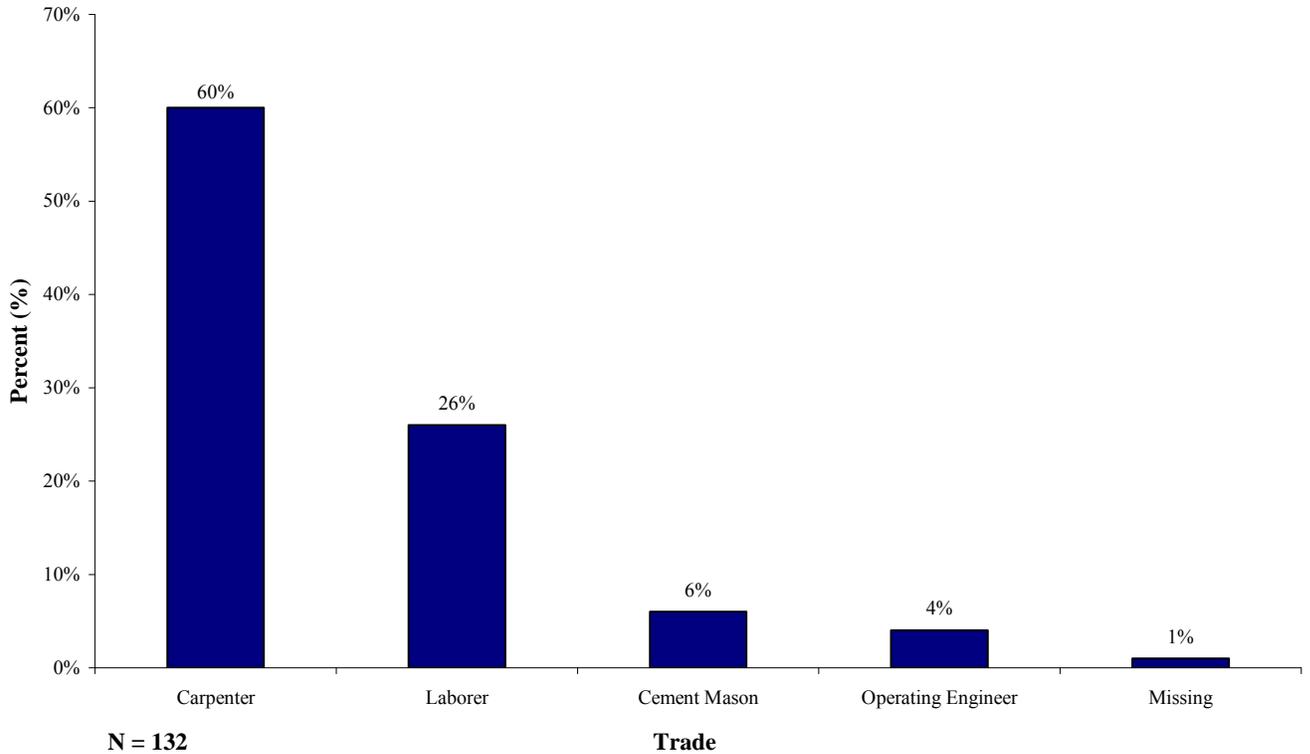


Figure 20 shows the self-reported racial distribution of the foremen on site is as follows: Half the foremen are Caucasian (52%), followed by Hispanics (34%), Native American (2%), Asian (2%) and African American (1%).

**Figure 20. Distribution of Construction Foremen by Race / Ethnicity**

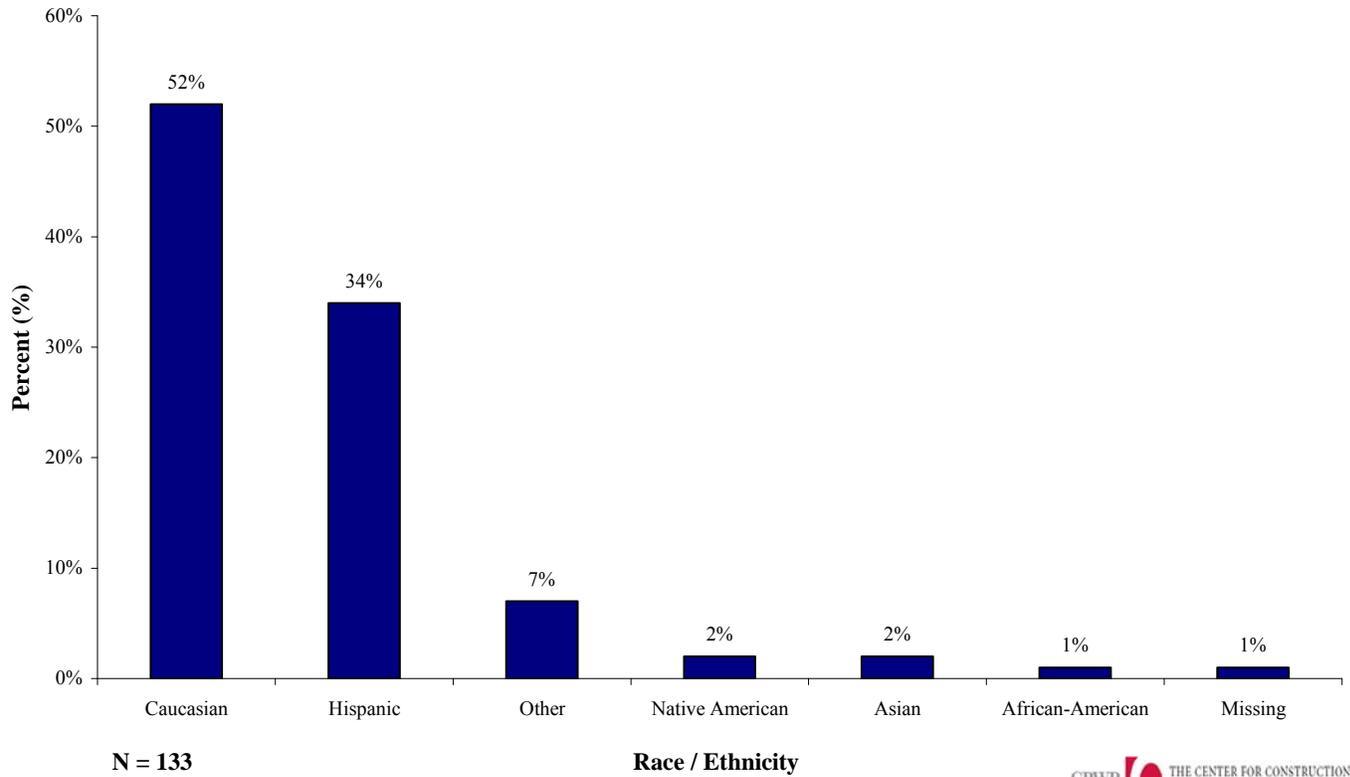


Figure 21 shows 43% of those completing the survey were General Foremen and 55% were classified as foremen.

**Figure 21. Distribution of Construction Foremen by Work Status**

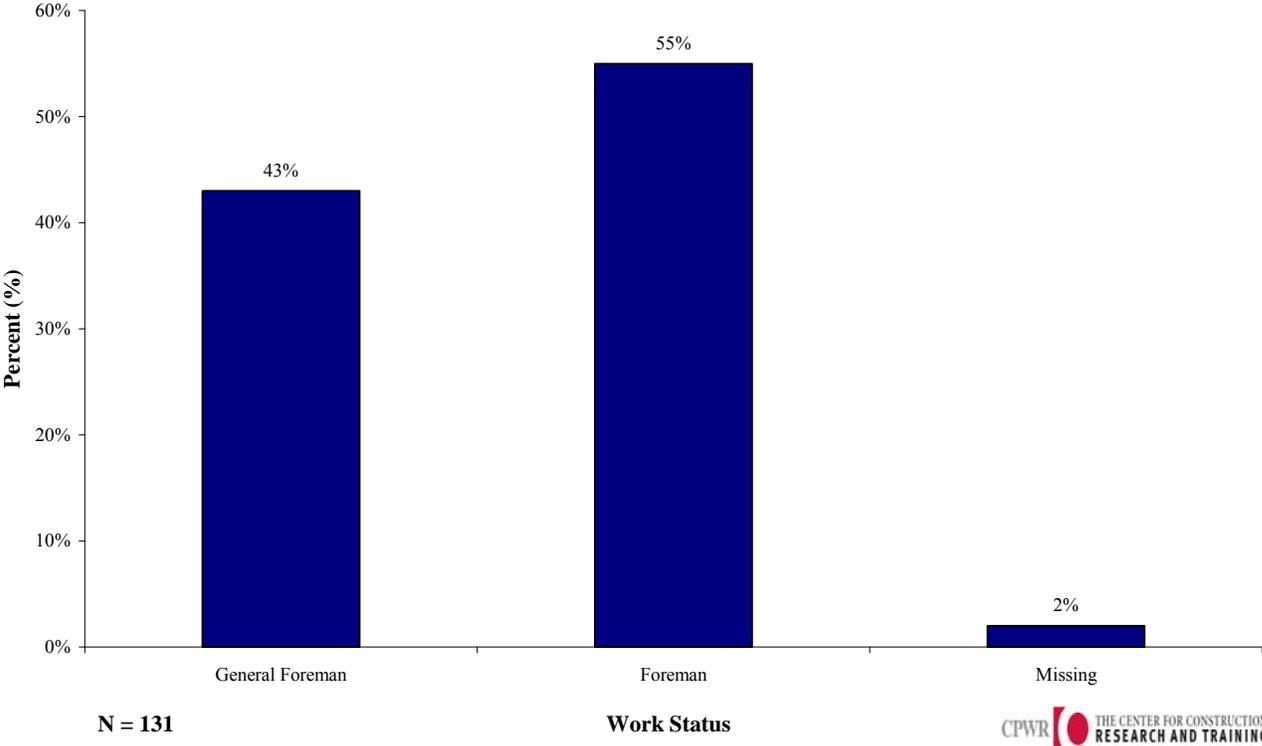


Figure 22 below shows the average number of months worked on the job by Perini foremen is 15 ranging from 1 to 39 months.

**Figure 22. Months Worked at City Center or Cosmopolitan Projects by Foremen**

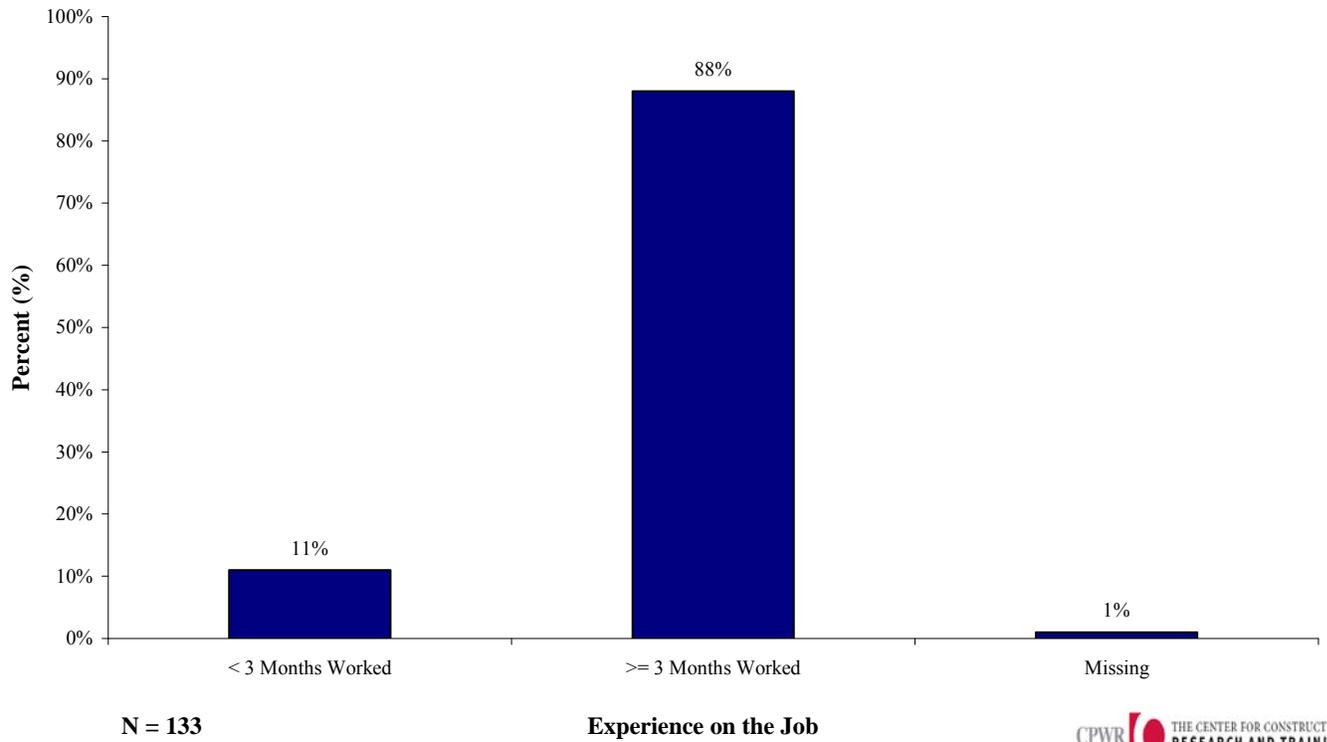
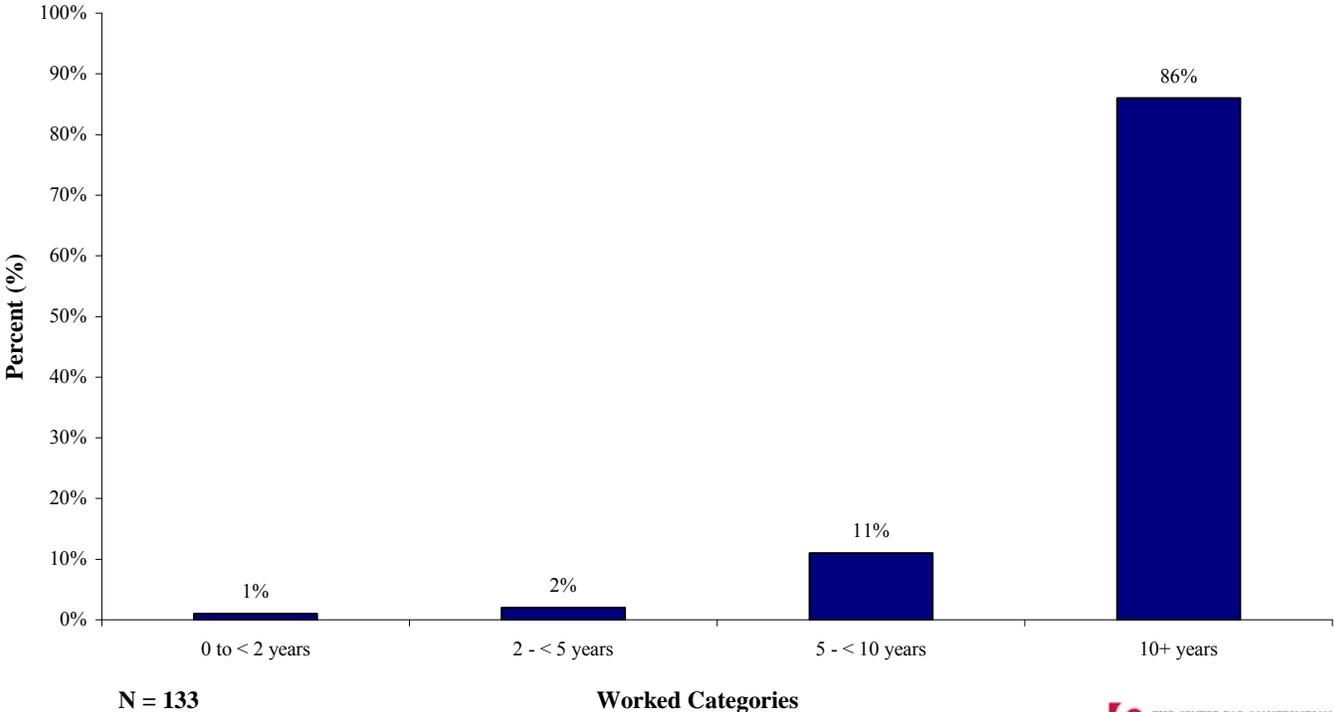


Figure 23 shows that the majority of General Foremen and Foremen had over ten years of experience in construction (86%).

**Figure 23. Distribution of Years Worked in the Construction Industry by Foremen**



**2-1-b. Item-Specific Responses**

Table 3 describes the frequency of responses for each category of the 6 point likert scale for each of the climate survey questions answered by Foremen. Selected highlights are presented at the end of Table 3.

**Table 3. Item-Specific Responses to Safety Climate Survey Questions – Foremen Responses**

Questions	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree	Missing	Mean
1. Safety is visible on this job – for example, I have seen safety personnel or site supervisors or site managers doing daily safety checks	0 (0%)	1 (1%)	3 (2%)	9 (7%)	59 (44%)	61 (46%)	1 (1%)	5.32 ± 0.76
2. Perini thinks that job site safety is more important than schedules or deadlines	0 (0%)	4 (3%)	3 (2%)	13 (10%)	58 (43%)	55 (41%)	1 (1%)	5.18 ± 0.92
3. Perini safety personnel step in to stop unsafe operations	1 (1%)	4 (3%)	2 (1%)	9 (7%)	50 (37%)	67 (50%)	1 (1%)	5.29 ± 0.97
4. The Perini safety staff follows up when there is a problem – it gets fixed right away and stays that way	1 (1%)	1 (1%)	6 (4%)	19 (14%)	61 (46%)	45 (34%)	1 (1%)	5.05 ± 0.92
5. Perini’s safety program works well together with other subcontractor safety programs – it is clear to me who is responsible for what	2 (1%)	5 (4%)	6 (4%)	21 (16%)	63 (47%)	37 (28%)	0 (0%)	4.86 ± 1.09
6. Perini believes that schedule in the most important issue on this project	17 (13%)	35 (26%)	21 (16%)	24 (18%)	25 (19%)	10 (7%)	2 (1%)	3.27 ± 1.53
7. Perini encourages employees to talk about near misses (close calls) that occurred at work	1 (1%)	6 (4%)	9 (7%)	14 (10%)	67 (50%)	35 (26%)	2 (1%)	4.86 ± 1.08
8. Perini cares for my safety on this site	1 (1%)	1 (1%)	1 (1%)	2 (1%)	51 (38%)	78 (58%)	0 (0%)	5.50 ± 0.75
9. Perini policy encourages the reporting of work-related injuries and illnesses	1 (1%)	1 (1%)	0 (0%)	2 (1%)	54 (40%)	74 (55%)	2 (1%)	5.49 ± 0.73
10. Perini regularly assesses the use of Personal Protective Equipment	0 (0%)	1 (1%)	0 (0%)	4 (3%)	70 (52%)	59 (44%)	0 (0%)	5.39 ± 0.62
11. Perini encourages communication of safety concerns between workers and management	1 (1%)	3 (2%)	2 (1%)	8 (6%)	46 (34%)	73 (54%)	1 (1%)	5.36 ± 0.93
12. Perini disciplines workers who do not follow safety procedures	1 (1%)	1 (1%)	3 (2%)	15 (11%)	58 (43%)	54 (40%)	2 (1%)	5.20 ± 0.88

(Cont'd)

13. Productivity is more important than safety to Perini	34 (25%)	55 (41%)	20 (15%)	10 (7%)	8 (6%)	5 (4%)	2 (1%)	2.38 ± 1.32
14. The General Contractor (Perini) gives employees positive feedback when they demonstrate good safety practices	1 (1%)	5 (4%)	3 (2%)	34 (25%)	57 (43%)	34 (25%)	0 (0%)	4.81 ± 1.01
15. Safety is important to my employer – he or she mentions it often when talking to me	0 (0%)	1 (1%)	1 (1%)	5 (4%)	68 (51%)	59 (44%)	0 (0%)	5.37 ± 0.67
16. My employer makes sure I have the safety knowledge needed for the hazards we face on this job	1 (1%)	2 (1%)	0 (0%)	4 (3%)	66 (49%)	61 (46%)	0 (0%)	5.35 ± 0.79
17. My employer makes sure we follow site safety rules and procedures very closely	1 (1%)	1 (1%)	0 (0%)	6 (4%)	62 (46%)	63 (47%)	1 (1%)	5.38 ± 0.75
18. My employer wants us to inform him/her of any safety problems so they can get them fixed or reported to others	0 (0%)	4 (3%)	0 (0%)	2 (1%)	53 (40%)	75 (56%)	0 (0%)	5.46 ± 0.80
19. If my employer is unsure of a safety question, he or she always calls in a safety specialist	0 (0%)	3 (2%)	5 (4%)	14 (10%)	74 (55%)	32 (24%)	6 (4%)	4.99 ± 0.86
20. My employer thinks that safety is more important than productivity	2 (1%)	4 (3%)	4 (3%)	13 (10%)	61 (46%)	44 (33%)	6 (4%)	5.02 ± 1.05
21. My employer thinks that productivity is more important than safety	32 (24%)	54 (40%)	13 (10%)	9 (7%)	13 (10%)	4 (3%)	9 (7%)	2.43 ± 1.39
22. My employer's safety program works well together with other subcontractor's safety programs	0 (0%)	11 (8%)	9 (7%)	13 (10%)	66 (49%)	29 (22%)	6 (4%)	4.73 ± 1.15
23. My employer supports me if I stop work because working conditions are unsafe, even if we have a deadline	0 (0%)	4 (3%)	2 (1%)	9 (7%)	67 (50%)	48 (36%)	4 (3%)	5.18 ± 0.87
24. My employer informs me of changing safety conditions on this job site	0 (0%)	1 (1%)	2 (1%)	16 (12%)	63 (47%)	46 (34%)	6 (4%)	5.18 ± 0.77
25. My employer gives me the responsibility I need to allow my crew to work safely	0 (0%)	1 (1%)	2 (1%)	3 (2%)	65 (49%)	59 (44%)	4 (3%)	5.38 ± 0.69
26. My crew works too many hours per week on this job	40 (30%)	64 (48%)	7 (5%)	10 (7%)	7 (5%)	1 (1%)	5 (4%)	2.09 ± 1.13
27. Fatigue is an issue for my workers – they have made mistakes on the job because they were tired	36 (27%)	60 (45%)	9 (7%)	13 (10%)	6 (4%)	1 (1%)	9 (7%)	2.17 ± 1.15

(Cont'd)

28. Doing the work safely on this job has definite priority over getting it done on schedule	5 (4%)	10 (7%)	7 (5%)	14 (10%)	62 (46%)	30 (22%)	6 (4%)	4.63 ± 1.33
29. Sometimes I don't report a hazard because there isn't time to stop work, or the work task is of too short a duration, so we work around the hazard	57 (43%)	52 (39%)	4 (3%)	10 (7%)	2 (1%)	3 (2%)	6 (4%)	1.88 ± 1.14
30. Sometimes the crew can't do the job safely because other trades are in our way	31 (23%)	43 (32%)	10 (7%)	18 (13%)	14 (10%)	10 (7%)	8 (6%)	2.77 ± 1.61
31. There is always enough personal protective equipment available to allow work to be done safely	3 (2%)	3 (2%)	6 (4%)	7 (5%)	59 (44%)	51 (38%)	5 (4%)	5.09 ± 1.10
32. The workers in my crew have received enough training to do the work safely	1 (1%)	2 (1%)	6 (4%)	16 (12%)	64 (48%)	40 (30%)	5 (4%)	5.02 ± 0.94
33. We always get enough site-specific information about a job to do it safely	0 (0%)	2 (1%)	4 (3%)	14 (10%)	74 (55%)	34 (25%)	6 (4%)	5.05 ± 0.80
34. My workers know what their safety responsibilities are at work	0 (0%)	1 (1%)	1 (1%)	8 (6%)	72 (54%)	47 (35%)	5 (4%)	5.26 ± 0.68
35. Sometimes I have to ignore a safety rule or policy in order to carry out an assignment to meet the schedule	50 (37%)	53 (40%)	1 (1%)	17 (13%)	4 (3%)	4 (3%)	5 (4%)	2.10 ± 1.30
36. The workers on my crew always report safety hazards that they see	2 (1%)	2 (1%)	11 (8%)	22 (16%)	58 (43%)	34 (25%)	5 (4%)	4.81 ± 1.07
37. The workers on my crew know who to report a hazard to when they see one on the job	0 (0%)	1 (1%)	0 (0%)	15 (11%)	65 (49%)	48 (36%)	5 (4%)	5.23 ± 0.71
38. The workers on my crew assist others to make sure they perform their work safely	0 (0%)	2 (1%)	1 (1%)	13 (10%)	75 (56%)	38 (28%)	5 (4%)	5.13 ± 0.74
39. Toolbox talks about safety are given regularly	0 (0%)	2 (1%)	1 (1%)	7 (5%)	60 (45%)	59 (44%)	5 (4%)	5.34 ± 0.76
40. Toolbox talks are helpful to my workers	0 (0%)	2 (1%)	1 (1%)	10 (7%)	60 (45%)	56 (42%)	5 (4%)	5.29 ± 0.77
41. Other workers care about my safety, and I care about theirs	0 (0%)	0 (0%)	0 (0%)	10 (7%)	51 (38%)	65 (49%)	8 (6%)	5.44 ± 0.64
42. I believe that safety committees for the project would be very beneficial	1 (1%)	2 (1%)	5 (4%)	25 (19%)	47 (35%)	48 (36%)	6 (4%)	5.02 ± 1.00
43. I'm confident neither my crew members nor I will suffer a lost-time injury on the job here	3 (2%)	5 (4%)	5 (4%)	28 (21%)	54 (40%)	30 (22%)	9 (7%)	4.72 ± 1.14

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(Cont'd)

44. Media attention has portrayed safety on the site accurately	47 (35%)	26 (19%)	14 (10%)	8 (6%)	22 (16%)	9 (7%)	8 (6%)	2.67 ± 1.74
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### Selected “Positive” Findings- Foremen Responses

- 99% of foremen agree that Perini regularly assesses the use of Personal Protective Equipment
- 99% of foremen agree that safety is important to their employer – their employer mentions it often when talking to them
- 98% of foremen agree their employer makes sure they have the safety knowledge needed for the hazards they face on this job
- 97% of foremen agree safety is visible on this job – for example, they have seen safety personnel or site supervisors or site managers doing daily safety checks
- 97% of foremen agree that Perini cares for their safety on this site
- 97% of foremen agree their employer makes sure they follow site safety rules and procedures very closely
- 97% of foremen agree their employer wants them to inform him/her of any safety problems so they can get them fixed or reported to others
- 96% of foremen agree that Perini policy encourages the reporting of work-related injuries and illnesses
- 96% of foremen agree that the workers on their crew know who to report a hazard to when they see one on the job
- 95% of foremen agree that their employer gives them the responsibility they need to allow their crew to work safely
- 95% of foremen agree their workers know what their safety responsibilities are at work

### Selected “Negative” Findings – Foremen Responses

- 85% of foremen disagree that sometimes they don’t report a hazard because there isn’t time to stop work, or the work task is of too short a duration, so they work around the hazard (10% agree)
- 83% of foremen disagree that their crew works too many hours per week on this job (13% agree)
- 81% of foremen disagree that productivity is more important than safety to Perini (17% agree)
- 79% of foremen disagree that fatigue is an issue for their workers – they have made mistakes on the job because they were tired (15% agree)
- 78% of foremen disagree that sometimes they have to ignore a safety rule or policy in order to carry out an assignment to meet the schedule (19% agree)
- 74% of foremen disagree that their employer thinks that productivity is more important than safety (20% agree)
- 64% of foremen disagree that media attention has portrayed safety on the site accurately (29% agree)
- 62% of foremen disagree that sometimes the crew can’t do the job safely because other trades are in their way (30% agree)
- 55% of foremen disagree that Perini believes that schedule is the most important issue on this project (44% agree)
- 16% of foremen disagree that doing the work safely on this job has definite priority over getting it done on schedule (78% agree)

## 2-2. Psychometric Analysis

### 2-2-a. Factors and Corresponding Survey Items for the Foremen Survey

Based on a series of factor analyses, parallel analyses, and item analyses, 15 factors were identified for the foremen survey. Factors and the correspondent survey items of each factor, and descriptive statistics (alpha coefficient, possible range, observed range, mean, standard deviation, and number of respondents) are reported in Table 4. See Appendix 3 for definitions of the 15 factors.

**Table 4. Factors and Corresponding Survey Items for the Foreman Survey**

<b>Factors with corresponding survey items</b>	<b>Alpha</b>	<b>PR</b>	<b>OR</b>	<b>Mean</b>	<b>SD</b>	<b>N</b>
<b>Perini Safety Climate</b>	.89	17-102	39-102	87.8	9.3	134
Safety is visible on this job – for example, I have seen safety personnel or site supervisors or site managers doing daily safety checks						
Perini thinks that job site safety is more important than schedules or deadlines						
Perini safety personnel step in to stop unsafe operations						
The Perini safety staff follows up when there is a problem – it gets fixed right away and stays that way						
Perini cares for my safety on this site						
Safety is important to my employer – he or she mentions it often when talking to me						
My employer thinks that productivity is more important than safety						
Perini regularly assesses the use of Personal Protective Equipment						
Perini encourages communication of safety concerns between workers and management						
Perini disciplines workers who do not follow safety procedures						
Productivity is more important than safety to Perini						
The General Contractor (Perini) gives employees positive feedback when they demonstrate good safety practices						
My employer supports me if I stop work because working conditions are unsafe, even if we have a deadline						
My employer informs me of changing safety conditions on this job site						

My employer gives me the responsibility I need to allow my crew to work safely						
Perini encourages employees to talk about near misses (close calls) that occurred at work						
Perini policy encourages the reporting of work-related injuries and illnesses						
<b>Factors with corresponding survey items</b>	<b>Alpha</b>	<b>PR</b>	<b>OR</b>	<b>Mean</b>	<b>SD</b>	<b>N</b>
<b>Employer Safety Management</b>	.82	5-30	10-30	26.2	3.3	130
My employer makes sure I have the safety knowledge needed for the hazards we face on this job						
My employer makes sure we follow site safety rules and procedures very closely						
My employer wants us to inform him/her of any safety problems so they can get them fixed or reported to others						
If my employer is unsure of a safety question, he or she always calls in a safety specialist						
My employer thinks that safety is more important than productivity						
<b>Safety Behaviors</b>	.66	3-18	8-18	15.2	2.0	129
The workers on my crew always report safety hazards that they see						
The workers on my crew know who to report a hazard to when they see one on the job						
The workers on my crew assist others to make sure they perform their work safely						
<b>Safety Practices</b>	.73	5-30	16-30	25.8	3.0	129
There is always enough personal protective equipment available to allow work to be done safely						
The workers in my crew have received enough training to do the work safely						
We always get enough site-specific information about a job to do it safely						
My workers know what their safety responsibilities are at work						
Toolbox talks about safety are given regularly						

<b>Fatigue</b>	.68	2-10	2-12	4.3	2.0	125
My crew works too many hours per week on this job						
Fatigue is an issue for my workers – they have made mistakes on the job because they were tired						
<b>Factors with corresponding survey items</b>	<b>Alpha</b>	<b>PR</b>	<b>OR</b>	<b>Mean</b>	<b>SD</b>	<b>N</b>
<b>Unsafe work due to time pressure</b>	.45	2-12	2-12	4.0	2.0	128
Sometimes I don't report a hazard because there isn't time to stop work, or the work task is of too short a duration, so we work around the hazard						
Sometimes I have to ignore a safety rule or policy in order to carry out an assignment to meet the schedule						
<b>Perini Safety Program</b>	.73	2-12	3-12	9.7	1.9	128
Perini's safety program works well together with other subcontractor safety programs – it is clear to me who is responsible for what						
My employer's safety program works well together with other subcontractor's safety programs						
<b>Importance of Scheduling</b>	N/A	1-6	1-6	3.3	1.5	132
Perini believes that schedule in the most important issue on this project						
<b>Safety Priority</b>	N/A	1-6	1-6	4.6	1.3	128
Doing the work safely on this job has definite priority over getting it done on schedule						
<b>Situational Constraints Caused by Other Trades</b>	N/A	1-6	1-6	2.8	1.6	126
Sometimes the crew can't do the job safely because other trades are in our way						
<b>Toolbox Talks Evaluation</b>	N/A	1-6	2-6	5.3	0.8	129
Toolbox talks are helpful to my workers						
<b>Concern for Others</b>	N/A	1-6	4-6	5.4	0.6	126
Other workers care about my safety, and I care about theirs						
<b>Perceived Need for Safety Committee</b>	N/A	1-6	1-6	5.0	1.0	128
I believe that safety committees for the project would be very beneficial						

<b>Injury Risk Perception</b>	N/A	1-6	1-6	2.3	1.1	125
I'm confident neither my crew members nor I will suffer a lost-time injury on the job here						
<b>Factors with corresponding survey items</b>	<b>Alpha</b>	<b>PR</b>	<b>OR</b>	<b>Mean</b>	<b>SD</b>	<b>N</b>
<b>Media Coverage</b>	N/A	1-6	1-6	2.7	1.7	126
Media attention has portrayed safety on the site accurately						

*Note.* **Alpha** = alpha coefficient, which is computed only for Factors consisting of 2 or more items. It ranges from 0 to 1, with values closer to 1 indicating that the set of items measures well a single Factor. **PR** = possible range of scores. **OR** = observed range of scores. **Mean** = an arithmetic average of the sum of the individual responses to the set of items for each Factor based on the survey respondents. **SD** = standard deviation, which is a measure of how widely the respondents' scores differ from the mean score. The larger the standard deviation, the more spread are the respondents' scores. **N** = number of respondents who provide valid responses for each factor. N may differ across factors due to missing responses.

**Summary of Table 4.**

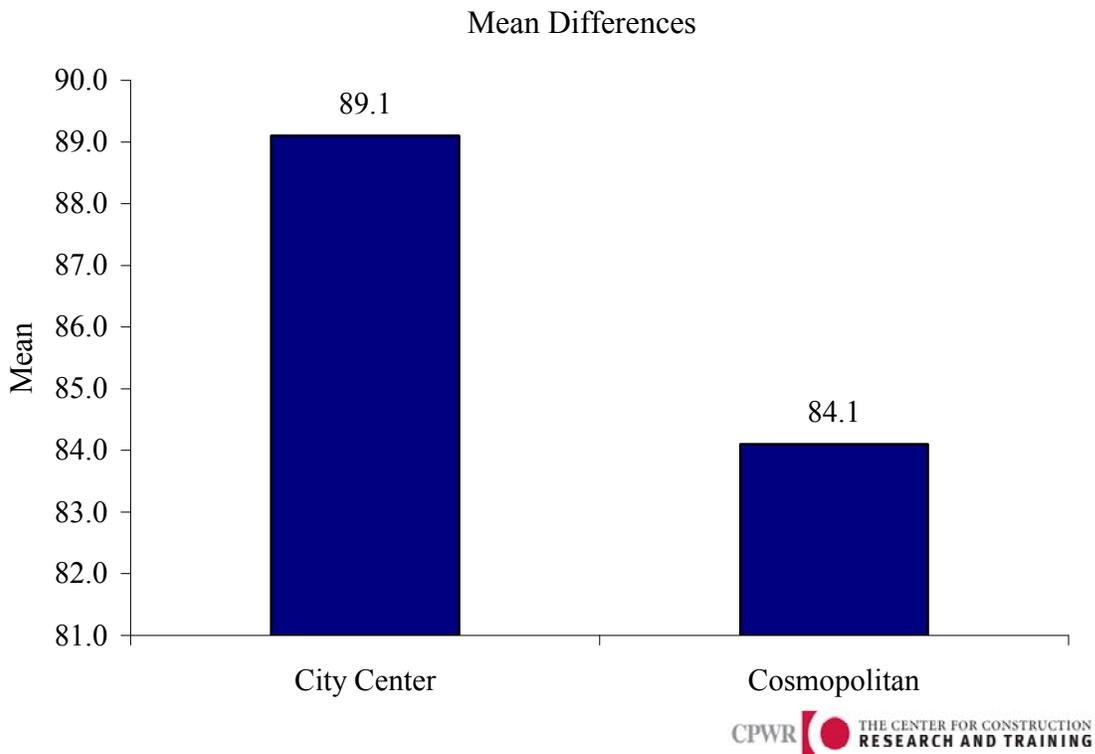
Overall, alpha coefficients were satisfactory, ranging from 0.66 to 0.89. The exception was unsafe work due to time pressure, which showed a low coefficient of alpha (i.e., 0.45). This indicated that foremen did not consistently respond to the two items comprising this scale. Both possible range of scores and observed range of scores were similar for most of the factors, indicating no or little evidence of range restriction. However, safety practices and concern for others exhibited narrower observed range of scores than the possible range of scores. In other words, responses on these two factors were significantly skewed in a positive direction.

**2-2-b. Mean Comparisons within the Foremen Survey**

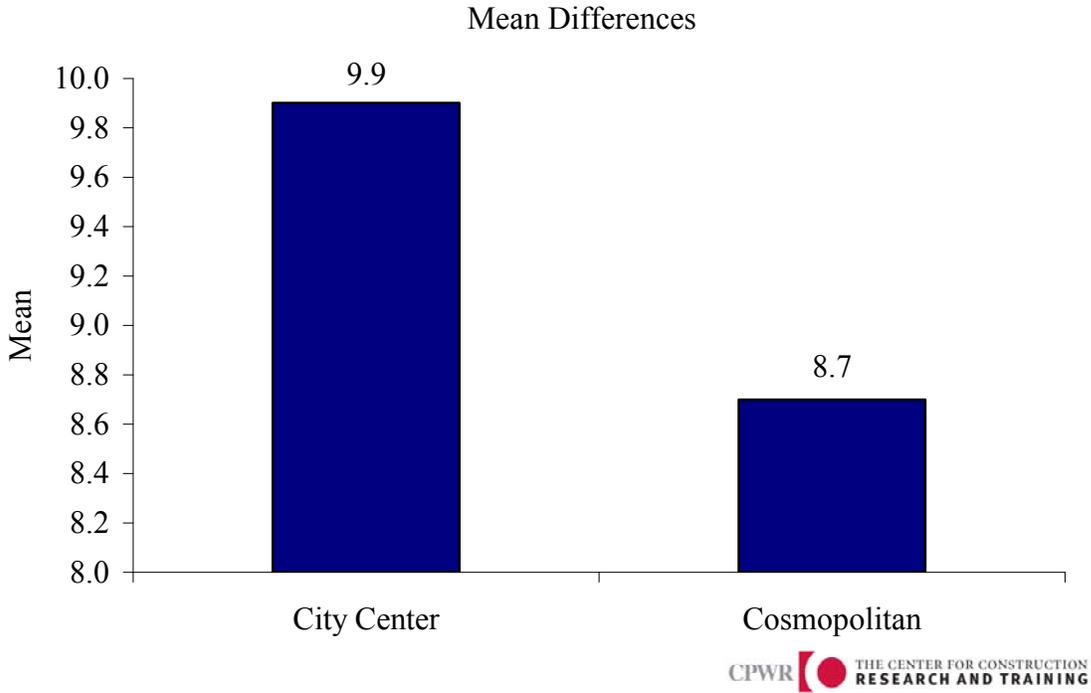
Mean comparisons of each of the 15 factors were conducted based on the following background characteristics: (1) three trades (carpenter, laborer, and cement mason), (2) months worked on the job site (less than 3-month vs. greater or equal to 3 months), (3) job site (City Center vs. Cosmopolitan), (4) work status (foremen vs. general foremen), and (5) years worked in the construction industry (less than 19 years vs. greater or equal to 19 years). No significant mean differences were found for the 15 factors based on months worked on the job site and years worked in construction. The remaining significant results based on job site are depicted in Figures 24a – 24c. Selected highlights are presented following these figures. Mean comparisons based on Months on the job, and years worked in construction were not significant. Therefore, no figures were provided in this report.

**2-2-b1. Mean Comparisons based on Job Site (City Center vs. Cosmopolitan)**

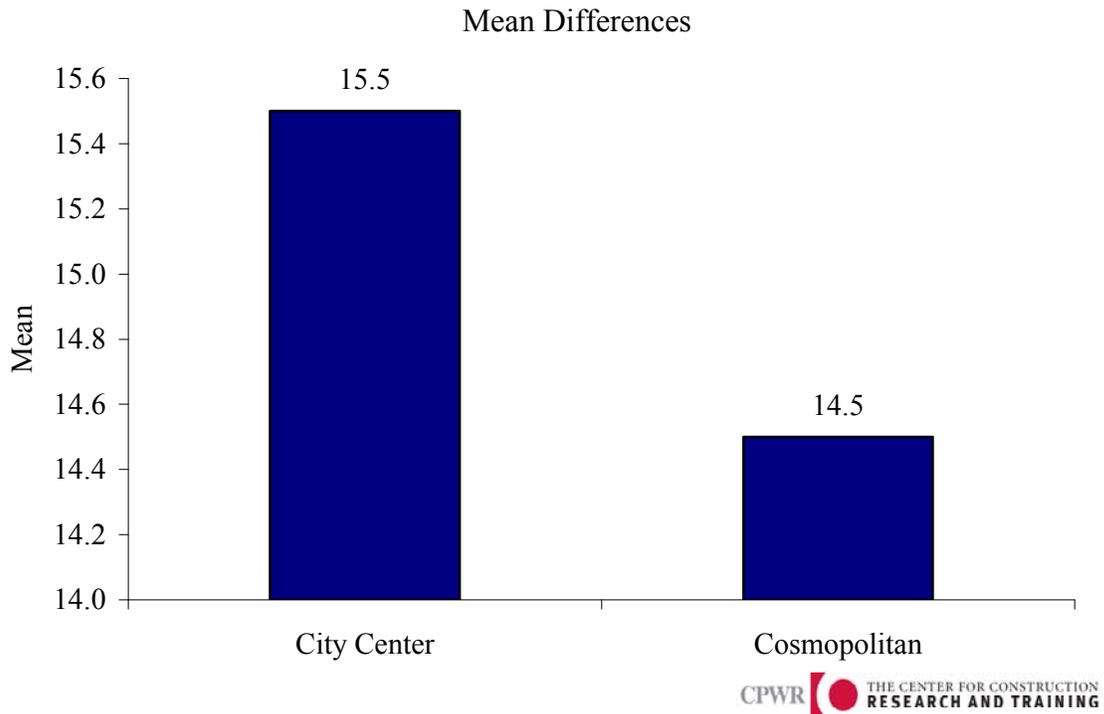
**Figure 24a. Perini Safety Climate**



**Figure 24b. Perini Safety Program**



**Figure 24c. Safety Behaviors**



**Summary of Key Findings Based Comparisons Between City Center vs. Cosmopolitan (Figures 24a-24c).**

Compared to foremen in Cosmopolitan, foremen at City Center

- reported more positive Perini safety climate.
- reported more positive Perini safety program.
- reported more crews' safety behaviors.

One key finding pertaining to Perini is related to mean differences across job sites. In contrast to foremen in Cosmopolitan, foremen in City Center reported more positive Perini safety climate, Perini safety program, and crews' safety behaviors. The current findings suggest a pattern of discrepancies in the perceptions and experiences about safety for foremen and workers at the two job sites, and an additional analysis was conducted.

### 3. Superintendents

#### 3-1. Descriptive Analysis

##### 3-1-a. Demographics

Figure 25 shows the age distribution of Superintendents. All 61 Superintendents who completed the survey worked on the City Center site (all hired by Perini –data was missing on employer for 2 superintendents). The average age of Superintendents at City Center was 48 years of age. Superintendents ranged in age from 34 to 64 years of age.

**Figure 25. Distribution of Construction Superintendents by Age**

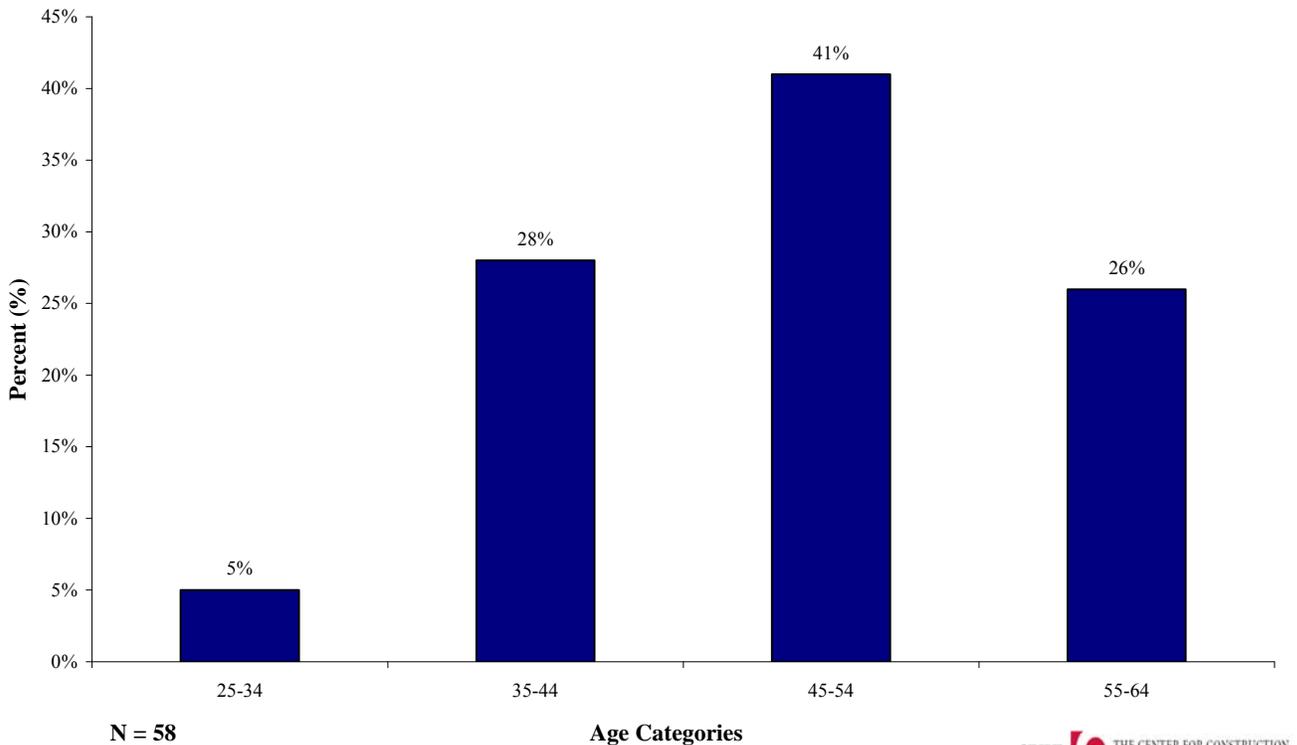
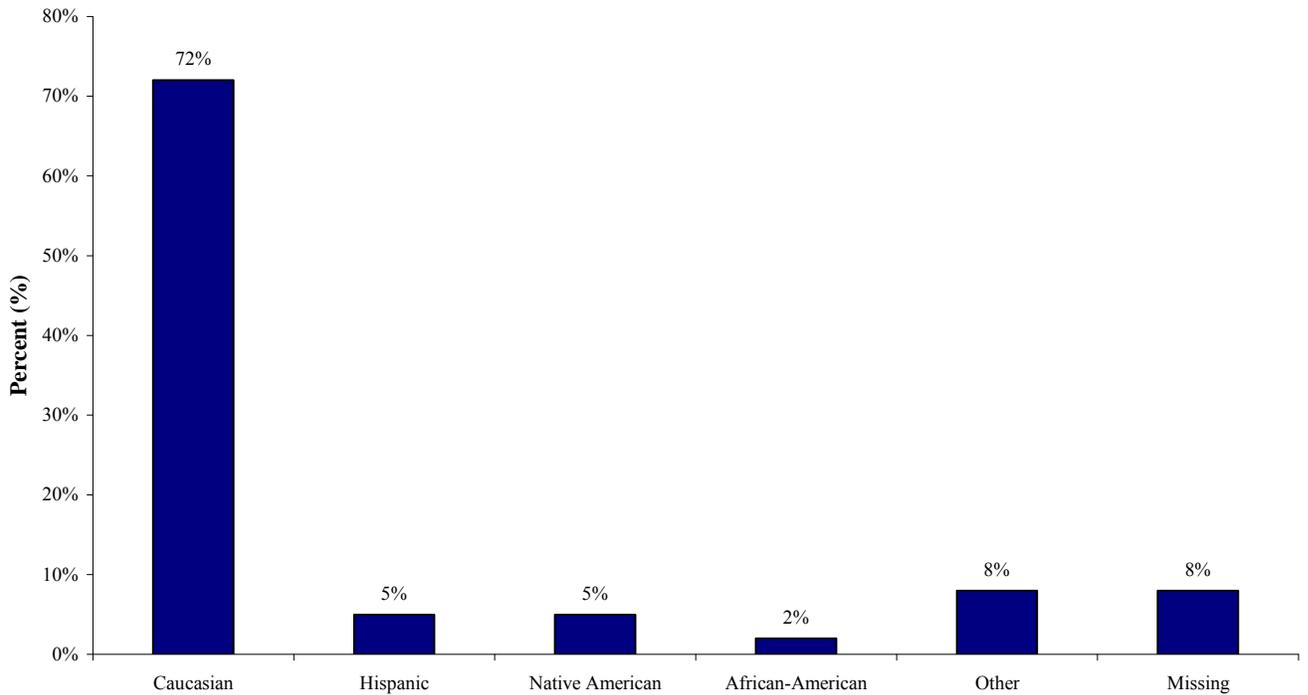


Figure 26 shows the race/ethnicity distribution of Superintendents. Nearly two thirds of the Superintendents (including Assistant Superintendents) are Caucasian (72%) followed by Hispanics (5%) and Native Americans (5%).

**Figure 26. Distribution of Construction Superintendents by Race / Ethnicity**



N = 56

Figure 27 shows the work status of Superintendents on the sites. There were 43 Superintendents and 12 Assistant Superintendents who completed the safety climate survey.

**Figure 27. Distribution of Construction Superintendents by Work Status**

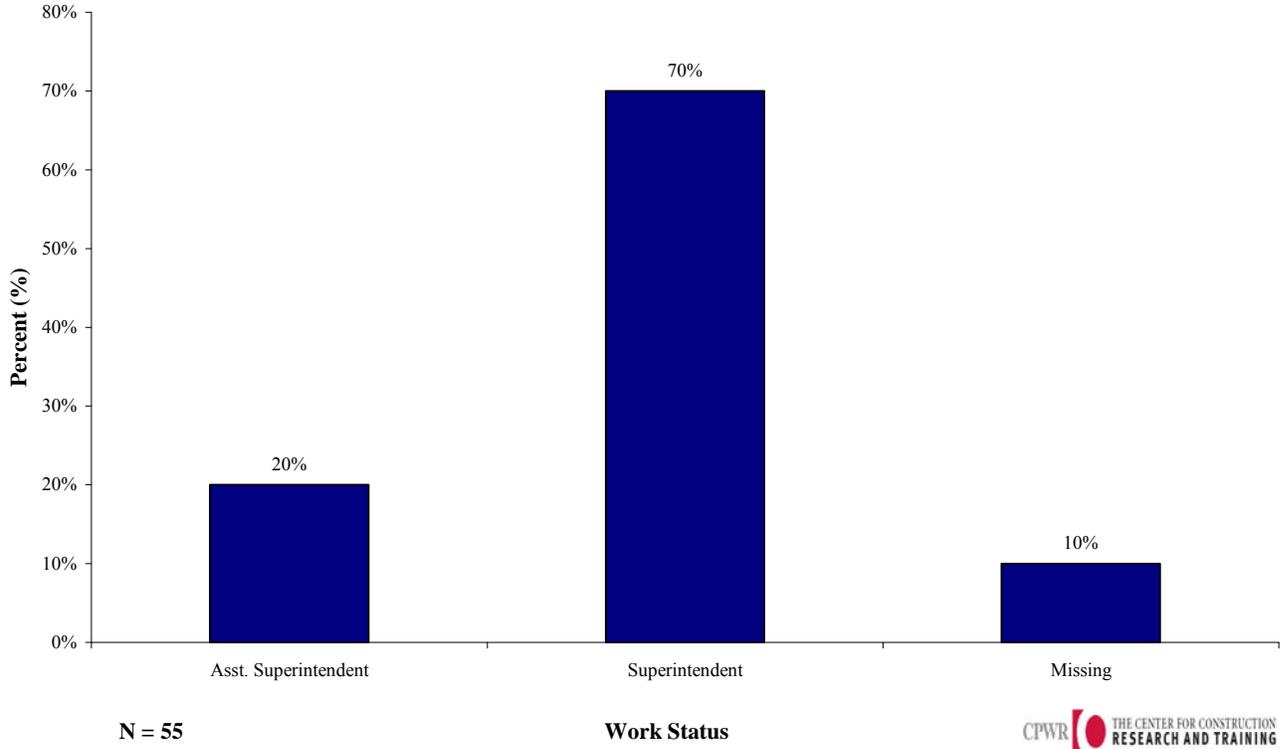
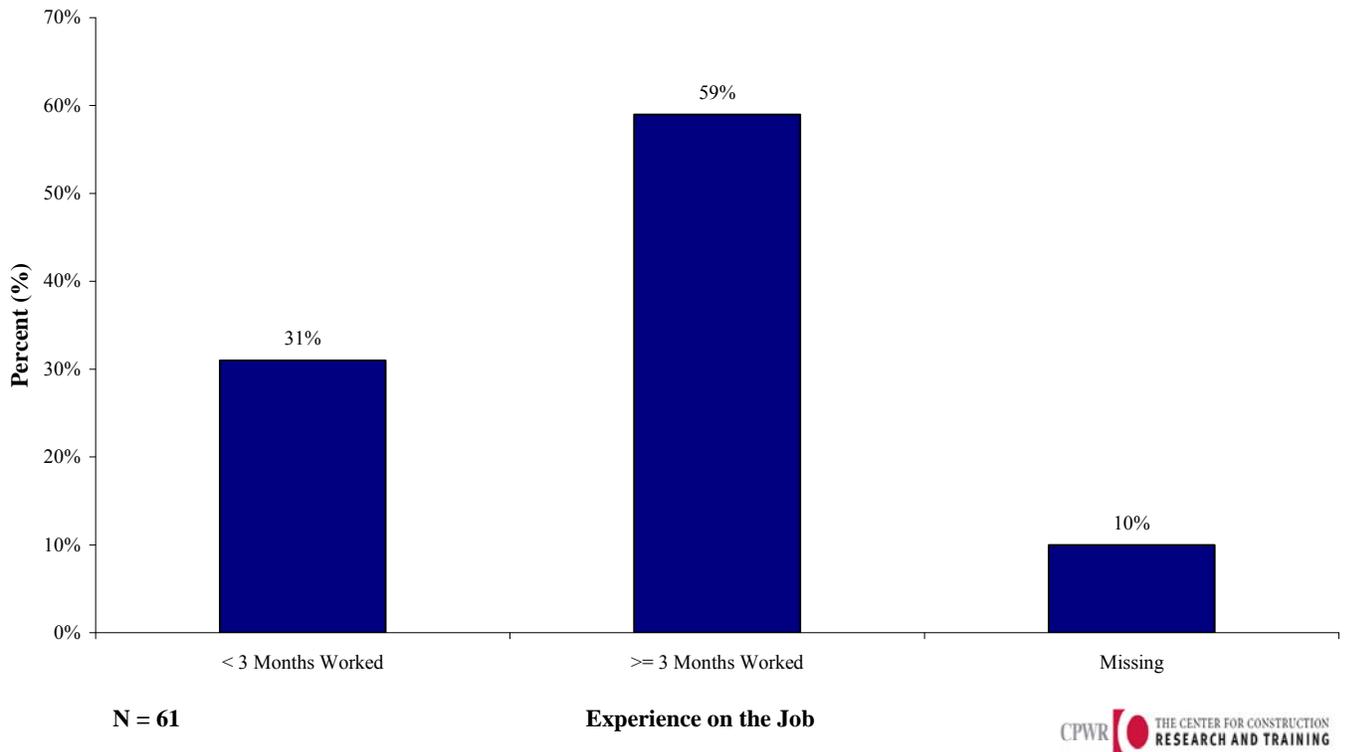


Figure 28 shows the distribution of Superintendents based on months worked on the job site. Most of the Superintendents have worked more than three months on either City Center site (59%). Roughly a third had been on site less than three months. All of the Superintendents have worked 10+ years in construction.

**Figure 28. Months Worked at City Center or Cosmopolitan Projects by Superintendents**



### 3-1-b. Item-Specific Responses

Table 5 describes the frequency of responses for each category of the 6 point likert scale for each of the climate survey questions answered by Superintendents. Selected highlights are presented at the end of Table 5.

**Table 5. Item-Specific Responses to Safety Climate Survey Questions – Superintendent Responses**

Questions	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree	Missing	Mean
1. MGM thinks that job site safety is more important than job schedules and deadlines	1 (2%)	3 (5%)	4 (7%)	9 (15%)	29 (48%)	13 (21%)	2 (3%)	4.71 ± 1.15
2. MGM has a management structure that encourages exchange of information about safety on the job	0 (0%)	2 (3%)	1 (2%)	11 (18%)	34 (56%)	11 (18%)	2 (3%)	4.86 ± 0.86
3. MGM communicates a commitment to safety throughout this project	0 (0%)	1 (2%)	3 (5%)	14 (23%)	31 (51%)	10 (16%)	2 (3%)	4.78 ± 0.85
4. Safety is visible on this job – for example, I have seen safety personnel or site supervisors or site managers doing daily safety checks	0 (0%)	0 (0%)	0 (0%)	4 (7%)	18 (30%)	38 (62%)	1 (2%)	5.57 ± 0.62
5. Perini thinks that job site safety is more important than schedules or deadlines	0 (0%)	0 (0%)	0 (0%)	4 (7%)	24 (39%)	31 (51%)	2 (3%)	5.46 ± 0.62
6. Perini safety personnel step in to stop unsafe operations	1 (2%)	0 (0%)	1 (2%)	0 (0%)	23 (38%)	34 (56%)	2 (3%)	5.47 ± 0.84
7. The Perini safety staff follows up when there is a problem – it gets fixed right away and stays that way	1 (2%)	0 (0%)	2 (3%)	3 (5%)	25 (41%)	29 (48%)	1 (2%)	5.30 ± 0.93
8. Perini’s safety program works well together with other subcontractor safety programs – it is clear to me who is responsible for what	1 (2%)	0 (0%)	2 (3%)	8 (13%)	28 (46%)	20 (33%)	2 (3%)	5.07 ± 0.94
9. Perini encourages employees to talk about near misses (close calls) that occurred at work	0 (0%)	0 (0%)	0 (0%)	6 (10%)	22 (36%)	32 (52%)	1 (2%)	5.43 ± 0.67
10. Perini policy encourages the reporting of work-related injuries or illnesses	0 (0%)	0 (0%)	1 (2%)	5 (8%)	23 (38%)	31 (51%)	1 (2%)	5.40 ± 0.72
11. Perini regularly assesses the use of Personal Protective Equipment	0 (0%)	0 (0%)	0 (0%)	1 (2%)	19 (31%)	40 (66%)	1 (2%)	5.65 ± 0.52
12. Perini encourages communication of safety concerns between workers and management	0 (0%)	0 (0%)	1 (2%)	3 (5%)	19 (31%)	37 (61%)	1 (2%)	5.53 ± 0.68

(Cont'd)								
13. Perini disciplines workers who do not follow safety procedures	1 (2%)	0 (0%)	1 (2%)	2 (3%)	20 (33%)	36 (59%)	1 (2%)	5.47 ± 0.87
14. Perini considers safety performance in pre-qualifying its subcontractors	1 (2%)	0 (0%)	2 (3%)	9 (15%)	18 (30%)	26 (43%)	5 (8%)	5.16 ± 1.02
15. Perini believes that productivity is more important than safety	31 (51%)	17 (28%)	3 (5%)	2 (3%)	3 (5%)	2 (3%)	3 (5%)	1.88 ± 1.33
16. The General Contractor (Perini) gives employees positive feedback when they demonstrate good safety practices	2 (3%)	1 (2%)	1 (2%)	7 (11%)	28 (46%)	20 (33%)	2 (3%)	5.00 ± 1.11
17. Perini always includes safety in the job planning process	0 (0%)	1 (2%)	1 (2%)	2 (3%)	24 (39%)	32 (52%)	1 (2%)	5.42 ± 1.79
18. Safety is important to my employer – he or she wants me to mention it often when talking with my staff	0 (0%)	0 (0%)	0 (0%)	0 (0%)	23 (38%)	37 (61%)	1 (2%)	5.62 ± 0.49
19. My employer makes sure all management personnel have the safety knowledge needed for the hazards we face on this job	0 (0%)	0 (0%)	1 (2%)	7 (11%)	22 (36%)	30 (49%)	1 (2%)	5.35 ± 0.76
20. My employer makes sure we follow site safety rules and procedures very closely	0 (0%)	0 (0%)	0 (0%)	3 (5%)	21 (34%)	36 (59%)	1 (2%)	5.55 ± 0.59
21. I inform my employer of any safety problems on the jobsite	0 (0%)	0 (0%)	0 (0%)	1 (2%)	22 (36%)	37 (61%)	1 (2%)	5.60 ± 0.53
22. My employer thinks that safety is more important than productivity	0 (0%)	0 (0%)	3 (5%)	6 (10%)	19 (31%)	31 (51%)	2 (3%)	5.32 ± 0.86
23. My safety program works well together with other subcontractor's safety programs	0 (0%)	0 (0%)	2 (3%)	7 (11%)	27 (44%)	24 (39%)	1 (2%)	5.22 ± 0.78
24. My employer supports me if I stop work because working conditions are unsafe	0 (0%)	0 (0%)	0 (0%)	2 (3%)	19 (31%)	38 (62%)	2 (3%)	5.61 ± 0.56
25. My employer gives me the responsibility I need to allow my crew to work safely	0 (0%)	0 (0%)	0 (0%)	1 (2%)	19 (31%)	38 (62%)	3 (5%)	5.64 ± 0.52
26. Fatigue is an issue for my workers – they have made mistakes on the job because they were tired	8 (13%)	17 (28%)	5 (8%)	15 (25%)	0 (0%)	0 (0%)	4 (7%)	3.11 ± 1.41
27. Doing the work safely on this job has definite priority over getting it done on schedule	0 (0%)	3 (5%)	1 (2%)	10 (16%)	22 (36%)	24 (39%)	1 (2%)	5.05 ± 1.05

(Cont'd)

28. Sometimes the crew can't do the job safely because other trades are in our way	16 (26%)	20 (33%)	6 (10%)	4 (7%)	9 (15%)	4 (7%)	2 (3%)	2.69 ± 1.63
29. There is always enough personal protective equipment available to allow work to be done safely	1 (2%)	0 (0%)	3 (5%)	2 (3%)	24 (39%)	30 (49%)	1 (2%)	5.30 ± 0.96
30. My workers have received enough training to do the work safely	1 (2%)	1 (2%)	1 (2%)	5 (8%)	39 (64%)	12 (20%)	2 (3%)	4.97 ± 0.89
31. I always make sure workers get enough site-specific information about a job to do it safely	0 (0%)	0 (0%)	1 (2%)	7 (11%)	27 (44%)	25 (41%)	1 (2%)	5.27 ± 0.73
32. My workers know what their safety responsibilities are at work	0 (0%)	2 (3%)	0 (0%)	5 (8%)	29 (48%)	24 (39%)	1 (2%)	5.22 ± 0.87
33. Sometimes workers have to ignore a safety rule or policy in order to carry out an assignment to meet the schedule	31 (51%)	20 (33%)	3 (5%)	0 (0%)	3 (5%)	1 (2%)	3 (5%)	1.74 ± 1.13
34. My workers always report safety hazards that they see	0 (0%)	2 (3%)	3 (5%)	19 (31%)	24 (39%)	11 (18%)	2 (3%)	4.66 ± 0.96
35. My workers know who to report a hazard to when they see one on the job	0 (0%)	1 (2%)	0 (0%)	7 (11%)	28 (46%)	23 (38%)	2 (3%)	5.22 ± 0.79
36. Workers assist others to make sure they perform their work safely	0 (0%)	1 (2%)	1 (2%)	14 (23%)	30 (49%)	13 (21%)	2 (3%)	4.90 ± 0.82
37. Toolbox talks about safety are given regularly	0 (0%)	0 (0%)	2 (3%)	2 (3%)	23 (38%)	32 (52%)	2 (3%)	5.44 ± 0.73
38. Toolbox talks are helpful to my workers	0 (0%)	0 (0%)	1 (2%)	6 (10%)	27 (44%)	25 (41%)	2 (3%)	5.29 ± 0.72
39. I believe that safety committees for the project would be very beneficial	1 (2%)	1 (2%)	2 (3%)	9 (15%)	31 (51%)	15 (25%)	2 (3%)	4.92 ± 0.99
40. Media attention has portrayed safety on the site accurately	36 (59%)	11 (18%)	3 (5%)	2 (3%)	5 (8%)	3 (5%)	1 (2%)	1.97 ± 1.54
41. My foreman and supervisors always report safety problems to me	0 (0%)	1 (2%)	0 (0%)	7 (11%)	34 (56%)	16 (26%)	3 (5%)	5.10 ± 0.74

### Selected “Positive” Findings- Superintendent Responses

- 99% of superintendents agree safety is visible on this job – for example, I have seen safety personnel or site supervisors or site managers doing daily safety checks
- 99% of superintendents agree that Perini regularly assesses the use of Personal Protective Equipment
- 99% of superintendents agree safety is important to their employer – he or she wants them to mention it often when talking with their staff
- 99% of superintendents agree that they inform their employer of any safety problems on the jobsite
- 98% of superintendents agree that Perini encourages employees to talk about near misses (close calls) that occurred at work
- 98% of superintendents agree their employer makes sure they follow site safety rules and procedures very closely
- 97% of superintendents agree that Perini thinks that job site safety is more important than schedules or deadlines
- 97% of superintendents agree that Perini policy encourages the reporting of work-related injuries or illnesses
- 97% of superintendents agree that Perini encourages communication of safety concerns between workers and management
- 96% of superintendents agree their employer makes sure all management personnel have the safety knowledge needed for the hazards they face on this job
- 96% of superintendents agree their employer supports them if they stop work because working conditions are unsafe
- 96% of superintendents agree they always make sure workers get enough site-specific information about a job to do it safely

### Selected “Negative” Findings – Superintendent Responses

- 89% of superintendents disagree that sometimes workers have to ignore a safety rule or policy in order to carry out an assignment to meet the schedule (7% agree)
- 84% of superintendents disagree that Perini believes that productivity is more important than safety (11% agree)
- 82% of superintendents disagree that media attention has portrayed safety on the site accurately (16% agree)
- 69% of superintendents disagree that sometimes the crew can’t do the job safely because other trades are in their way (29% agree)
- 49% of superintendents disagree that fatigue is an issue for their workers – they have made mistakes on the job because they were tired (25% agree)
- 14% of superintendents disagree that MGM thinks that job site safety is more important than job schedules and deadlines (84% agree)
- 8% of superintendents disagree that their workers always report safety hazards that they see (88% agree)
- 7% of superintendents disagree that MGM communicates a commitment to safety throughout this project (90% agree)

- 7% of superintendents disagree that the General Contractor (Perini) gives employees positive feedback when they demonstrate good safety practices (90% agree)
- 7% of superintendents disagree that doing the work safely on this job has definite priority over getting it done on schedule (91% agree)
- 7% of superintendents disagree that there is always enough personal protective equipment available to allow work to be done safely (91% agree)
- 7% of superintendents disagree that they believe that safety committees for the project would be very beneficial (91% agree)

### 3-2. Psychometric Analysis

#### 3-2-a. Factors and Corresponding Survey Items for the Superintendent Survey

Based on a series of factor analyses, parallel analyses, and item analyses, 13 factors were identified for the superintendent survey, respectively. Factors and the correspondent survey items of each factor, and descriptive statistics (alpha coefficient, possible range, observed range, mean, standard deviation, and number of respondents) are reported in Table 6. See Appendix 4 for definitions of the 13 factors.

**Table 6 – Factors and Corresponding Survey Items for the Superintendent Survey**

<b>Factors with corresponding survey items</b>	<b>Alpha</b>	<b>PR</b>	<b>OR</b>	<b>Mean</b>	<b>SD</b>	<b>N</b>
<b>Perini Safety Climate</b>	.92	17-102	61-102	92.0	8.5	60
Safety is visible on this job – for example, I have seen safety personnel or site supervisors or site managers doing daily safety checks						
Perini thinks that job site safety is more important than schedules or deadlines						
Perini safety personnel step in to stop unsafe operations						
The Perini safety staff follows up when there is a problem – it gets fixed right away and stays that way						
Safety is important to my employer – he or she wants me to mention it often when talking with my staff						
Perini regularly assesses the use of Personal Protective Equipment						
Perini encourages communication of safety concerns between workers and management						
Perini disciplines workers who do not follow safety procedures						
Perini believes that productivity is more important than safety						
The General Contractor (Perini) gives employees positive feedback when they demonstrate good safety practices						
My employer supports me if I stop work because working conditions are unsafe						
My employer gives me the responsibility I need to allow my crew to work safely						

Perini encourages employees to talk about near misses (close calls) that occurred at work						
Perini policy encourages the reporting of work-related injuries or illnesses						
Perini considers safety performance in pre-qualifying its subcontractors						
Perini always includes safety in the job planning process						
My foreman and supervisors always report safety problems to me						
<b>Factors with corresponding survey items</b>	<b>Alpha</b>	<b>PR</b>	<b>OR</b>	<b>Mean</b>	<b>SD</b>	<b>N</b>
<b>Employer Safety Management</b>	.84	4-24	17-24	21.8	2.3	60
My employer makes sure all management personnel have the safety knowledge needed for the hazards we face on this job						
My employer makes sure we follow site safety rules and procedures very closely						
I inform my employer of any safety problems on the jobsite						
My employer thinks that safety is more important than productivity						
<b>Safety Behaviors</b>	.79	3-18	6-18	14.8	2.2	57
My workers always report safety hazards that they see						
My workers know who to report a hazard to when they see one on the job						
Workers assist others to make sure they perform their work safely						
<b>Safety Practices</b>	.70	5-30	17-30	26.2	2.8	60
There is always enough personal protective equipment available to allow work to be done safely						
My workers have received enough training to do the work safely						
I always make sure workers get enough site-specific information about a job to do it safely						
My workers know what their safety responsibilities are at work						
Toolbox talks about safety are given regularly						

<b>Fatigue</b>	N/A	1-6	1-5	3.1	1.4	57
Fatigue is an issue for my workers – they have made mistakes on the job because they were tired						
<b>Unsafe work due to time pressure</b>	N/A	1-6	1-6	1.7	1.1	58
Sometimes workers have to ignore a safety rule or policy in order to carry out an assignment to meet the schedule						
<b>Factors with corresponding survey items</b>	<b>Alpha</b>	<b>PR</b>	<b>OR</b>	<b>Mean</b>	<b>SD</b>	<b>N</b>
<b>Perini Safety Program</b>	.81	2-12	5-12	10.3	1.6	59
Perini’s safety program works well together with other subcontractor safety programs – it is clear to me who is responsible for what						
My safety program works well together with other subcontractor’s safety programs						
<b>Safety Priority</b>	N/A	1-6	2-6	5.1	1.1	60
Doing the work safely on this job has definite priority over getting it done on schedule						
<b>Situational Constraints Caused by Other Trades</b>	N/A	1-6	1-6	2.7	1.6	59
Sometimes the crew can’t do the job safely because other trades are in our way						
<b>Toolbox Talks Evaluation</b>	N/A	1-6	3-6	5.3	0.7	59
Toolbox talks are helpful to my workers						
<b>Perceived Need for Safety Committee</b>	N/A	1-6	1-6	4.9	1.0	59
I believe that safety committees for the project would be very beneficial						
<b>Media Coverage</b>	N/A	1-6	1-6	2.0	1.5	60
Media attention has portrayed safety on the site accurately						
<b>MGM Safety Climate</b>	.75	3-18	7-18	14.4	2.4	59
MGM thinks that job site safety is more important than job schedules and deadlines						
MGM has a management structure that encourages exchange of information about safety on the job						

MGM communicates a commitment to safety throughout this project						
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*Note.* **Alpha** = alpha coefficient, which is computed only for Factors consisting of 2 or more items. It ranges from 0 to 1, with values closer to 1 indicating that the set of items measures well a single Factor. **PR** = possible range of scores. **OR** = observed range of scores. **Mean** = an arithmetic average of the sum of the individual responses to the set of items for each Factor based on the survey respondents. **SD** = standard deviation, which is a measure of how widely the respondents' scores differ from the mean score. The larger the standard deviation, the more spread are the respondents' scores. **N** = number of respondents who provide valid responses for each factor. N may differ across factors due to missing responses.

**Summary of Table 6.**

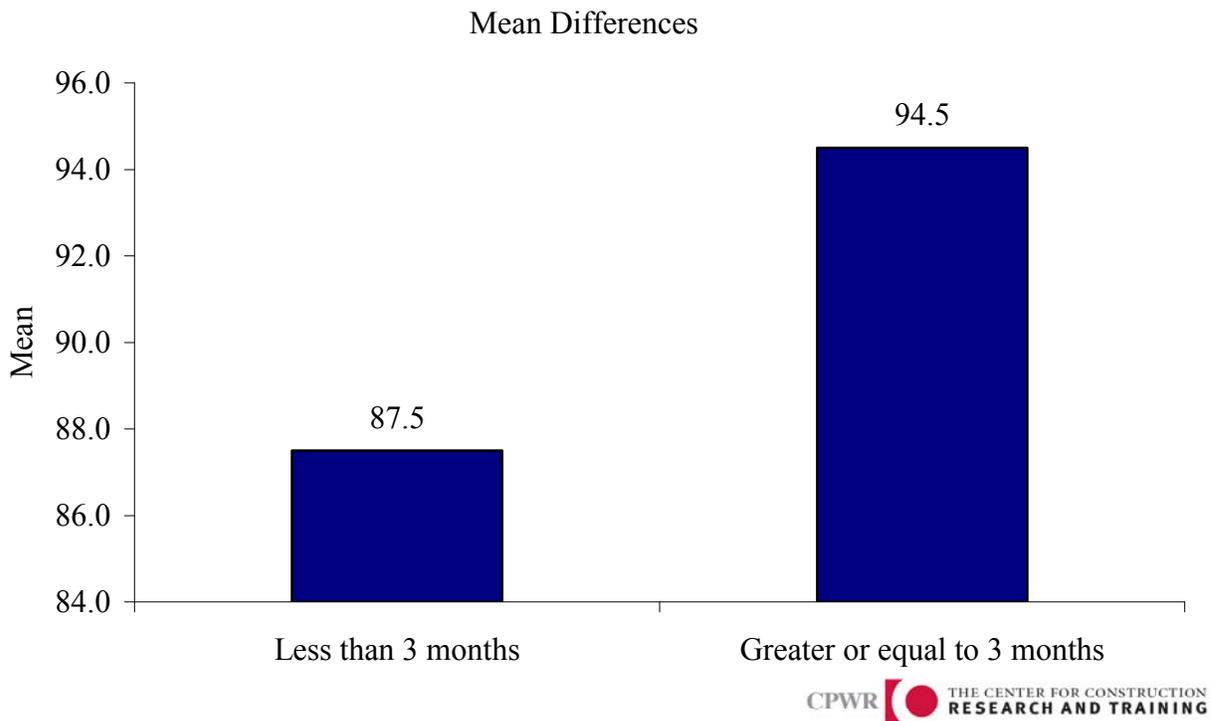
Overall, alpha coefficients ranged from 0.70 to 0.92, which were satisfactory. Perini safety climate, employer safety management, safety practice, and Perini safety program exhibited narrower observed range of scores than the possible range of scores. In other words, responses on these four factors were significantly skewed in a positive direction.

### 3-2-b. Mean Comparisons within the Superintendent Survey

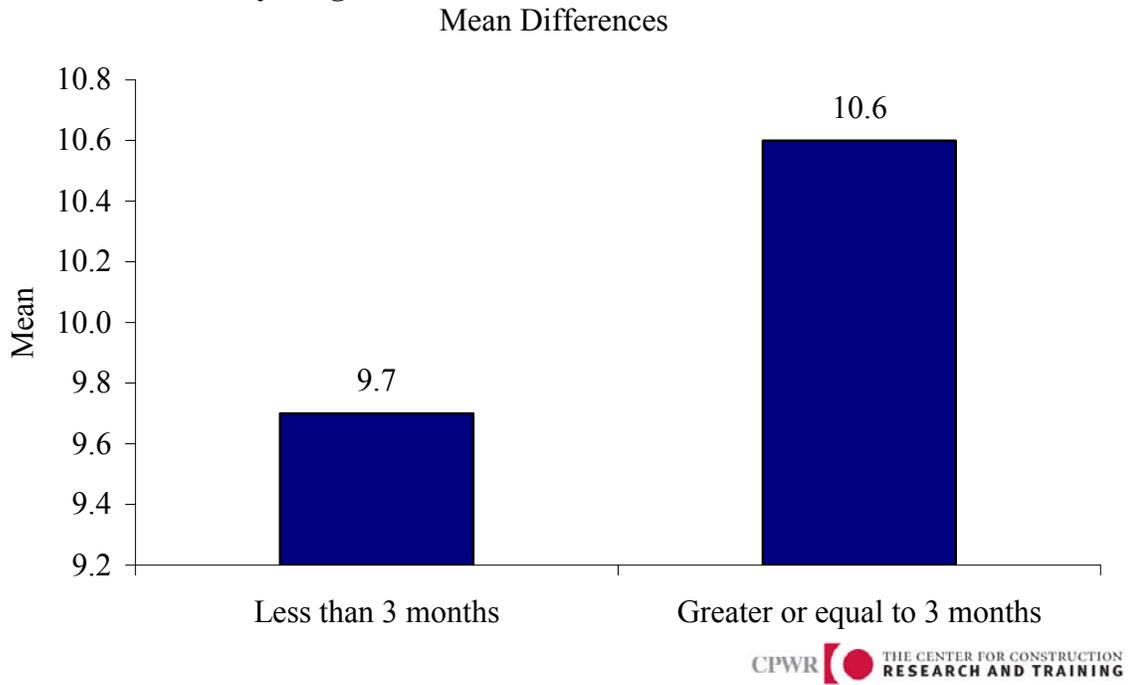
Mean comparisons of each of the 13 factors of the superintendent survey were conducted based on the following background characteristics: (1) months worked on the job site (less than 3-month vs. greater or equal to 3 months), (2) work status (superintendents, assistant superintendents, and project managers), and (3) years worked in the construction industry (less than 29 years vs. greater or equal to 29 years). No significant mean differences were found for the 13 factors based on work status. The remaining significant results based on months worked on the job site are depicted in Figures 29a – 29c.

#### 3-2-b1. Mean Comparisons based on Months Worked

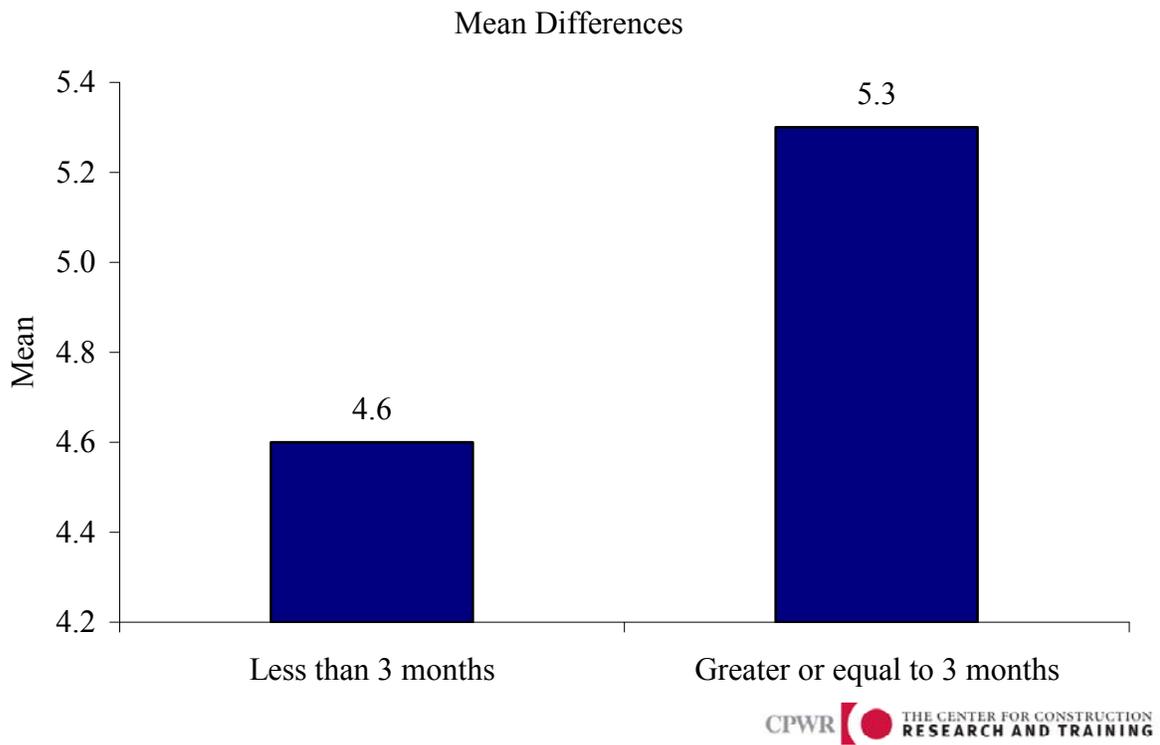
Figure 29a. Perini Safety Climate



**Figure 29b. Perini Safety Program**



**Figure 29c. Safety Priority**



**Summary of Key Findings Based on Comparisons Between Those Who Worked <3 Months vs. Those Who Worked >3 Months (Figures 29a-29c).**

Superintendents who have worked greater or equal to 3 months on the job site

- reported more positive Perini safety climate.
- reported more positive Perini safety program.
- reported more safety priority.

Given that the Superintendent surveys were distributed later than October of 2009, those who just came on board may not have the same frame of reference as those who have been working for more than 3 months. Thus, these findings indirectly support the implication that safety may have improved (cf. 1-2-b2). However, the above speculation should be interpreted with caution because these findings may also suggest that the two groups of Superintendents may have different standards or experience about Perini safety climate.

Overall, Superintendents who have worked greater or equal to 3 months on the job site reported more positive Perini safety climate, Perini safety program, and safety priority. Given that the superintendent surveys were distributed later than October of 2009, those who just came on board may not have the same frame of reference as those who have been working for more than 3 months. Thus, these findings indirectly support the implication that safety may have improved. However, the above speculation should be interpreted with caution because these findings may also suggest that the two groups of superintendents may have different standards or experience about Perini safety climate.

## 4. Executives

### 4-1. Descriptive Analysis

#### 4-1-a. Demographics

Seventeen top Perini Management Executives completed the safety climate survey. Figure 30 shows the age distribution of the executives. Nearly half (41%) ranged in age from 45 to 54 years of age (Figure 30). One quarter were between 35 to 44 years of age and the remainder (29%) were between 55 to 64 years of age.

**Figure 30. Distribution of Construction Executives by Age**

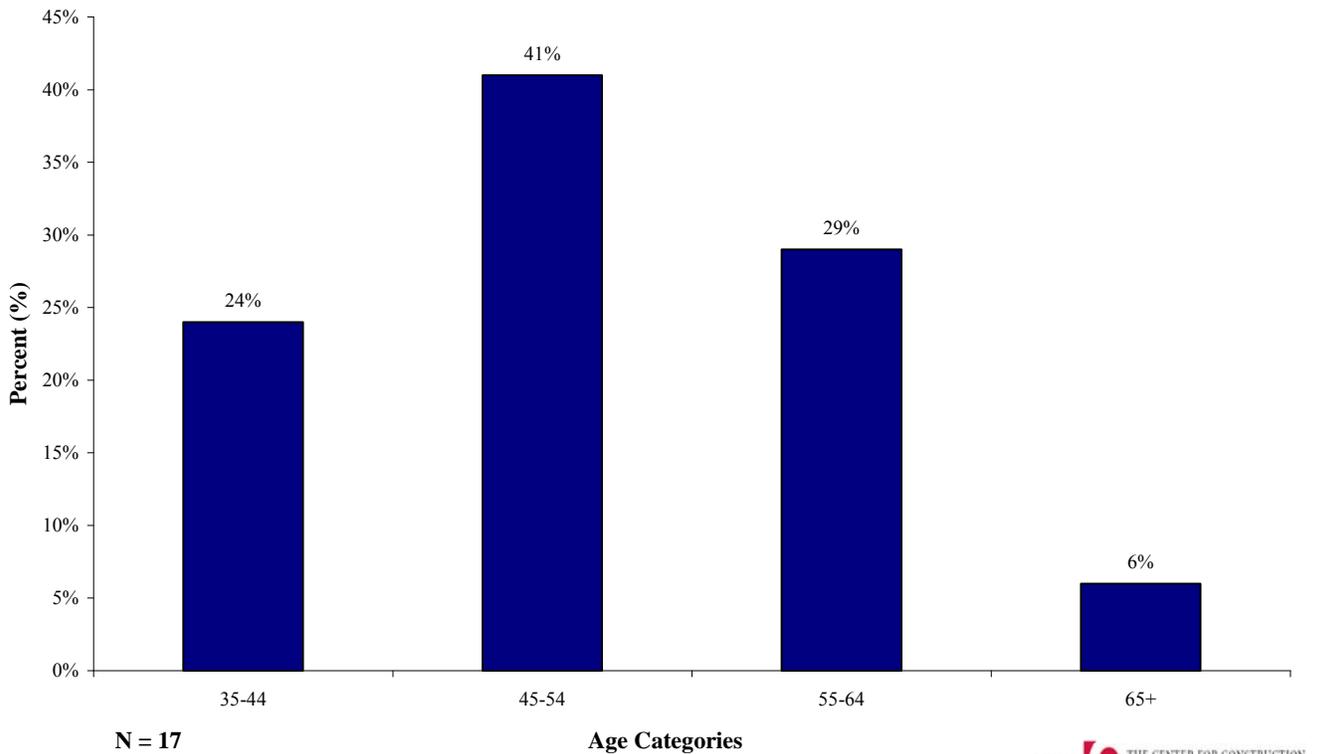


Figure 31 shows the distribution of executives based on construction trade work experience. Among the Top Management Executives surveyed (64%) have been carpenters, 27% laborers and 9% iron workers.

**Figure 31. Distribution of Executives who worked in construction, by Trade**

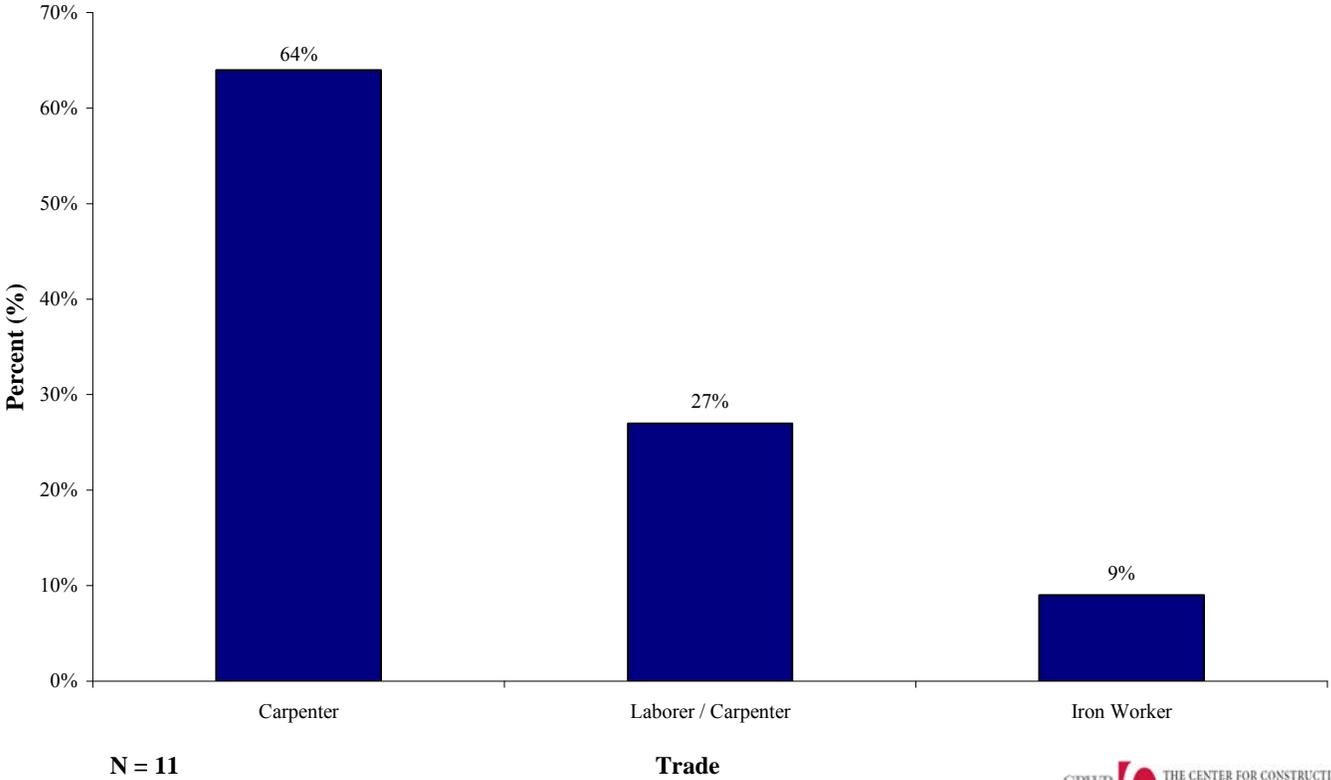
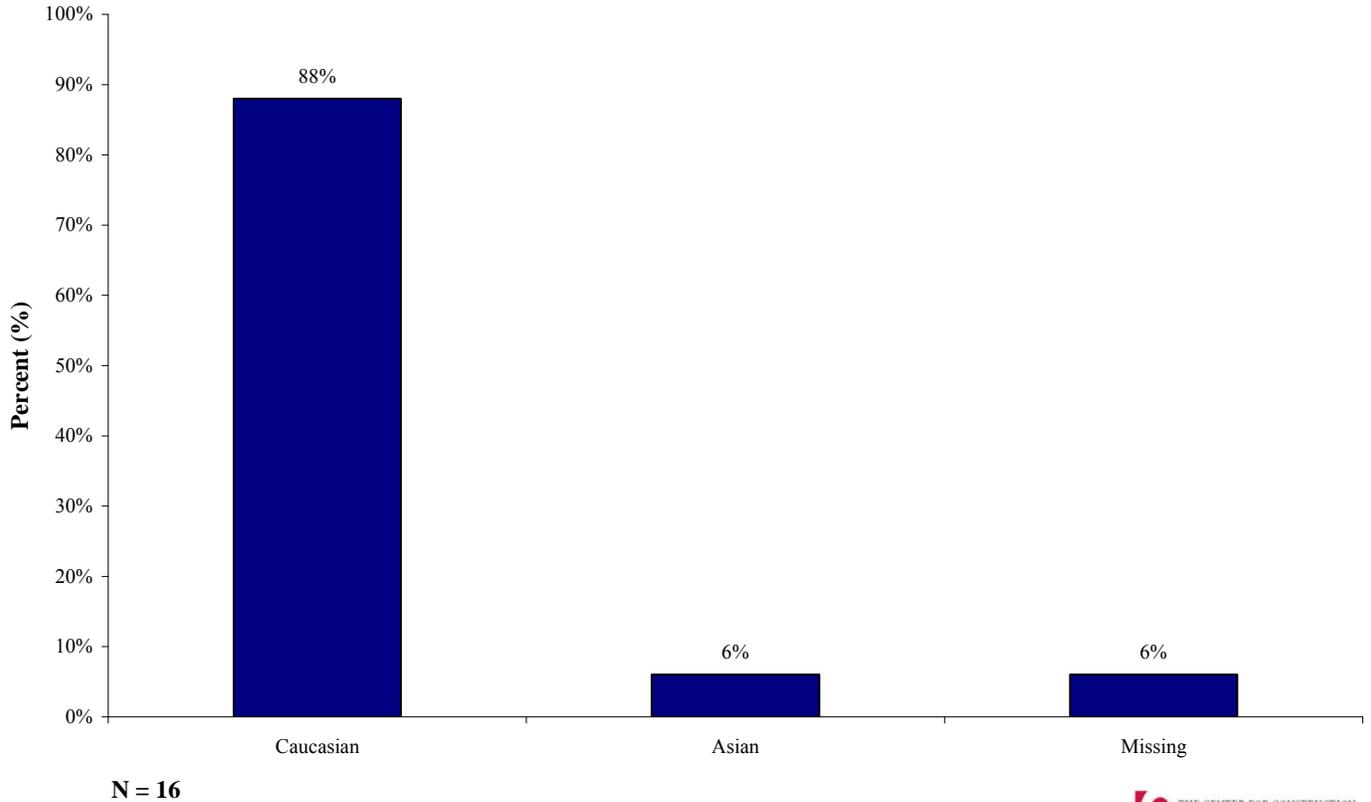


Figure 32 shows the race/ethnicity distribution of executives. Nearly all of the top management executives were Caucasian (88%). Six percent reported their race/ethnicity as Asian.

**Figure 32. Distribution of Construction Executives by Race / Ethnicity**



**4-1-b. Item-Specific Responses**

Table 7 describes the frequency responses for each category of the 6 point likert scale for each of the climate survey questions answered by Executives. Selected highlights are presented at the end of Table 7.

**Table 7. Item-Specific Responses to Safety Climate Survey Questions – Executive Responses**

Questions	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree	Missing	Mean
1. MGM thinks that job site safety is more important than job schedules and deadlines	0 (0%)	2 (12%)	1 (6%)	1 (6%)	8 (47%)	2 (12%)	3 (18%)	4.54 ± 1.29
2. MGM has a management structure that encourages exchange of information about safety on the job	0 (0%)	2 (12%)	1 (6%)	5 (29%)	5 (29%)	1 (6%)	3 (18%)	4.14 ± 1.17
3. MGM communicates a commitment to safety throughout this project	0 (0%)	2 (12%)	2 (12%)	3 (18%)	6 (35%)	1 (6%)	3 (18%)	4.14 ± 1.23
4. Safety is important to MGM – they want me to mention it often when talking with my staff	0 (0%)	2 (12%)	1 (6%)	4 (24%)	5 (29%)	2 (12%)	3 (18%)	4.29 ± 1.27
5. I inform MGM of serious safety problems on the jobsite	0 (0%)	0 (0%)	2 (12%)	1 (6%)	7 (41%)	3 (18%)	4 (24%)	4.85 ± 0.99
6. MGM thinks that safety is more important than productivity	0 (0%)	0 (0%)	2 (12%)	1 (6%)	8 (47%)	2 (12%)	4 (24%)	4.77 ± 0.93
7. MGM supports me if I stop work because working conditions are unsafe	0 (0%)	1 (6%)	0 (0%)	2 (12%)	6 (35%)	4 (24%)	4 (24%)	4.92 ± 1.12
8. Safety is visible on this job – for example, I have seen safety personnel or site supervisors or site managers doing daily safety checks	0 (0%)	0 (0%)	0 (0%)	0 (0%)	5 (29%)	11 (65%)	1 (6%)	5.69 ± 0.48
9. Perini thinks that job site safety is more important than schedules or deadlines	0 (0%)	1 (6%)	0 (0%)	1 (6%)	5 (29%)	10 (59%)	0 (0%)	5.35 ± 1.06
10. Perini safety personnel step in to stop unsafe operations	0 (0%)	0 (0%)	0 (0%)	1 (6%)	8 (47%)	7 (41%)	1 (6%)	5.38 ± 0.62
11. The Perini safety staff follows up when there is a problem – it gets fixed right away and stays that way	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (35%)	10 (59%)	1 (6%)	5.63 ± 0.50
12. Perini’s safety program works well together with other subcontractor safety programs – it is clear to me who is responsible for what	0 (0%)	0 (0%)	0 (0%)	4 (24%)	8 (47%)	4 (24%)	1 (6%)	5.00 ± 0.73

(Cont'd)

13. Perini encourages employees to talk about near misses (close calls) that occurred at work	0 (0%)	0 (0%)	0 (0%)	5 (29%)	4 (24%)	7 (41%)	1 (6%)	5.13 ± 0.89
14. Perini policy encourages the reporting of work-related injuries or illnesses	0 (0%)	0 (0%)	0 (0%)	0 (0%)	4 (24%)	13 (76%)	0 (0%)	5.76 ± 0.44
15. Perini regularly assesses the use of Personal Protective Equipment	0 (0%)	0 (0%)	0 (0%)	1 (6%)	3 (18%)	12 (71%)	1 (6%)	5.69 ± 0.60
16. Perini encourages communication of safety concerns between workers and management	0 (0%)	0 (0%)	0 (0%)	1 (6%)	8 (47%)	8 (47%)	0 (0%)	5.41 ± 0.62
17. Perini disciplines workers who do not follow safety procedures	0 (0%)	0 (0%)	0 (0%)	0 (0%)	10 (59%)	7 (41%)	0 (0%)	5.41 ± 0.51
18. Perini believes that productivity is more important than safety	7 (41%)	8 (47%)	0 (0%)	0 (0%)	0 (0%)	1 (6%)	1 (6%)	2.00 ± 1.41
19. The General Contractor (Perini) gives foremen positive feedback when they demonstrate good safety practices	0 (0%)	0 (0%)	0 (0%)	4 (24%)	6 (35%)	6 (35%)	1 (6%)	5.13 ± 0.81
20. Perini considers safety performance in pre-qualifying its subcontractors	0 (0%)	2 (12%)	0 (0%)	4 (24%)	7 (41%)	4 (24%)	0 (0%)	4.65 ± 1.22
21. Perini always includes safety in the job planning process	0 (0%)	0 (0%)	0 (0%)	1 (6%)	6 (35%)	10 (59%)	0 (0%)	5.53 ± 0.62
22. Fatigue is an issue for our employees – they have made mistakes on the job or been injured because they were tired	1 (6%)	3 (18%)	5 (29%)	4 (24%)	4 (24%)	0 (0%)	0 (0%)	3.41 ± 1.23
23. Doing the work safely on this job has definite priority over getting it done on schedule	0 (0%)	0 (0%)	0 (0%)	3 (18%)	8 (47%)	6 (35%)	0 (0%)	5.18 ± 0.73
24. Sometimes a crew can't do the job safely because other trades are in its way	4 (24%)	7 (41%)	0 (0%)	1 (6%)	4 (24%)	0 (0%)	1 (6%)	2.63 ± 1.59
25. There is always enough personal protective equipment available to allow work to be done safely	0 (0%)	0 (0%)	0 (0%)	3 (18%)	4 (24%)	9 (53%)	1 (6%)	5.38 ± 0.81
26. Our employees have received enough training to do the work safely	0 (0%)	0 (0%)	2 (12%)	3 (18%)	8 (47%)	3 (18%)	1 (6%)	4.75 ± 0.93
27. I believe we always make sure workers get enough site-specific information about a job to do it safely	0 (0%)	0 (0%)	2 (12%)	1 (6%)	11 (65%)	2 (12%)	1 (6%)	4.81 ± 0.83
28. I believe our employees know what their safety responsibilities are at work	0 (0%)	0 (0%)	1 (6%)	4 (24%)	10 (59%)	2 (12%)	0 (0%)	4.76 ± 0.75

(Cont'd)

29. Sometimes employees have to ignore a safety rule or policy in order to carry out an assignment to meet the schedule	5 (29%)	10 (59%)	0 (0%)	1 (6%)	0 (0%)	1 (6%)	0 (0%)	2.06 ± 1.25
30. I believe our employees always report safety hazards that they see	0 (0%)	0 (0%)	5 (29%)	5 (29%)	5 (29%)	2 (12%)	0 (0%)	4.24 ± 1.03
31. I believe our employees know who to report a hazard to when they see one on the job	0 (0%)	0 (0%)	0 (0%)	4 (24%)	8 (47%)	5 (29%)	0 (0%)	5.06 ± 0.75
32. Employees assist others to make sure they perform their work safely	0 (0%)	0 (0%)	0 (0%)	7 (41%)	7 (41%)	2 (12%)	1 (6%)	4.69 ± 0.70
33. Toolbox talks about safety are given regularly	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (41%)	9 (53%)	1 (6%)	5.56 ± 0.51
34. Toolbox talks are helpful to our employees	0 (0%)	0 (0%)	0 (0%)	1 (6%)	10 (59%)	5 (29%)	1 (6%)	5.25 ± 0.58
35. I believe that safety committees for the project would be very beneficial	0 (0%)	0 (0%)	0 (0%)	3 (18%)	9 (53%)	5 (29%)	0 (0%)	5.12 ± 0.70
36. Media attention has portrayed safety on the site accurately	9 (53%)	5 (29%)	1 (6%)	0 (0%)	1 (6%)	1 (6%)	0 (0%)	1.94 ± 1.48
37. Our foreman and supervisors always report safety problems	0 (0%)	0 (0%)	1 (6%)	4 (24%)	9 (53%)	2 (12%)	1 (6%)	4.75 ± 0.77

### Selected “Positive” Findings- Executive Responses

- 100% of executives agree that Perini policy encourages the reporting of work-related injuries or illnesses
- 100% of executives agree that Perini encourages communication of safety concerns between workers and management
- 100% of executives agree that Perini disciplines workers who do not follow safety procedures
- 100% of executives agree that Perini always includes safety in the job planning process
- 100% of executives agree that doing the work safely on this job has definite priority over getting it done on schedule
- 100% of executives agree they believe their employees know who to report a hazard to when they see one on the job
- 100% of executives agree they believe that safety committees for the project would be very beneficial
- 95% of executives agree that Perini’s safety program works well together with other subcontractor safety programs – it is clear to them who is responsible for what
- 95% of executives agree that Perini regularly assesses the use of Personal Protective Equipment
- 95% of executives agree that there is always enough personal protective equipment available to allow work to be done safely
- 95% of executives agree they believe their employees know what their safety responsibilities are at work

### Selected “Negative” Findings – Executive Responses

- 88% of executives disagree that Perini believes that productivity is more important than safety (6% agree)
- 88% of executives disagree that sometimes employees have to ignore a safety rule or policy in order to carry out an assignment to meet the schedule (12% agree)
- 88% of executives disagree that media attention has portrayed safety on the site accurately (12% agree)
- 65% of executives disagree that sometimes a crew can’t do the job safely because other trades are in its way (30% agree)
- 53% of executives disagree that fatigue is an issue for their employees – they have made mistakes on the job or been injured because they were tired (48%)
- 29% of executives disagree that they believe their employees always report safety hazards that they see (70% agree)
- 24% of executives disagree that MGM communicates a commitment to safety throughout this project (59% agree)
- 18% of executives disagree that MGM thinks that job site safety is more important than job schedules and deadlines (65% agree)
- 18% of executives disagree that MGM has a management structure that encourages exchange of information about safety on the job (64% agree)
- 18% of executives disagree that safety is important to MGM – they want them to mention it often when talking with their staff (65% agree)

## 4-2. Psychometric Analysis

### 4-2-a. Factors and Corresponding Survey Items for the Executive Survey

Based on a series of factor analyses, parallel analyses, and item analyses, 12 factors were identified for the executive survey. Factors and the correspondent survey items of each factor, and descriptive statistics (alpha coefficient, possible range, observed range, mean, standard deviation, and number of respondents) are reported in Table 8. See Appendix 5 for definitions of the 12 factors.

**Table 8. Factors and Corresponding Survey Items for the Executive Survey**

Factors with corresponding survey items	Alpha	PR	OR	Mean	SD	N
<b>Perini Safety Climate</b>	.87	16-84	61-84	74.8	6.7	16
Safety is visible on this job – for example, I have seen safety personnel or site supervisors or site managers doing daily safety checks						
Perini thinks that job site safety is more important than schedules or deadlines						
Perini safety personnel step in to stop unsafe operations						
The Perini safety staff follows up when there is a problem – it gets fixed right away and stays that way						
Perini regularly assesses the use of Personal Protective Equipment						
Perini encourages communication of safety concerns between workers and management						
Perini disciplines workers who do not follow safety procedures						
Perini believes that productivity is more important than safety						
The General Contractor (Perini) gives foremen positive feedback when they demonstrate good safety practices						
Perini encourages employees to talk about near misses (close calls) that occurred at work						
Perini policy encourages the reporting of work-related injuries or illnesses						
Perini considers safety performance in pre-qualifying its subcontractors						
Perini always includes safety in the job planning process						

Our foreman and supervisors always report safety problems						
<b>Safety Behaviors</b>	.92	3-18	11-18	14.0	2.4	16
I believe our employees always report safety hazards that they see						
I believe our employees know who to report a hazard to when they see one on the job						
Employees assist others to make sure they perform their work safely						
<b>Factors with corresponding survey items</b>	<b>Alpha</b>	<b>PR</b>	<b>OR</b>	<b>Mean</b>	<b>SD</b>	<b>N</b>
<b>Safety Practices</b>	.82	5-30	19-30	25.3	3.0	16
There is always enough personal protective equipment available to allow work to be done safely						
Our employees have received enough training to do the work safely						
I believe we always make sure workers get enough site-specific information about a job to do it safely						
I believe our employees know what their safety responsibilities are at work						
Toolbox talks about safety are given regularly						
<b>Fatigue</b>	N/A	1-6	1-5	3.4	1.2	17
Fatigue is an issue for our employees – they have made mistakes on the job or been injured because they were tired						
<b>Unsafe work due to time pressure</b>	N/A	1-6	1-6	2.1	1.3	17
Sometimes employees have to ignore a safety rule or policy in order to carry out an assignment to meet the schedule						
<b>Perini Safety Program</b>	N/A	1-6	4-6	5.0	0.7	16
Perini's safety program works well together with other subcontractor safety programs – it is clear to me who is responsible for what						
<b>Safety Priority</b>	N/A	1-6	4-6	5.2	0.7	17

Doing the work safely on this job has definite priority over getting it done on schedule						
<b>Situational Constraints Caused by Other Trades</b>	N/A	1-6	1-5	2.6	1.6	16
Sometimes a crew can't do the job safely because other trades are in its way						
<b>Toolbox Talks Evaluation</b>	N/A	1-6	4-6	5.3	0.6	16
Toolbox talks are helpful to our employees						
<b>Factors with corresponding survey items</b>	<b>Alpha</b>	<b>PR</b>	<b>OR</b>	<b>Mean</b>	<b>SD</b>	<b>N</b>
<b>Perceived Need for Safety Committee</b>	N/A	1-6	4-6	5.1	0.7	17
I believe that safety committees for the project would be very beneficial						
<b>Media Coverage</b>	N/A	1-6	1-6	1.9	1.5	17
Media attention has portrayed safety on the site accurately						
<b>MGM Safety Climate</b>	.96	7-42	17-42	31.4	7.0	14
MGM thinks that job site safety is more important than job schedules and deadlines						
MGM has a management structure that encourages exchange of information about safety on the job						
MGM communicates a commitment to safety throughout this project						
Safety is important to MGM – they want me to mention it often when talking with my staff						
I inform MGM of serious safety problems on the jobsite						
MGM thinks that safety is more important than productivity						
MGM supports me if I stop work because working conditions are unsafe						

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*Note.* **Alpha** = alpha coefficient, which is computed only for Factors consisting of 2 or more items. It ranges from 0 to 1, with values closer to 1 indicating that the set of items measures well a single Factor. **PR** = possible range of scores. **OR** = observed range of scores. **Mean** = an arithmetic average of the sum of the individual responses to the set of items for each Factor based on the survey respondents. **SD** = standard deviation, which is a measure of how widely the respondents' scores differ from the mean score. The larger the standard deviation, the more spread are the respondents' scores. **N** = number of respondents who provide valid responses for each factor. N may differ across factors due to missing responses.

**Summary of Table 8.**

Overall, alpha coefficients ranged from 0.82 to 0.92, which were satisfactory. Perini safety climate, employer safety management, safety practice, and Perini safety program exhibited narrower observed range of scores than the possible range of scores. In other words, responses toward these four factors were significantly skewed in a positive direction.

***4-2-b. Mean Comparisons within the Executive Survey***

Mean comparisons of each of the 12 factors of the executive survey were conducted based on years worked in the construction industry (less than 26 years vs. greater or equal to 26 years). No statistically significant differences were found.

## 5. Comparison of 4 groups

### 5-1. Descriptive Analysis

#### 5-1-a. Item-Specific Responses

Next, we examined differences in perception/attitude regarding the safety climate by comparing safety climate survey responses among the workers, foremen, superintendents and top management executives. Table 9 below shows the item specific responses to the safety climate survey questions asked of all groups. Responses that were statistically significantly different between the 4 groups are indicated in yellow and blue. If there were significant differences across multiple groups then a third color (red) was introduced to make it visually clear. For example, for question #1, worker responses were significantly different from foremen, superintendents and top management executives (hereafter referred to as executives). In question #5, not only were worker responses significantly different from foremen, superintendents, and executives, but executives responses were significantly different from foremen, and superintendents as well as workers. Overall, there were significant differences among the 4 groups (workers, foremen, superintendent and executives) for 16 of the 24 comparable questions on the safety climate survey. Table 9 shows the responses for each category of the 6 point likert scale for each of the climate survey questions. Selected highlights are presented at the end of Table 9.

**Table 9. Comparison of Item-Specific Responses to Safety Climate Survey Questions across the 4 groups – Workers, Foremen, Superintendents, Executives**

Questions	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree	Missing	Mean
Safety is visible on this job – for example, I have seen safety personnel or site supervisors or site management doing daily safety checks.								
Construction Workers	108 (4%)	163 (5%)	200 (7%)	578 (19%)	1,271 (42%)	575 (19%)	140 (5%)	4.54 ± 1.25
Foremen	0 (0%)	1 (1%)	3 (2%)	9 (7%)	59 (44%)	61 (46%)	1 (1%)	5.32 ± 0.76
Superintendents	0 (0%)	0 (0%)	0 (0%)	4 (7%)	18 (30%)	38 (62%)	1 (2%)	5.57 ± 0.62
Executives	0 (0%)	0 (0%)	0 (0%)	0 (0%)	5 (29%)	11 (65%)	1 (6%)	5.69 ± 0.48
The General Contractor (Perini) thinks that job site safety is more important than job schedules and deadlines.								
Construction Workers	202 (7%)	268 (9%)	338 (11%)	728 (24%)	902 (30%)	450 (15%)	147 (5%)	4.11 ± 1.43
Foremen	0 (0%)	4 (3%)	3 (2%)	13 (10%)	58 (43%)	55 (41%)	1 (1%)	5.18 ± 0.92
Superintendents	0 (0%)	0 (0%)	0 (0%)	4 (7%)	24 (39%)	31 (51%)	2 (3%)	5.46 ± 0.62
Executives	0 (0%)	1 (6%)	0 (0%)	1 (6%)	5 (29%)	10 (59%)	0 (0%)	5.35 ± 1.06
Perini safety personnel step in to stop unsafe operations.								
Construction Workers	122 (4%)	203 (7%)	253 (8%)	683 (23%)	1,118 (37%)	486 (16%)	170 (6%)	4.37 ± 1.30
Foremen	1 (1%)	4 (3%)	2 (1%)	9 (7%)	50 (37%)	67 (50%)	1 (1%)	5.29 ± 0.97
Superintendents	1 (2%)	0 (0%)	1 (2%)	0 (0%)	23 (38%)	34 (56%)	2 (3%)	5.47 ± 0.84
Executives	0 (0%)	0 (0%)	0 (0%)	1 (6%)	8 (47%)	7 (41%)	1 (6%)	5.38 ± 0.62

(Cont'd)									
The Perini safety staff follows up when there is a problem - it gets fixed right away and stays that way.									
Construction Workers	146 (5%)	212 (7%)	344 (11%)	912 (30%)	867 (29%)	348 (11%)	206 (7%)	4.13 ± 1.29	
Foremen	1 (1%)	1 (1%)	6 (4%)	19 (14%)	61 (46%)	45 (34%)	1 (1%)	5.05 ± 0.92	
Superintendents	1 (2%)	0 (0%)	2 (3%)	3 (5%)	25 (41%)	29 (48%)	1 (2%)	5.30 ± 0.93	
Executives	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (35%)	10 (59%)	1 (6%)	5.63 ± 0.50	
Perini's safety program works well together with other subcontractor safety programs – it is clear to me who is responsible for what.									
Construction Workers	147 (5%)	249 (8%)	329 (11%)	738 (24%)	965 (32%)	380 (13%)	227 (7%)	4.16 ± 1.34	
Foremen	2 (1%)	5 (4%)	6 (4%)	21 (16%)	63 (47%)	37 (28%)	0 (0%)	4.86 ± 1.09	
Superintendents	1 (2%)	0 (0%)	2 (3%)	8 (13%)	28 (46%)	20 (33%)	2 (3%)	5.07 ± 0.94	
Executives	0 (0%)	0 (0%)	0 (0%)	4 (24%)	8 (47%)	4 (24%)	1 (6%)	5.00 ± 0.73	
My subcontractor's safety program works well together with other subcontractor's safety programs									
Construction Workers	68 (2%)	119 (4%)	175 (6%)	700 (23%)	1,215 (40%)	506 (17%)	252 (8%)	4.58 ± 1.13	
Foremen	0 (0%)	11 (8%)	9 (7%)	13 (10%)	66 (49%)	29 (22%)	6 (4%)	4.73 ± 1.15	
Superintendents	0 (0%)	0 (0%)	2 (3%)	7 (11%)	27 (44%)	24 (39%)	1 (2%)	5.22 ± 0.78	
Executives	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Safety is important to Perini / my subcontractor – he or she mentions it often when talking to crews on site.									
Construction Workers	72 (2%)	108 (4%)	146 (5%)	520 (17%)	1,159 (38%)	834 (27%)	196 (6%)	4.79 ± 1.18	
Foremen	0 (0%)	1 (1%)	1 (1%)	5 (4%)	68 (51%)	59 (44%)	0 (0%)	5.37 ± 0.67	
Superintendents	0 (0%)	0 (0%)	0 (0%)	0 (0%)	23 (38%)	37 (61%)	1 (2%)	5.62 ± 0.49	
Executives	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
My foreman has the safety knowledge needed for the hazards we face on this job.									
Construction Workers	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Foremen	1 (1%)	2 (1%)	0 (0%)	4 (3%)	66 (49%)	61 (46%)	0 (0%)	5.35 ± 0.79	
Superintendents	0 (0%)	0 (0%)	1 (2%)	7 (11%)	22 (36%)	30 (49%)	1 (2%)	5.35 ± 0.76	
Executives	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
My foreman makes sure we follow site safety rules and procedures very closely.									
Construction Workers	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Foremen	1 (1%)	1 (1%)	0 (0%)	6 (4%)	62 (46%)	63 (47%)	1 (1%)	5.38 ± 0.75	
Superintendents	0 (0%)	0 (0%)	0 (0%)	3 (5%)	21 (34%)	36 (59%)	1 (2%)	5.55 ± 0.59	
Executives	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
My foreman thinks that safety is more important than productivity.									
Construction Workers	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Foremen	2 (1%)	4 (3%)	4 (3%)	13 (10%)	61 (46%)	44 (33%)	6 (4%)	5.02 ± 1.05	
Superintendents	0 (0%)	0 (0%)	3 (5%)	6 (10%)	19 (31%)	31 (51%)	2 (3%)	5.32 ± 0.86	
Executives	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

(Cont'd)									
Fatigue is an issue for me – I have caught myself making mistakes on the job when I was tired.									
Construction Workers	951 (31%)	999 (33%)	266 (9%)	266 (9%)	234 (8%)	117 (4%)	202 (7%)	2.36 ± 1.44	
Foremen	36 (27%)	60 (45%)	9 (7%)	13 (10%)	6 (4%)	1 (1%)	9 (7%)	2.17 ± 1.15	
Superintendents	8 (13%)	17 (28%)	5 (8%)	15 (25%)	0 (0%)	0 (0%)	4 (7%)	3.11 ± 1.41	
Executives	1 (6%)	3 (18%)	5 (29%)	4 (24%)	4 (24%)	0 (0%)	0 (0%)	3.41 ± 1.23	
Doing the work safely on this job has definite priority over getting it done on schedule.									
Construction Workers	129 (4%)	164 (5%)	232 (8%)	454 (15%)	984 (32%)	865 (29%)	207 (7%)	4.62 ± 1.38	
Foremen	5 (4%)	10 (7%)	7 (5%)	14 (10%)	62 (46%)	30 (22%)	6 (4%)	4.63 ± 1.33	
Superintendents	0 (0%)	3 (5%)	1 (2%)	10 (16%)	22 (36%)	24 (39%)	1 (2%)	5.05 ± 1.05	
Executives	0 (0%)	0 (0%)	0 (0%)	3 (18%)	8 (47%)	6 (35%)	0 (0%)	5.18 ± 0.73	
Sometimes I can't do my job safely because other trades are in my way.									
Construction Workers	346 (11%)	573 (19%)	260 (9%)	564 (19%)	684 (23%)	395 (13%)	213 (7%)	3.66 ± 1.64	
Foremen	31 (23%)	43 (32%)	10 (7%)	18 (13%)	14 (10%)	10 (7%)	8 (6%)	2.77 ± 1.61	
Superintendents	16 (26%)	20 (33%)	6 (10%)	4 (7%)	9 (15%)	4 (7%)	2 (3%)	2.69 ± 1.63	
Executives	4 (24%)	7 (41%)	0 (0%)	1 (6%)	4 (24%)	0 (0%)	1 (6%)	2.63 ± 1.59	
There is always enough personal protective equipment available to allow work to be done safely.									
Construction Workers	135 (4%)	169 (6%)	195 (6%)	415 (14%)	1,163 (38%)	756 (25%)	202 (7%)	4.61 ± 1.36	
Foremen	3 (2%)	3 (2%)	6 (4%)	7 (5%)	59 (44%)	51 (38%)	5 (4%)	5.09 ± 1.10	
Superintendents	1 (2%)	0 (0%)	3 (5%)	2 (3%)	24 (39%)	30 (49%)	1 (2%)	5.30 ± 0.96	
Executives	0 (0%)	0 (0%)	0 (0%)	3 (18%)	4 (24%)	9 (53%)	1 (6%)	5.38 ± 0.81	
I have received enough training to do my work safely.									
Construction Workers	49 (2%)	71 (2%)	99 (3%)	306 (10%)	1,305 (43%)	1,024 (34%)	181 (6%)	5.04 ± 1.05	
Foremen	1 (1%)	2 (1%)	6 (4%)	16 (12%)	64 (48%)	40 (30%)	5 (4%)	5.02 ± 0.94	
Superintendents	1 (2%)	1 (2%)	1 (2%)	5 (8%)	39 (64%)	12 (20%)	2 (3%)	4.97 ± 0.89	
Executives	0 (0%)	0 (0%)	2 (12%)	3 (18%)	8 (47%)	3 (18%)	1 (6%)	4.75 ± 0.93	
I know what my safety responsibilities are at work.									
Construction Workers	35 (1%)	33 (1%)	51 (2%)	231 (8%)	1,304 (43%)	1,157 (38%)	224 (7%)	5.21 ± 0.91	
Foremen	0 (0%)	1 (1%)	1 (1%)	8 (6%)	72 (54%)	47 (35%)	5 (4%)	5.26 ± 0.68	
Superintendents	0 (0%)	2 (3%)	0 (0%)	5 (8%)	29 (48%)	24 (39%)	1 (2%)	5.22 ± 0.87	
Executives	0 (0%)	0 (0%)	1 (6%)	4 (24%)	10 (59%)	2 (12%)	0 (0%)	4.76 ± 0.75	
Sometimes I ignore a safety rule or policy in order to carry out an assignment to meet the schedule.									
Construction Workers	863 (28%)	853 (28%)	284 (9%)	345 (11%)	338 (11%)	119 (4%)	233 (8%)	2.57 ± 1.53	
Foremen	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Superintendents	31 (51%)	20 (33%)	3 (5%)	0 (0%)	3 (5%)	1 (2%)	3 (5%)	1.74 ± 1.13	
Executives	5 (29%)	10 (59%)	0 (0%)	1 (6%)	0 (0%)	1 (6%)	0 (0%)	2.06 ± 1.25	

(Cont'd)									
I always report safety hazards that I see.									
Construction Workers	80 (3%)	122 (4%)	162 (5%)	447 (15%)	1,203 (40%)	815 (27%)	206 (7%)	4.77 ± 1.21	
Foremen	2 (1%)	2 (1%)	11 (8%)	22 (16%)	58 (43%)	34 (25%)	5 (4%)	4.81 ± 1.07	
Superintendents	0 (0%)	2 (3%)	3 (5%)	19 (31%)	24 (39%)	11 (18%)	2 (3%)	4.66 ± 0.96	
Executives	0 (0%)	0 (0%)	5 (29%)	5 (29%)	5 (29%)	2 (12%)	0 (0%)	4.24 ± 1.03	
I know who to report a hazard to when I see one on the job.									
Construction Workers	67 (2%)	69 (2%)	77 (3%)	230 (8%)	1,349 (44%)	1,021 (34%)	222 (7%)	5.06 ± 1.07	
Foremen	0 (0%)	1 (1%)	0 (0%)	15 (11%)	65 (49%)	48 (36%)	5 (4%)	5.23 ± 0.71	
Superintendents	0 (0%)	1 (2%)	0 (0%)	7 (11%)	28 (46%)	23 (38%)	2 (3%)	5.22 ± 0.79	
Executives	0 (0%)	0 (0%)	0 (0%)	4 (24%)	8 (47%)	5 (29%)	0 (0%)	5.06 ± 0.75	
I assist others to make sure they perform their work safely.									
Construction Workers	49 (2%)	55 (2%)	72 (2%)	426 (14%)	1,358 (45%)	845 (28%)	230 (8%)	4.97 ± 1.01	
Foremen	0 (0%)	2 (1%)	1 (1%)	13 (10%)	75 (56%)	38 (28%)	5 (4%)	5.13 ± 0.74	
Superintendents	0 (0%)	1 (2%)	1 (2%)	14 (23%)	30 (49%)	13 (21%)	2 (3%)	4.90 ± 0.82	
Executives	0 (0%)	0 (0%)	0 (0%)	7 (41%)	7 (41%)	2 (12%)	1 (6%)	4.69 ± 0.70	
Toolbox talks about safety are given regularly.									
Construction Workers	105 (3%)	106 (3%)	104 (3%)	249 (8%)	1,146 (38%)	1,086 (36%)	239 (8%)	4.96 ± 1.25	
Foremen	0 (0%)	2 (1%)	1 (1%)	7 (5%)	60 (45%)	59 (44%)	5 (4%)	5.34 ± 0.76	
Superintendents	0 (0%)	0 (0%)	2 (3%)	2 (3%)	23 (38%)	32 (52%)	2 (3%)	5.44 ± 0.73	
Executives	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (41%)	9 (53%)	1 (6%)	5.56 ± 0.51	
Toolbox talks are helpful to me.									
Construction Workers	68 (2%)	85 (3%)	127 (4%)	438 (14%)	1,168 (38%)	898 (30%)	251 (8%)	4.88 ± 1.15	
Foremen	0 (0%)	2 (1%)	1 (1%)	10 (7%)	60 (45%)	56 (42%)	5 (4%)	5.29 ± 0.77	
Superintendents	0 (0%)	0 (0%)	1 (2%)	6 (10%)	27 (44%)	25 (41%)	2 (3%)	5.29 ± 0.72	
Executives	0 (0%)	0 (0%)	0 (0%)	1 (6%)	10 (59%)	5 (29%)	1 (6%)	5.25 ± 0.58	
I believe that safety committees for the project would be very beneficial.									
Construction Workers	55 (2%)	68 (2%)	94 (3%)	473 (16%)	1,104 (36%)	1,002 (33%)	239 (8%)	4.97 ± 1.09	
Foremen	1 (1%)	2 (1%)	5 (4%)	25 (19%)	47 (35%)	48 (36%)	6 (4%)	5.02 ± 1.00	
Superintendents	1 (2%)	1 (2%)	2 (3%)	9 (15%)	31 (51%)	15 (25%)	2 (3%)	4.92 ± 0.99	
Executives	0 (0%)	0 (0%)	0 (0%)	3 (18%)	9 (53%)	5 (29%)	0 (0%)	5.12 ± 0.70	
Media attention has portrayed safety on the site accurately									
Construction Workers	143 (10%)	154 (11%)	197 (14%)	284 (20%)	296 (21%)	144 (10%)	210 (15%)	3.71 ± 1.54	
Foremen	47 (35%)	26 (19%)	14 (10%)	8 (6%)	22 (16%)	9 (7%)	8 (6%)	2.67 ± 1.74	
Superintendents	36 (59%)	11 (18%)	3 (5%)	2 (3%)	5 (8%)	3 (5%)	1 (2%)	1.97 ± 1.54	
Executives	9 (53%)	5 (29%)	1 (6%)	0 (0%)	1 (6%)	1 (6%)	0 (0%)	1.94 ± 1.48	

Note: Refer to Appendix 1-5 for mapping of question numbers corresponding to each of the 4 survey groups.

Selected highlights showing significant differences comparing responses across the 4 groups (workers, foremen, superintendents, and top management executives)

- 80% of the workers compared with 97% foremen, 99% superintendents, and 94% executives agree that safety is visible on the job or site management is doing daily safety check
- 69% of the workers compared with 94% foremen, 97% superintendents, and 94% executives agree that Perini thinks that job site safety is more important than job schedules and deadlines
- 76% of the workers compared with 94% foremen, 94% superintendents and executives agree that Perini safety personnel step in to stop unsafe operations
- 70% of the workers compared with 94% foremen, superintendents, and executives agree that Perini safety staff follows up when there is a problem- it gets fixed right away and stays that way
- 82% of the workers compared with 99% of foremen, superintendents agree that safety is important to Perini/my subcontractor-he or she mentions it often when talking to crews on site
- 51% of the workers compared with 29% foremen, 16% superintendents, and 13% executives agree that the media portrayed safety on the site accurately

## ***5-2. Psychometric Analysis***

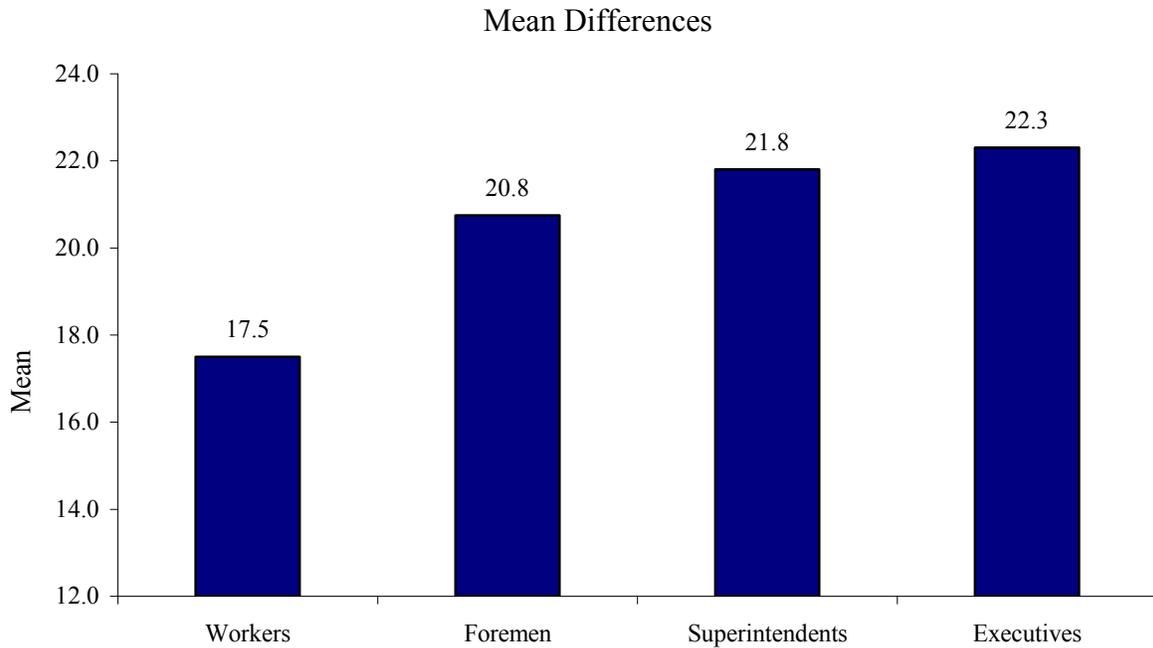
### ***5-2-a. Mean Comparisons between the Four Surveys (i.e., Responses from Four Organizational Levels)***

To compare underlying themes or factors between the four surveys (i.e., different organizational levels: workers, foremen, superintendents, or executives), the following steps were followed. First, common survey items among two or more of the four surveys were matched. Second, the correspondent factors of the above common items were identified. Thus, the number of items associated with the correspondent factor are either the same or smaller.

#### ***5-2-a1. Mean Comparisons between Workers, Foremen, Superintendents, and Executives***

Eight factors were compared between the four organizational levels. These factors were (1) Perini safety climate, (2) Perini safety program, (3) fatigue, (4) safety practices, (5) safety priority, (6) situational constraints caused by other trades, (7) toolbox talks evaluation, and (8) accuracy of media coverage. Only statistically significant results are reported in Figures 33a – 33h.

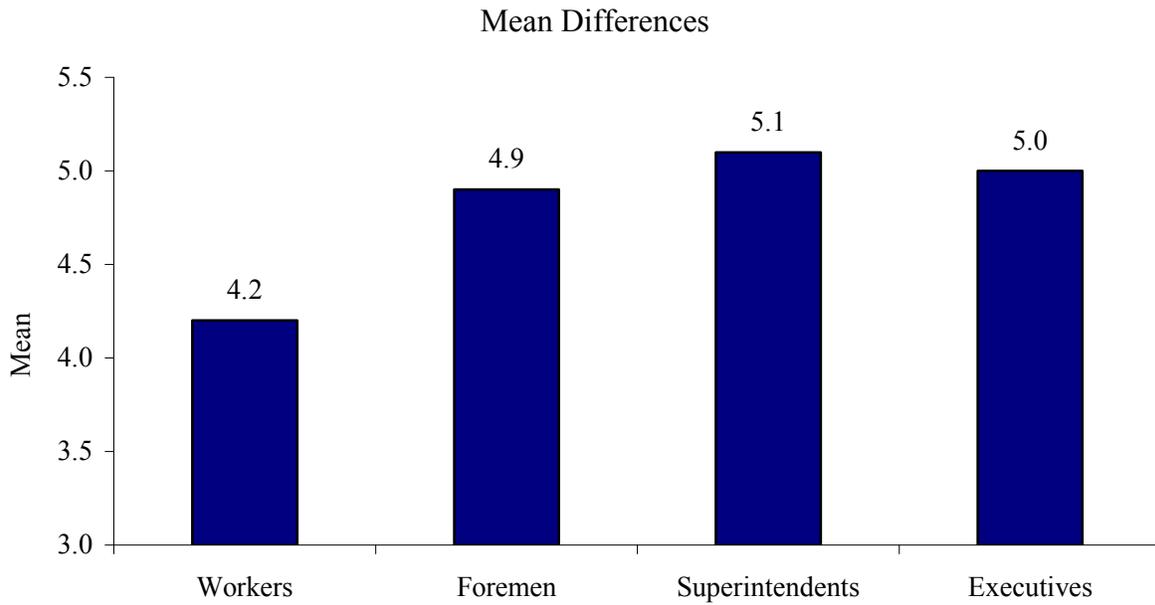
**Figure 33a. Perini Safety Climate**



<u>Organizational Level</u>	<u>Mean</u>	Workers	Foremen	Superintendents	Executives
Workers	17.5				
Foremen	20.8	x			
Superintendents	21.8	x			
Executives	22.3	x			

*Note: An "x" indicates two groups are significantly different from each other.*

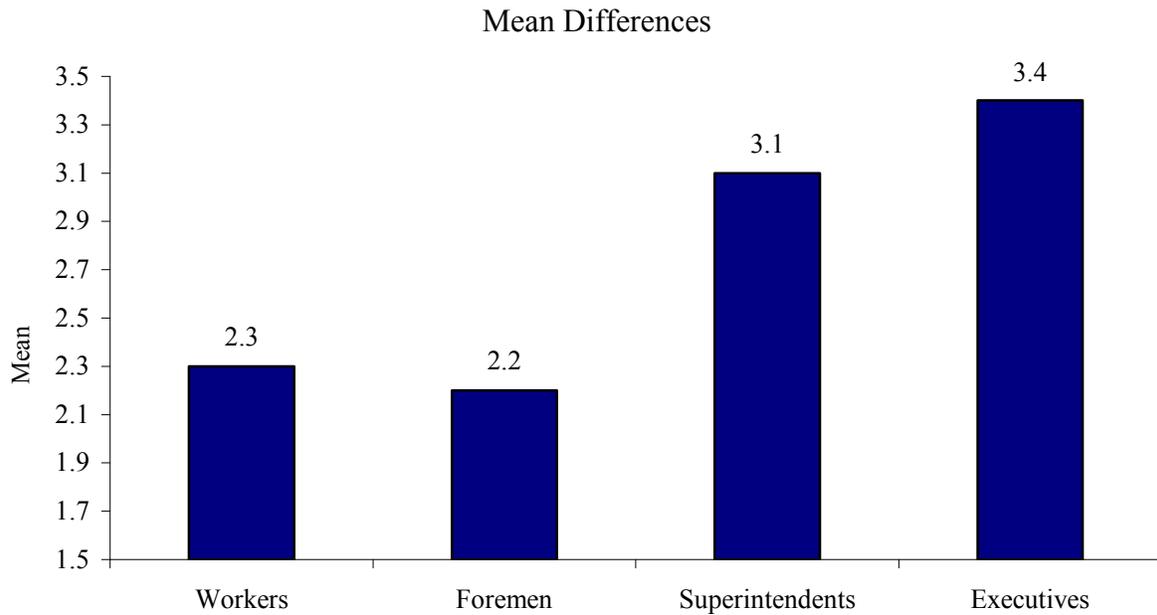
**Figure 33b. Perini Safety Program**



<u>Organizational Level</u>	<u>Mean</u>	Workers	Foremen	Superintendents	Executives
Workers	4.2				
Foremen	4.9	x			
Superintendents	5.1	x			
Executives	5.0				

*Note: An "x" indicates two groups are significantly different from each other.*

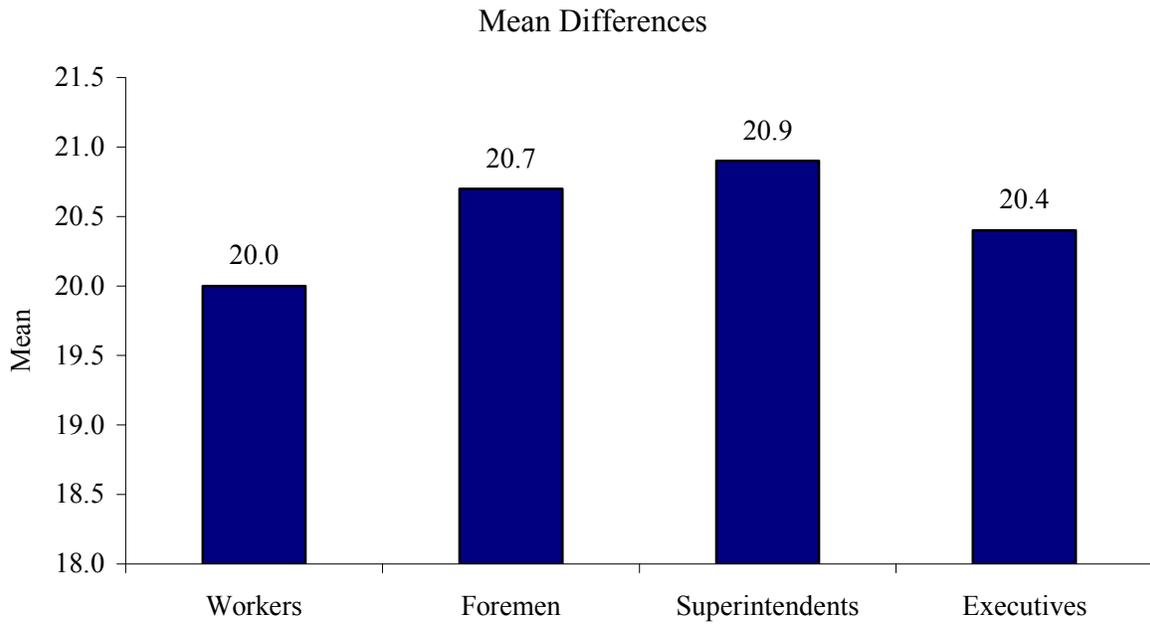
**Figure 33c. Fatigue**



<u>Organizational Level</u>	<u>Mean</u>	Workers	Foremen	Superintendents	Executives
Workers	2.3				
Foremen	2.2				
Superintendents	3.1	x	x		
Executives	3.4	x	x		

*Note: An “x” indicates two groups are significantly different from each other.*

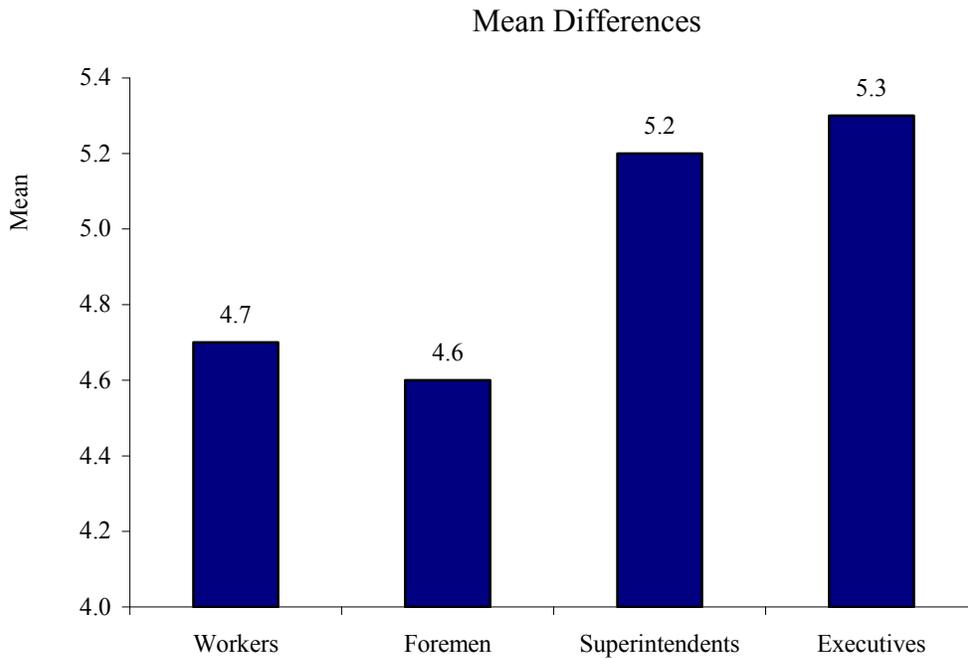
**Figure 33d. Safety Practices**



<u>Organizational Level</u>	<u>Mean</u>	Workers	Foremen	Superintendents	Executives
Workers	20.0				
Foremen	20.7	x			
Superintendents	20.9				
Executives	20.4				

*Note: An “x” indicates two groups are significantly different from each other.*

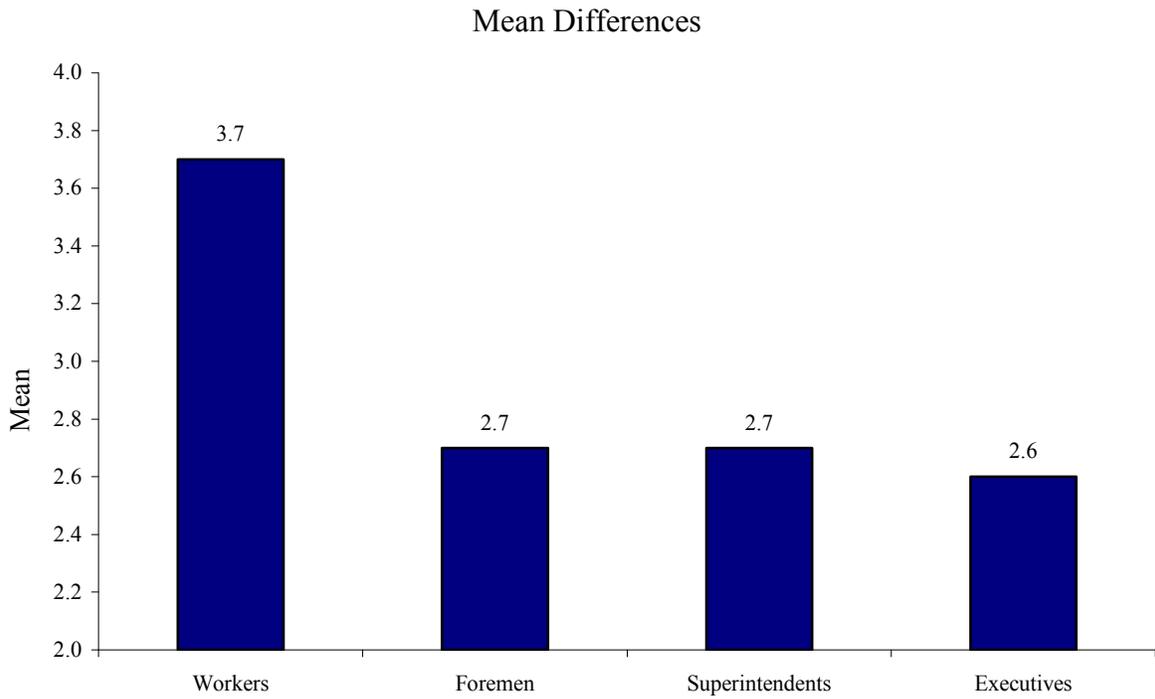
**Figure 33e. Safety Priority**



<b><u>Organizational Level</u></b>	<b><u>Mean</u></b>	Workers	Foremen	Superintendents	Executives		
Workers	4.7						
Foremen	4.6						
Superintendents	5.2					x	x
Executives	5.3						

*Note: An "x" indicates two groups are significantly different from each other.*

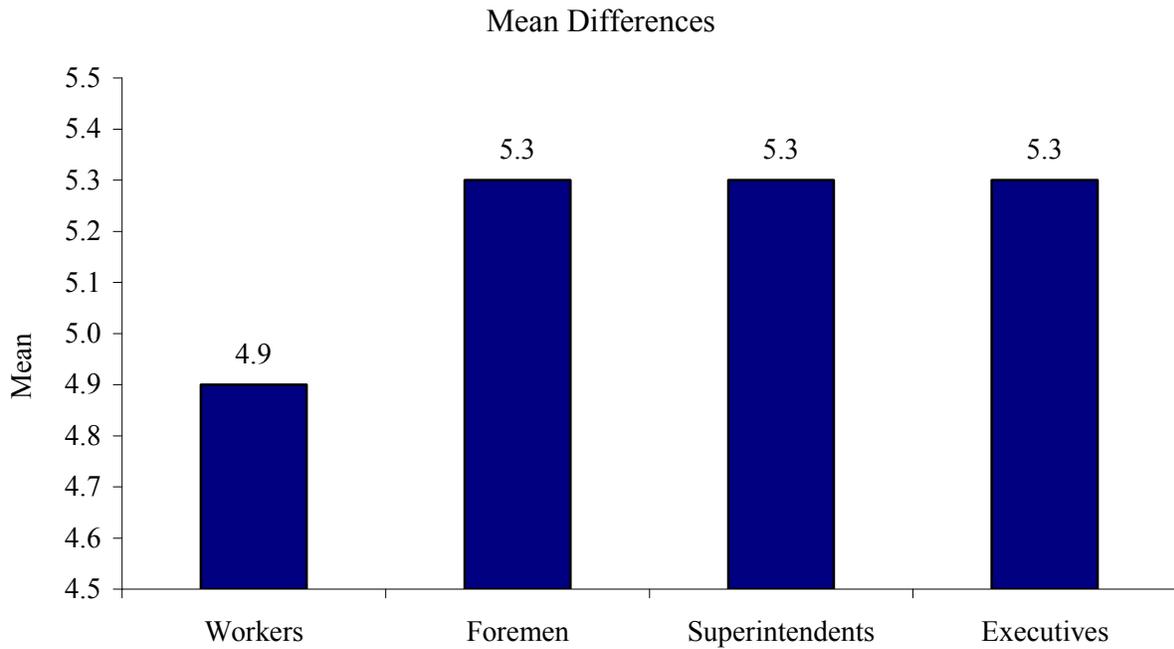
**Figure 33f. Situational Constraints Caused by Other Trades**



<u>Organizational Level</u>	<u>Mean</u>	Workers	Foremen	Superintendents	Executives
Workers	3.7				
Foremen	2.7	x			
Superintendents	2.7	x			
Executives	2.6				

*Note: An “x” indicates two groups are significantly different from each other.*

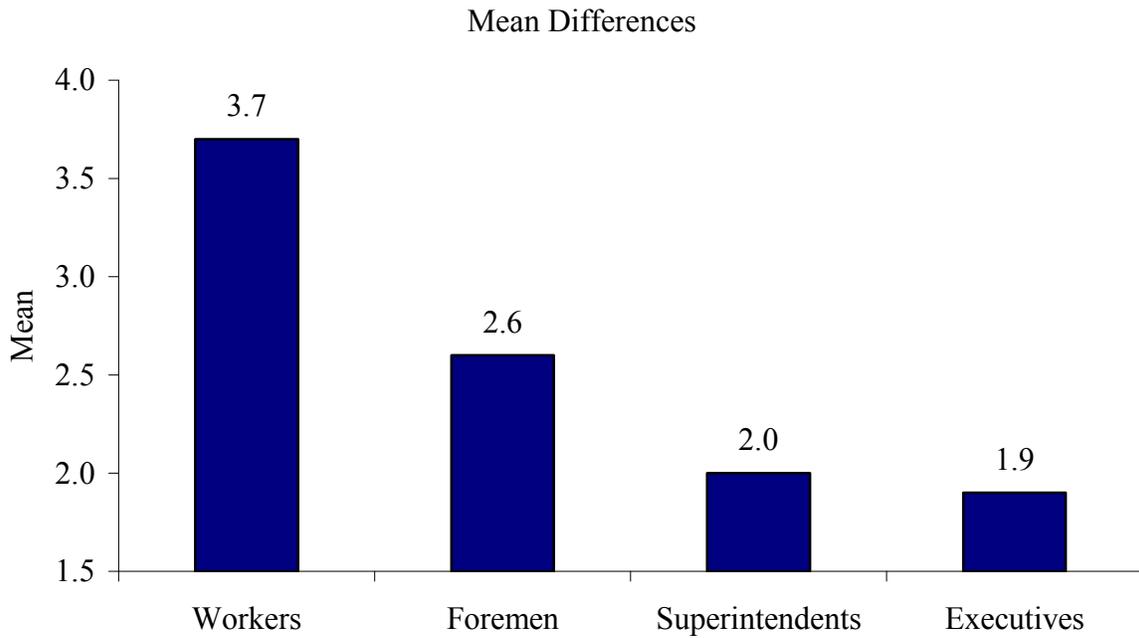
**Figure 33g. Toolbox Talks Evaluation**



<u>Organizational Level</u>	<u>Mean</u>	Workers	Foremen	Superintendents	Executives
Workers	4.9				
Foremen	5.3	x			
Superintendents	5.3	x			
Executives	5.3				

*Note: An “x” indicates two groups are significantly different from each other.*

**Figure 33h. Media Coverage**



<u>Organizational Level</u>	<u>Mean</u>	Workers	Foremen	Superintendents	Executives
Workers	3.7				
Foremen	2.6	x			
Superintendents	2.0	x			
Executives	1.9	x			

*Note: An “x” indicates two groups are significantly different from each other.*

Summary of key findings pertaining to Perini are highlighted below

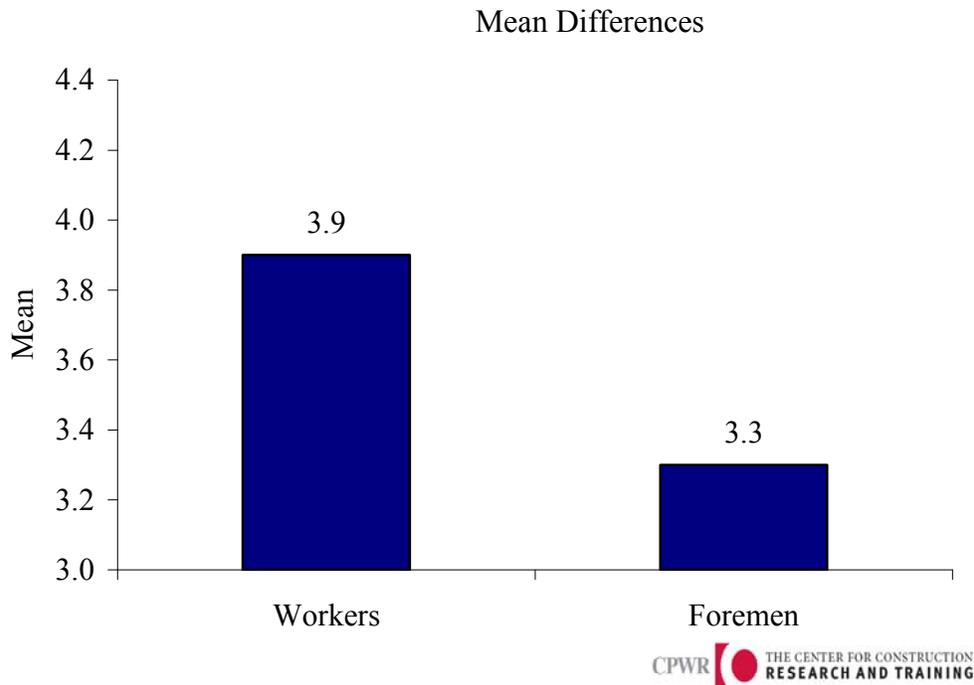
Workers overall reported less positive Perini safety climate, compared to foremen, superintendents, and executives.

- Workers overall reported less positive evaluation of Perini safety program and toolbox talks, as well as experienced more situational constraints caused by other trades, compared to foremen and superintendents. It should be noted that the mean differences between workers and executives are noticeable, although they are not significantly different due to statistical anomaly (e.g., a small sample size of executives, and/or wide standard deviations for either or both groups).
- In contrast to either superintendents or executives, both workers and foremen reported less fatigue (i.e., Fatigue is an issue for my workers – they have made mistakes on the job because they were tired). This result suggests that superintendents and executives may have attributed the causes of mistakes at work differently from workers and foremen.
- Workers overall reported less positive safety practices than foremen. It should be noted that the mean difference between workers and superintendent is noticeable, although it is not significantly different due to statistical anomaly.
- Compared to superintendents, both workers and foremen reported less positive safety priority. Again, the mean differences with executives are noticeable, although they are not significantly different due to statistical anomaly.
- Workers overall had stronger beliefs that media coverage was accurate, compared to foremen, superintendents, and executives.

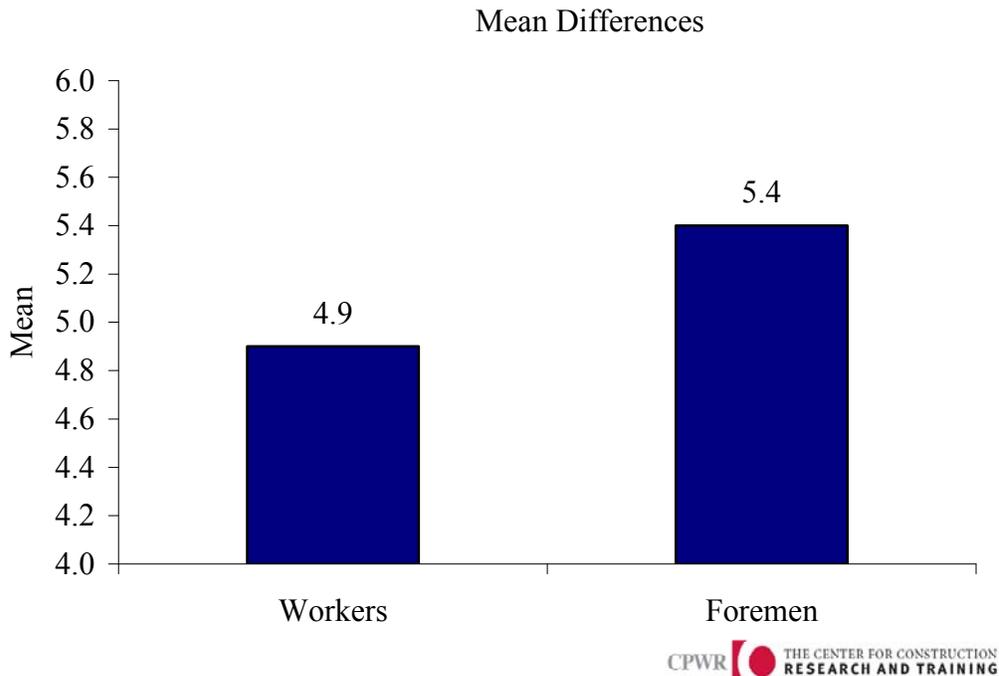
### 5-2-a2. Mean Comparisons between Workers and Foremen

Two factors were compared between the two organizational levels: workers and foremen. These factors were (1) importance of scheduling, and (2) concern for others. Significant mean differences are shown in Figures 34a and 34b.

**Figure 34a. Importance of Scheduling**



**Figure 34b. Concern for Others**



In contrast to foremen, workers expressed stronger beliefs that scheduling was important to Perini. Foremen reported significantly more concern for others' safety than workers.

***5-2-a3. Mean comparisons between foremen and superintendents***

One factor, employer safety management, was compared between the two organizational levels: foremen and superintendents. No significant mean differences were found.

***5-2-a4. Mean comparisons between superintendents and executives***

One factor, MGM safety climate, was compared between the two organizational levels: superintendents and executives. No significant mean differences were found.

***5-2-a5. Mean comparisons between workers and foremen at two job sites***

Previous findings from sections 1-2-b3 and 2-2-b1 suggested the need to examine if foremen and workers at the two job sites differ in their perceptions or experiences about safety. Thus, we investigated how Perini safety climate was perceived by foremen and workers at the two job sites. The significant results show that (1) foremen generally reported more positive Perini

safety climate than workers did, and (2) foremen in City Center reported disproportionately more positive Perini safety climate than foremen in Cosmopolitan (21.3 vs. 19.6), in comparison to workers at both job sites (17.1 vs. 17.2).

### **5-3. Predictors of Safety Performance**

To understand what factors would predict workers' safety performance, we tested several prediction models by multiple regression analyses based on three sets of data (i.e., the worker survey, the foreman survey, and the combination of superintendent and executive surveys). These empirically verified factors provide directions of future improvement.

#### **5-3-a. Prediction Models Based on the Worker Survey**

Three prediction models were examined to identify the most important predictors of safety performance as indicated by workers' safety behaviors, concern for others' safety, and their perceptions of injury risk.

- According to the first prediction model, the following factors were identified as most important in predicting an increase in **workers' safety behaviors**.
  - Positive foremen safety management (e.g., my foreman thinks that safety is more important than productivity).
  - Positive Perini safety program (e.g., Perini's safety program works well together with other subcontractor safety programs).
  - Positive perception of safety practices such as having enough personal protective equipment, as well as receiving information and training about safety.
  - Emphasis on safety as the priority.
  - Less fatigue.
  - Less time pressure.
  - Positive evaluation about toolbox talks.
  - Desire to have safety committee for the project.
- According to the second prediction model, the following factors were identified as most important in predicting an increase in **workers' concern for others' safety**.
  - Positive Perini's safety climate.
  - Positive foremen safety management.
  - Positive perception of safety practices.
  - Positive subcontractor safety programs (e.g., subcontractor's safety program works well together with other subcontractor's safety programs).
  - Emphasis on safety as the priority.
  - Less fatigue.
  - Positive evaluation of toolbox talks.
  - Desire to have safety committee for the project.
- According to the third prediction model, the following factors were identified as most important in predicting **a decrease** in **workers' perception of injury risk**.
  - Positive Perini's safety climate.
  - Positive perception of safety practices.
  - Positive subcontractor safety programs.

- Emphasis on safety as the priority.
- Positive evaluation of toolbox talks.
- Reduction of situational constraints caused by other trades.

**5-3-b. *Prediction Model Based on the Foreman Survey***

One prediction model was examined to identify the most important predictors of safety performance as indicated by workers' safety behaviors. According to the model, the following factors were identified as most important in predicting an increase in workers' safety behaviors.

- Positive Perini safety climate.
- Positive perception of safety practices.

**5-3-c. *Prediction Model Based on the Superintendent and Executive Surveys***

Because of the small sample size for both surveys, the current prediction model was conducted after combining two samples: superintendents and executives. Similarly, the goal of this analysis is to identify the most important predictors of safety performance as indicated by workers' safety behaviors. According to the model, the following factors were identified as most important in predicting an increase in workers' safety behaviors.

- Positive subcontractors' safety program.
- Positive perception of safety practices.
- Positive evaluation of toolbox talks.

## D. CONCLUSIONS & RECOMMENDATIONS

The results of the safety climate surveys reveal the factors that best predict workers' safety performance from different organizational levels. These results suggest several areas for improvement and/or management attention.

Based on the above prediction models of the four surveys, positive Perini's safety climate, Perini and subcontractor safety programs, safety practices, and foreman safety management, as well as quality toolbox talks are, overall, consistently associated with an increase of safety performance. The results also revealed that there were discrepant perceptions about safety issues between the four organizational levels, and the two job sites.

The above findings are consistent with a significant body of literature in construction and other industries recognizing the important role of organizational factors in workplace safety, such as safety climate and leadership (e.g. Zohar, 2002)<sup>5</sup>. Thus, we recommend that promoting and maintaining a positive safety climate should be a major goal of the leadership in the organizations involved in these projects. Below, we offer four recommendations with specific strategies on how to achieve this.

**Recommendation #1:** Demonstrate the organization's commitment to safety and its willingness to assume responsibility and solve safety problems in action (i.e. talk the talk, and walk the walk).

### *How to achieve this?*

- Provide workers with timely feedback for improvement, and recognition for their safety behaviors.
- Provide clearly defined organizational safety goals and policies.
- Provide adequate resources (e.g., equipment, budget) and consistently support the development and implementation of safety activities (e.g., programs, trainings).
- Develop and distribute quality toolbox talks.
- Provide frequent feedback and training of managers and workers on specific hazards and safety regulations and practices.
- Ensure cleanliness and orderliness of the work site, and the absence of hindrances to safe work practices.
- Conduct regular workplace hazard analyses to identify safety improvement opportunities.
- Routinely evaluate all operations, such as equipment, procedures, personnel selection – what valid criteria should be used to select or promote foremen, superintendents, etc., training, and work schedules, and if necessary, modify them to improve safety.
- Respond quickly and effectively, and comprehensively to correct any reported safety hazards.
- Provide detailed safety reports to all employees (e.g., injuries, near accidents).

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<sup>5</sup> Zohar, D. (2002). The effects of leadership dimensions, safety climate, and assigned priorities on minor injuries in work groups. *Journal of Organizational Behavior*, 23, 75–92.

- Consider one's safety record/behavior when promoting people.
- Consider safety when setting production speed and schedules.
- Regularly hold safety-awareness events (e.g., presentations, ceremonies).
- Give safety personnel the power they need to do their job.

**Recommendation #2:** Involve senior and middle-level management in safety.

Based on our prior research, we encourage both general contractor and subcontractors to provide training to their senior and middle-level management on proactive management skills.

***How to achieve this?***

- Senior and middle-level management need to frequently communicate to their employees and show their genuine concern for safety through their participation in day-to-day operations.
- Explicitly include safety as senior and middle-level management's responsibility and in their performance standards. Their promotion and/or merit raises should be evaluated also based on their efforts and strategies in promoting safety.
- Senior and middle-level management need to be the role model and get involved in critical safety activities (e.g., safety seminars and training, toolbox talks, safety critical operations).
- Senior and middle-level management need to promote a climate of open communication about safety issues, errors, and near-misses through a non-punitive and constructive approach to safety.
- Senior and middle-level management need to provide timely feedback and recognition to foremen on a daily basis with the goals of maintaining and improving their proactive management skills listed in Recommendation #3.

**Recommendation #3:** Encourage foremen to display positive and constructive attitudes, actions, expectations, and communications about safety.

***How to achieve this?***

- Both general contractor and subcontractors are encouraged to provide training to foremen on proactive management skills.
  - Provide immediate, constructive, and specific feedback to workers when they demonstrate poor performance;
  - Discuss with workers specifically how to improve their work while giving feedback;
  - Give employees positive recognition and praise when they demonstrate good performance;
  - Engage open communications about safety, errors, and near-misses with workers to prevent injury and accidents
- Provide training to foremen on how to design and deliver effective toolbox talks. Our previous research has shown that construction workers consider toolbox talks as the most preferred approach to disseminate safety information.
- Explicitly include safety in foremen's position responsibilities and their performance standard. Their promotion and/or merit raises should be evaluated also based on their efforts and strategies in promoting safety.

- Consider providing, at a minimum, the OSHA 30-hour training for all foremen.

**Recommendation #4:** Empower workers to become actively involved in safety.

***How to achieve this?***

- Periodically conduct anonymous short safety climate surveys or informal interviews to allow employees the opportunity to voice their opinions and provide suggestions on the current status of the safety programs.
- Establish labor/management safety committees with appropriate experience and skill who have a voice in organizational safety decisions and also have the leverage to initiate and achieve safety improvements.
- Establish a formal reporting system including weekly information and an emergency reporting system for emergent issues that need to be conveyed to all on site personnel- that is easily accessible to all employees (i.e. blast text messages). This system should allow and encourage employees to report safety problems, and should also provide timely and valuable feedback to both management and employees.

**Appendix 1 – Workplace Safety Surveys**

**Appendix 1-1. Worker version**

**Appendix 1-2. Foreman version**

**Appendix 1-3. Superintendent version**

**Appendix 1-4. Executive version**

**Appendix 1-5. Mapping of Questions across the 4 Survey Groups**

**Appendix 2 - Definitions of 16 Factors for the Worker Survey**

**Appendix 3 - Definitions of 15 factors for the Foreman Survey**

**Appendix 4 - Definitions of 13 Factors for the Superintendent Survey**

**Appendix 5 - Definitions of 12 Factors for the Executive Survey**

**Appendix 1-1. Workplace Safety Survey for Construction Workers**



**Workplace Safety Survey for Construction Workers**

**Section I: About you:**

What site do you work at? (Check ✓ only one)	<input type="checkbox"/> City Center
	<input type="checkbox"/> Cosmopolitan

What is today's date? \_\_\_\_\_

How old are you? \_\_\_\_\_ How many years have you worked in construction? \_\_\_\_\_

What is your work status? (Check ✓ only one):  Journeyman - or -  Apprentice

How many months have you worked on this job? \_\_\_\_\_

Who is your employer/subcontractor? \_\_\_\_\_

What is your trade/union? \_\_\_\_\_

Where is your home local (city and local number)? \_\_\_\_\_

*Please circle one response:* What is your race/ethnicity?

African-American    Asian    Caucasian    Hispanic    Native American    Other

*For the statements below, please put a check ( ✓ ) to indicate how much you agree or disagree with each one:*

	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
<b>Section II: About the General Contractor (Perini):</b>						
1. Safety is visible on this job – for example, I have seen safety personnel or site supervisors or site management doing daily safety checks						
2. The General Contractor (Perini) thinks that job site safety is more important than job schedules and deadlines						
3. Perini safety personnel step in to stop unsafe operations						
4. Perini thinks that safety is more important than productivity						
5. The Perini safety staff follows up when there is a problem - it gets fixed right away and stays that way						
6. Perini likes to get safety reports/feedback from workers like me						

7. Perini's safety program works well together with other subcontractor safety programs – it is clear to me who is responsible for what						
8. Perini believes that schedule is the most important issue on this project						
9. Perini cares for my safety on this job						

<b>Section III: About your employer and/or foreman:</b> Check <input checked="" type="checkbox"/> only one, either: <input type="checkbox"/> Perini or <input type="checkbox"/> Subcontractor						
10. Safety is important to Perini / my subcontractor – he or she mentions it often when talking to crews on site						
11. My foreman has the safety knowledge needed for the hazards we face on this job						
12. My foreman makes sure we follow site safety rules and procedures very closely						
13. My foreman wants us to inform him/her of any safety problems so they can get them fixed or reported to others						

<b>Section III (Cont'd):</b>	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
14. If my foreman is unsure of a safety question, he or she always calls in a safety specialist						
15. My foreman thinks that safety is more important than productivity						
16. My foreman thinks that productivity is more important than safety						
17. My subcontractor's safety program works well together with other subcontractor's safety programs						
18. My foreman stops work if working conditions are unsafe, even if we have a deadline						

<b>Section IV: About you and this job:</b>						
19. I work too many hours per week on this job						
20. Fatigue is an issue for me – I have caught myself making mistakes on the job when I was tired						
21. Doing the work safely on this job has definite priority over getting it done on schedule						
22. Sometimes I don't report a hazard because there isn't time to stop work or the work task is of too short a duration, so I work around the hazard						
23. Sometimes I can't do my job safely because other trades are in my way						

24. There is always enough personal protective equipment available to allow work to be done safely						
25. I have received enough training to do my work safely						
26. I always get enough site-specific information about a job to do it safely						
27. I know what my safety responsibilities are at work						
28. Sometimes I ignore a safety rule or policy in order to carry out an assignment to meet the schedule						
29. I always report safety hazards that I see						
30. I know who to report a hazard to when I see one on the job						
31. I assist others to make sure they perform their work safely						
32. Toolbox talks about safety are given regularly						
33. Toolbox talks are helpful to me						
34. Other workers care about my safety, and I care about theirs						
35. I believe that safety committees for the project would be very beneficial						
36. I'm confident I will not suffer a lost-time injury on my job here						
37. Media attention has portrayed safety on the site accurately						

→ Please add any additional comments about safety on this job and actions you think would improve safety:

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– *Thank you for your important feedback !!!* –

**Appendix 1-2. Workplace Safety Survey for Foremen**



**Workplace Safety Survey for Construction Foreman and General Foreman**

**Section I: About You**

What site do you work at? (Check ✓ only one)     City Center  
 Cosmopolitan

What is today's date? \_\_\_\_\_

How many years have you worked in construction? \_\_\_\_\_ How old are you? \_\_\_\_\_

How many months have you worked on this job? \_\_\_\_\_ What is your trade/union? \_\_\_\_\_

Who is your employer/subcontractor? \_\_\_\_\_

What is your work status? (Check ✓ only one):     Foreman     General Foreman

Where is your home local (city and local number)? \_\_\_\_\_

Ethnicity (circle one):    • African American    • Asian    • Caucasian    • Hispanic    • Native American    • Other

*For the statements below, please put a check ( ✓ ) to indicate how much you agree or disagree with each one:*

	Strongly Disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly agree
<b>Section II: About the General Contractor (Perini):</b>						
1. Safety is visible on this job – for example, I have seen safety personnel or site supervisors or site managers doing daily safety checks						
2. Perini thinks that job site safety is more important than schedules or deadlines						
3. Perini safety personnel step in to stop unsafe operations						
4. The Perini safety staff follows up when there is a problem – it gets fixed right away and stays that way						
5. Perini's safety program works well together with other subcontractor safety programs – it is clear to me who is responsible for what						
6. Perini believes that schedule is the most important issue on this project						
7. Perini encourages employees to talk about near misses (close calls) that occurred at work						
8. Perini cares for my safety on this site						
9. Perini policy encourages the reporting of work-related injuries and illnesses						

10. Perini regularly assesses the use of Personal Protective Equipment					
11. Perini encourages communication of safety concerns between workers and management					
12. Perini disciplines workers who do not follow safety procedures					
13. Productivity is more important than safety to Perini					
14. The General Contractor (Perini) gives employees positive feedback when they demonstrate good safety practices					

<b>Section III: About your current employer:</b>					
Check ✓ only one, either: <input type="checkbox"/> Perini or <input type="checkbox"/> Subcontractor					
15. Safety is important to my employer – he or she mentions it often when talking to me					
16. My employer makes sure I have the safety knowledge needed for the hazards we face on this job					
17. My employer makes sure we follow site safety rules and procedures very closely					
18. My employer wants us to inform him/her of any safety problems so they can get them fixed or reported to others					

**(Turn Over)**

For each of the statements below, please check ( ✓ ) to indicate how much you agree or disagree with each one:

	Strongly Disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly agree
<b>Section IV: About you and your crew:</b>						
19. If my employer is unsure of a safety question, he or she always calls in a safety specialist						
20. My employer thinks that safety is more important than productivity						
21. My employer thinks that productivity is more important than safety						
22. My employer's safety program works well together with other subcontractor's safety programs						
23. My employer supports me if I stop work because working conditions are unsafe, even if we have a deadline						
24. My employer informs me of changing safety conditions on this job site						
25. My employer gives me the responsibility I need to allow my crew to work safely						

<b>Section IV: About you and your crew:</b>						
26. My crew works too many hours per week on this job						
27. Fatigue is an issue for my workers – they have made mistakes on the job because they were tired						
28. Doing the work safely on this job has definite priority over getting it done on schedule						
29. Sometimes I don't report a hazard because there isn't time to stop work, or the work task is of too short a duration, so we work around the hazard						
30. Sometimes the crew can't do the job safely because other trades are in our way						
31. There is always enough personal protective equipment available to allow work to be done safely						
32. The workers in my crew have received enough training to do the work safely						
33. We always get enough site-specific information about a job to do it safely						
34. My workers know what their safety responsibilities are at work						
35. Sometimes I have to ignore a safety rule or policy in order to carry out an assignment to meet the schedule						
36. The workers on my crew always report safety hazards that they see						

37. The workers on my crew know who to report a hazard to when they see one on the job					
38. The workers on my crew assist others to make sure they perform their work safely					
39. Toolbox talks about safety are given regularly					
40. Toolbox talks are helpful to my workers					
41. Other workers care about my safety, and I care about theirs					
42. I believe that safety committees for the project would be very beneficial					
43. I'm confident neither my crew members nor I will suffer a lost-time injury on the job here					
44. Media attention has portrayed safety on the site accurately					

→ Please add any additional comments about safety on this job and actions you think would improve safety:

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***Thank you for your important feedback !!!***

**Appendix 1-3. Workplace Safety Survey for Superintendents**



**Workplace Safety Survey for Superintendents, Assistant Superintendents and Project Managers**

What site(s) do you work at? (Check )  City Center  
 Cosmopolitan

**Section I: About You**

What is today's date? \_\_\_\_\_

How many years have you worked in construction? \_\_\_\_\_ How old are you? \_\_\_\_\_

How many months have you worked on this job? \_\_\_\_\_

Who is your employer/subcontractor? \_\_\_\_\_

What is your work status? (Check  only one):  Superintendent  Asst. Superintendent  Project Manager

Ethnicity (circle one): • African American • Asian • Caucasian • Hispanic • Native American • Other

*For the statements below, please put a check (  ) to indicate how much you agree or disagree with each one:*

	Strongly Disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly agree
<b>Section II: About the Owner (MGM)</b>						
1. MGM thinks that job site safety is more important than job schedules and deadlines						
2. MGM has a management structure that encourages exchange of information about safety on the job						
3. MGM communicates a commitment to safety throughout this project						

<b>Section III: About the General Contractor (Perini)</b>						
4. Safety is visible on this job – for example, I have seen safety personnel or site supervisors or site managers doing daily safety checks						
5. Perini thinks that job site safety is more important than schedules or deadlines						

6. Perini safety personnel step in to stop unsafe operations					
7. The Perini safety staff follows up when there is a problem – it gets fixed right away and stays that way					
8. Perini’s safety program works well together with other subcontractor safety programs – it is clear to me who is responsible for what					
9. Perini encourages employees to talk about near misses (close calls) that occurred at work					
10. Perini policy encourages the reporting of work-related injuries or illnesses					
11. Perini regularly assesses the use of Personal Protective Equipment					
12. Perini encourages communication of safety concerns between workers and management					
13. Perini disciplines workers who do not follow safety procedures					
14. Perini considers safety performance in pre-qualifying its subcontractors					
15. Perini believes that productivity is more important than safety					
16. The General Contractor (Perini) gives employees positive feedback when they demonstrate good safety practices					
17. Perini always includes safety in the job planning process					

**(Turn Over)**

For each of the statements below, please check ( ✓ ) to indicate how much you agree or disagree with each one:

<b>Section IV: About Your Current Employer:</b>	Strongly Disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly agree
Check ✓ only one, either: <input type="checkbox"/> Perini or <input type="checkbox"/> Subcontractor						
18. Safety is important to my employer – he or she wants me to mention it often when talking with my staff						
19. My employer makes sure all management personnel have the safety knowledge needed for the hazards we face on this job						
20. My employer makes sure we follow site safety rules and procedures very closely						
21. I inform my employer of any safety problems on the jobsite						
22. My employer thinks that safety is more important than productivity						
23. My safety program works well together with other subcontractor’s safety programs						
24. My employer supports me if I stop work because working conditions are unsafe						
25. My employer gives me the responsibility I need to allow my crew to work safely						

<b>Section V: About you and this job</b>						
26. Fatigue is an issue for my workers – they have made mistakes on the job because they were tired						
27. Doing the work safely on this job has definite priority over getting it done on schedule						
28. Sometimes the crew can’t do the job safely because other trades are in our way						
29. There is always enough personal protective equipment available to allow work to be done safely						
30. My workers have received enough training to do the work safely						
31. I always make sure workers get enough site-specific information about a job to do it safely						
32. My workers know what their safety responsibilities are at work						
33. Sometimes workers have to ignore a safety rule or policy in order to carry out an assignment to meet the schedule						
34. My workers always report safety hazards that they see						
35. My workers know who to report a hazard to when they see one on the job						
36. Workers assist others to make sure they perform their work safely						

37. Toolbox talks about safety are given regularly					
38. Toolbox talks are helpful to my workers					
39. I believe that safety committees for the project would be very beneficial					
40. Media attention has portrayed safety on the site accurately					
41. My foreman and supervisors always report safety problems to me					

→ Please add any additional comments about safety on this job and actions you think would improve safety:

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***Thank you for your important feedback !!!***

**Appendix 1-4. Workplace Safety Survey for Executives**



**Workplace Safety Survey for Perini Management Executives**

What site(s) do you work at? (Check )  City Center  
 Cosmopolitan

**Section I: About You**

What is today's date? \_\_\_\_\_ How many years have you worked in construction? \_\_\_\_\_

What is the highest level of education you have completed? \_\_\_\_\_

How old are you? \_\_\_\_\_ How many months have you worked on this job? \_\_\_\_\_

Have you ever worked as a construction worker? (Check  one)  Yes  No

If yes, what trade(s)? \_\_\_\_\_

Ethnicity (circle one): • African American • Asian • Caucasian • Hispanic • Native American • Other

*For the statements below, please put a check (  ) to indicate how much you agree or disagree with each one:*

	Strongly Disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly agree
<b>Section II: About the Owner (MGM)</b>						
1. MGM thinks that job site safety is more important than job schedules and deadlines						
2. MGM has a management structure that encourages exchange of information about safety on the job						
3. MGM communicates a commitment to safety throughout this project						
4. Safety is important to MGM – they want me to mention it often when talking with my staff						
5. I inform MGM of serious safety problems on the jobsite						
6. MGM thinks that safety is more important than productivity						
7. MGM supports me if I stop work because working conditions are unsafe						

<b><i>Section III: About the General Contractor (Perini)</i></b>					
8. Safety is visible on this job – for example, I have seen safety personnel or site supervisors or site managers doing daily safety checks					
9. Perini thinks that job site safety is more important than schedules or deadlines					
10. Perini safety personnel step in to stop unsafe operations					
11. The Perini safety staff follows up when there is a problem – it gets fixed right away and stays that way					
12. Perini’s safety program works well together with other subcontractor safety programs – it is clear to me who is responsible for what					
13. Perini encourages employees to talk about near misses (close calls) that occurred at work					
14. Perini policy encourages the reporting of work-related injuries or illnesses					
15. Perini regularly assesses the use of Personal Protective Equipment					

***(Turn Over)***

For each of the statements below, please check ( ✓ ) to indicate how much you agree or disagree with each one:

<b>Section III Cont'd:</b>	Strongly Disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly agree
16. Perini encourages communication of safety concerns between workers and management						
17. Perini disciplines workers who do not follow safety procedures						
18. Perini believes that productivity is more important than safety						
19. The General Contractor (Perini) gives foremen positive feedback when they demonstrate good safety practices						
20. Perini considers safety performance in pre-qualifying its subcontractors						
21. Perini always includes safety in the job planning process						

<b>Section V: About you and this job</b>						
22. Fatigue is an issue for our employees – they have made mistakes on the job or been injured because they were tired						
23. Doing the work safely on this job has definite priority over getting it done on schedule						
24. Sometimes a crew can't do the job safely because other trades are in its way						
25. There is always enough personal protective equipment available to allow work to be done safely						
26. Our employees have received enough training to do the work safely						
27. I believe we always make sure workers get enough site-specific information about a job to do it safely						
28. I believe our employees know what their safety responsibilities are at work						
29. Sometimes employees have to ignore a safety rule or policy in order to carry out an assignment to meet the schedule						
30. I believe our employees always report safety hazards that they see						
31. I believe our employees know who to report a hazard to when they see one on the job						
32. Employees assist others to make sure they perform their work safely						
33. Toolbox talks about safety are given regularly						
34. Toolbox talks are helpful to our employees						
35. I believe that safety committees for the project would be very beneficial						

36. Media attention has portrayed safety on the site accurately						
37. Our foreman and supervisors always report safety problems						

→ Please add any additional comments about safety on this job and actions you think would improve safety:

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*Thank you for your important feedback !!!*

### Appendix 1-5. Mapping of Questions across the 4 Survey Groups

QUESTIONS IN SURVEY	Workers	Foremen	Supervisors	Top Execs
Safety is visible on this job – for example, I have seen safety personnel or site supervisors or site management doing daily safety checks.	1	1	4	8
The General Contractor (Perini) thinks that job site safety is more important than job schedules and deadlines.	2	2	5	9
Perini safety personnel step in to stop unsafe operations.	3	3	6	10
Perini thinks that safety is more important than productivity.	4	na	na	na
The Perini safety staff follows up when there is a problem - it gets fixed right away and stays that way.	6	4	7	11
Perini likes to get safety reports/feedback from workers like me.	7	na	na	na
Perini's safety program works well together with other subcontractor safety programs – it is clear to me who is responsible for what.	8	5	8	12
Perini believes that schedule is the most important issue on this project.	18	6	na	na
Perini cares for my safety on this job.	10	8	na	na
Safety is important to Perini / my subcontractor – he or she mentions it often when talking to crews on site.	11	15	18	na
My foreman has the safety knowledge needed for the hazards we face on this job.	12	16	19	na
My foreman makes sure we follow site safety rules and procedures very closely.	13	17	20	na
My foreman wants us to inform him/her of any safety problems so they can get them fixed or reported to others.	14	18	21	na
If my foreman is unsure of a safety question, he or she always calls in a safety specialist.	15	19	na	na
My foreman thinks that safety is more important than productivity.	16	20	22	na
My foreman thinks that productivity is more important than safety.	17	21	na	na

My subcontractor's safety program works well together with other subcontractor's safety programs	9	22	23	na
My foreman stops work if working conditions are unsafe, even if we have a deadline.	19	na	na	na
I work too many hours per week on this job.	20	26	na	na
Fatigue is an issue for me – I have caught myself making mistakes on the job when I was tired.	21	27	26	22
Doing the work safely on this job has definite priority over getting it done on schedule.	22	28	27	23
Sometimes I don't report a hazard because there isn't time to stop work or the work task is of too short a duration, so I work around the hazard	23	29	na	na
Sometimes I can't do my job safely because other trades are in my way.	24	30	28	24
There is always enough personal protective equipment available to allow work to be done safely.	25	31	29	25
I have received enough training to do my work safely.	26	32	30	26
I always get enough site-specific information about a job to do it safely.	27	33	31	27
I know what my safety responsibilities are at work.	28	34	32	28
Sometimes I ignore a safety rule or policy in order to carry out an assignment to meet the schedule.	29	35	33	29
I always report safety hazards that I see.	30	36	34	30
I know who to report a hazard to when I see one on the job.	31	37	35	31
I assist others to make sure they perform their work safely.	32	38	36	32
Toolbox talks about safety are given regularly.	33	39	37	33
Toolbox talks are helpful to me.	34	40	38	34
Other workers care about my safety, and I care about theirs.	35	41	na	na
I believe that safety committees for the project would be very beneficial.	36	42	39	35
I'm confident I will not suffer a lost-time injury on my job here.	37	43	na	na

Media attention has portrayed safety on the site accurately	38	44	40	36
Perini regularly assess the use of Personal Protective Equipment	na	10	11	15
Perini encourages communication of safety concerns between workers and management	na	11	12	16
Perini disciplines workers who do not follow safety procedures	na	12	13	17
Productivity is more important than safety to Perini	na	13	15	18
The General Contractor (Perini) gives employees positive feedback when they demonstrate good safety practices	na	14	16	19
My employer supports me if I stop work because working conditions are unsafe, even if we have a deadline	na	23	24	
My employer informs me of changing safety conditions on this job site	na	24		
My employer gives me the responsibility I need to allow my crew to work safely	na	25	25	
MGM thinks that job site safety is more important than job schedules and deadlines	na	na	1	1
MGM has a management structure that encourages exchange of information about safety on the job	na	na	2	2
MGM communicates a commitment to safety throughout this project	na	na	3	3
Perini encourages employees to talk about near misses (close calls) that occurred at work	na	7	9	13
Perini policy encourages the reporting of work-related injuries or illnesses	na	9	10	14
Perini considers safety performance in pre-qualifying its subcontractors	na	na	14	20
Perini always includes safety in the job planning process	na	na	17	21
My foreman and supervisors always report safety problems to me	na	na	41	37
Safety is important to my employer (MGM) – he or she wants me to mention it often when talking with my staff	na	na	na	4
I inform MGM of serious safety problems on the jobsite	na	na	na	5

MGM thinks that safety is more important than productivity	na	na	na	6
MGM supports me if I stop work because working conditions are unsafe	na	na	na	7

## Appendix 2 - Definitions of 16 Factors for the Worker Survey

1. **Perini Safety Climate:** Perceptions of Perini's safety practices and commitment to safety.
2. **Foreman Safety Management:** Perceptions of foreman safety management skills and knowledge.
3. **Safety Behaviors:** Workers' safety behaviors.
4. **Safety Practices:** Perceptions of general job site safety practices (e.g., availability of protective equipment and safety information and training).
5. **Fatigue:** Perceptions of fatigue and amount of hours worked.
6. **Unsafe work due to time pressure:** Workers' unsafe behavior due to time pressures.
7. **Perini Safety Program:** Perceived quality of Perini safety program.
8. **Subcontractor Safety Program:** Perceived quality of subcontractor's safety program.
9. **Importance of Scheduling:** Perceived importance of scheduling to Perini.
10. **Safety Priority:** Perceptions of safety as a priority over scheduled production.
11. **Situational Constraints Caused by Other Trades:** Perceptions of work disruption caused by other trades.
12. **Toolbox Talks Evaluation:** Perceptions of the effectiveness of toolbox talks.
13. **Concern for Others:** Feelings of concern for other's safety.
14. **Perceived Need for Safety Committee:** Perceptions of the benefit of having safety committees.
15. **Injury Risk Perception:** Perceptions of the risk of suffering lost-time injuries.
16. **Media Coverage:** Perceptions of the accuracy of media coverage about safety on the job site.

### Appendix 3 - Definitions of 15 Factors for the Foreman Survey

1. **Perini Safety Climate:** Perceptions of Perini's safety practices and commitment to safety.
2. **Employer Safety Management:** Perceptions of employer safety management skills and knowledge.
3. **Safety Behaviors:** Workers' safety behaviors.
4. **Safety Practices:** Perceptions of general job site safety practices (e.g., availability of protective equipment and safety information and training).
5. **Fatigue:** Perceptions of workers' fatigue and amount of hours worked.
6. **Unsafe work due to time pressure:** Foremen unsafe behavior due to time pressures.
7. **Perini Safety Program:** Perceived quality of Perini safety program.
8. **Importance of Scheduling:** Perceived importance of scheduling to Perini.
9. **Safety Priority:** Perceptions of safety as a priority over scheduled production.
10. **Situational Constraints Caused by Other Trades:** Perceptions of work disruption caused by other trades.
11. **Toolbox Talks Evaluation:** Perceptions of the effectiveness of toolbox talks.
12. **Concern for Others:** Feelings of concern for other's safety.
13. **Perceived Need for Safety Committee:** Perceptions of the benefit of having safety committees.
14. **Injury Risk Perception:** Perceptions of the risk of suffering lost-time injuries.
15. **Media Coverage:** Perceptions of the accuracy of media coverage about safety on the job site.

## Appendix 4 - Definitions of 13 Factors for the Superintendent Survey

1. **Perini Safety Climate:** Perceptions of Perini's safety practices and commitment to safety.
2. **Employer Safety Management:** Perceptions of employer safety management skills and knowledge.
3. **Safety Behaviors:** Workers' safety behaviors.
4. **Safety Practices:** Perceptions of general job site safety practices (e.g., availability of protective equipment and safety information and training).
5. **Fatigue:** Perceptions of workers' fatigue.
6. **Unsafe work due to time pressure:** Workers' unsafe behavior due to time pressures.
7. **Perini Safety Program:** Perceived quality of Perini safety program.
8. **Safety Priority:** Perceptions of safety as a priority over scheduled production.
9. **Situational Constraints Caused by Other Trades:** Perceptions of work disruption caused by other trades.
10. **Toolbox Talks Evaluation:** Perceptions of the effectiveness of toolbox talks.
11. **Perceived Need for Safety Committee:** Perceptions of the benefit of having safety committees.
12. **Media Coverage:** Perceptions of the accuracy of media coverage about safety on the job site.
13. **MGM Safety Climate:** Perceptions of MGM's safety practices and commitment to safety.

## Appendix 5 - Definitions of 12 Factors for the Executive Survey

1. **Perini Safety Climate:** Perceptions of Perini's safety practices and commitment to safety.
2. **Safety Behaviors:** Workers' safety behaviors.
3. **Safety Practices:** Perceptions of general job site safety practices (e.g., availability of protective equipment and safety information and training).
4. **Fatigue:** Perceptions of workers' fatigue.
5. **Unsafe work due to time pressure:** Workers' unsafe behavior due to time pressures.
6. **Perini Safety Program:** Perceived quality of Perini safety program.
7. **Safety Priority:** Perceptions of safety as a priority over scheduled production.
8. **Situational Constraints Caused by Other Trades:** Perceptions of work disruption caused by other trades.
9. **Toolbox Talks Evaluation:** Perceptions of the effectiveness of toolbox talks.
10. **Perceived Need for Safety Committee:** Perceptions of the benefit of having safety committees.
11. **Media Coverage:** Perceptions of the accuracy of media coverage about safety on the job site.
12. **MGM Safety Climate:** Perceptions of MGM's safety practices and commitment to safety.

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