

Final Report

NIOSH/CDC - 7 R01 CCR317873-01

Intervention Studies for Construction Safety and Health by

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New England Project Final Report

I. Background

In the fall of 1996, 22 small (10 to 50 full-time-equivalent carpenters) union carpentry firms were recruited for a prospective controlled injury intervention trial. The intervention was a company wide health and safety plan, consisting of a few simple steps:

1. Each worksite shall have a safety notebook.
2. This notebook shall have a plan for safety on the site.
3. The notebook shall include a section on materials safety data sheets.
4. The notebook will contain the records of weekly safety meetings at each site.
5. Each site will have a designated competent person.

The goal of this program was to prove that an intervention in management level dedication to safety could improve safety practice and injury rates for construction workers, who suffer one of the highest rates of work-related injuries of any work group in America. This size of firm was chosen because the firms could be expected not to have a full-time safety official of their own.

The protocol was:

1. to implement the company wide safety plan.
2. follow up the plan with a visit to a site for each study company every two months.
3. to see whether the plan was present and implemented on each site visited.
4. to measure the work practice safety on each site by measuring sentinel events on the site - hard hat use, eye protection use, hearing protection use, ground fault protection and fall protection.
5. measure other relevant variables about the worksites - size, presence of serious hazards, OSHA training of foremen, location.
6. to report any serious hazard to someone locally in charge.
7. to collect OSHA 200 injury logs, carpenters hours worked, and Insurance Experience Modification Ratios (EMRs) for each company.

In addition, questionnaires were collected at a sample of sites from workers and foremen, on safety at the companies. The goal of the questionnaires was to determine whether the personnel working for the company knew there was a safety plan. The questionnaires were discontinued in the final year of the study, as it was felt that by then the implementation of the project had to be complete.

The protocol called for frequent meetings and phone calls with the company officials; these proved impossible to achieve, and were replaced with follow-up mailings to the contractors concerning what had been seen at the sites.

The original methodology for controlling the intervention was to recruit 50 similar firms to those in the study. The 50 firms would submit their OSHA 200 logs, hours worked and EMRs, so that a control measure was available for the most important outcome - injury rates, but not for safety practice. It proved impossible to recruit these firms, so the methodology was changed to controlling for safety practice. Carpentry worksites were visited and the same measurements taken as at the study group worksites, on the same dates and in the same cities as the study group worksite visits. Injury rates were not collected for these control firms.

During the final months of the project, an interview process was instituted with union stewards, to determine the effects of the program on both the study group companies and on the general workforce. These interviews were hoped to be useful for describing and explaining the success of the intervention.

II. Data

558 site visits were performed in New England. This data set is by far the most useful measured outcome of the program. Table 1 describes the visits, by state, study/control /non-union, and calendar year. Table 3 shows the averages by company.

The injury data proved much harder to get than was expected. 20 of the 21 firms that remained in business for the length of the study provided baseline (1996) data. In succeeding years the data was collected from 16 of the 21. The remaining companies were simply not cooperative in providing OSHA 200 logs, hours worked and EMRs. There was no coercion possible. In addition, there were differences in the reporting: some hours worked included non-carpenters, and some came from the union and others from the company. Union hours varied from one report to another. Some injury logs did not classify injuries by trade. Table 2 shows the data.

Workers' questionnaires were collected from 95 workers. Foreman's questionnaires were collected from 60 foremen. Sixty stewards were interviewed.

III. Results

The results must be divided by type of measurement - safety practice, injury rates, and the perceptions measured - of workers, foremen and stewards. Since the safety practice turned out to be the most important part of the data, the bulk of the analysis will be devoted to it.

A. Results of the Worksite Visits

Table 1 shows the outline of the data collected. There were 558 site visits, of which 407 were performed by a single observer. Inter-observer variability proved important on most questions. Appendix 1 shows the instrument used for the worksite visits.

Figure 1 shows the most important single result. The study group use of hardhats increased each year of the study, from 58.0% in 1997 to 84.9% in 2000. The 95% confidence interval on the mean for 1997 excludes the other years; the same is true for 2000. The averages are calculated as follows: the percent hardhat usage at each site is measured, and then the average of the site averages is calculated. In this way large sites do not dominate the measurement, which would be the case if an average of all the carpenters working for the study group contractors were taken. The average used is called the site average. The control group did not change significantly over time in 1998 to 2000, going from 69.0% in 1998 to 82.5% in 1999 to 76.9% in 2000. For hardhat use, all observers had similar averages and thus the result is for all observers.

Eye protection is shown in Figure 2. Only the observations made by the main observer are considered, as different observers differed on whether eye protection was necessary. Refer to the worksite checklist in Appendix 1 to see the difference between this question and the hardhat question. Eye protection also increased among the study group contractors, from 44.9% in 1998 to 53.1% in 2000. The main observer only performed 5 observations in 1997. The results are not statistically significant, but the trend is the same as for hardhat usage. Simultaneously, the control group usage dropped from 51.0% in 1998 to 48.2% in 2000.

Hearing protection was properly used by even one worker on only 27 of the sites, and so the number of observations is too small to say anything useful about trends. Another 77 sites required hearing protection in the opinion of the observers, and did not have it. The overall observation, that 22.3 of the workers who needed hearing protection were wearing it, is worth reporting. The site average was 21.2%, and only 26.0% of the sites at which hearing protection was needed had any at all.

At the opposite extreme is ground fault circuit protection. Here the measurement was taken for the whole site - properly protected or not. No equipment was used, simply an eye observation of ground fault protection was made. The results were too strong to show trends - 89.8% of sites appeared to have ground fault protection - 334 sites were judged to have GFCI and 38 were not. There was no pattern over time.

Fall protection was measured like ground fault protection, for the whole site. In practice, this resulted in counting any site where a worker for the subcontractor being observed was exposed to improper fall protection being counted as a "no". There were 82 no answers - 82 sites on which there was at least one worker exposed to improper fall protection. There were 199 yes answers - sites for which there were workers at elevation, all of whom were properly fall protected. The remainder of the sites involved no exposures to heights. As in all other questions except hardhat use, the judgement necessary led to inter-observer differences. For the 189 fall protection observations by the main observer, figure 3 graphs the results for study and control groups for percentage of sites properly fall protected by year. As in hardhat usage and eye protection usage, the study group went up in fall protection usage while the control group showed an up-then-down pattern. Study group fall protection rose from 64.5% in 1998 to 81.6% in 1999 and 81.3% in 2000, while control group fall protection went from 72.7% in 1998 to 83.3% in 1999 to 78.9% in 2000. While the numbers are not statistically significant, they do show an improvement by the study group that follows the pattern.

B. Injury Rate Results

The overriding goal of the project was to prove that injury rates could be lowered by management dedication to safety. Unfortunately, the success or failure of this goal cannot be shown from the data collected.

It proved impossible to collect the data from all of the contractors. Small construction contractors are incredibly hard-working people. Providing us with this data proved to be a low priority for many of them. We put extra personnel on this data collection, with the result that we were able to obtain the data from about half of the recalcitrant contractors. As of this writing, only 16 of the 21 contractors have provided us with the data, and not all of that data is comparable.

The injury rate results that we do have are shown in table 2. Figure 4 shows the lost time injury rate results over time. Figure 5 shows the EMR results over time.

C. Foreman, Worker and Steward Questionnaires

The foreman, worker and steward questionnaires were analyzed by coworkers. Separate reports are attached on their results, in Appendices 3, 4 & 5.

IV. Discussion

A. Safety Practice Over Time

The safety practice of the study group contractors improved over time. To restate this, the project was a success in improving safety practice among the study group contractors. Figures 1, 2, and 3 show this success for hardhat use, eye protection use, and fall protection use.

The controls show that this improvement was not due to a secular trend. Between the data and the interviews with workers, foremen and stewards, we have come to believe that the improvement in safety practice was due to the following factors:

1. Buy-in by the company management to the idea that safety could and should be improved, around the time of the start of the program. The implementation of the study safety program was a part of this buy-in. Most of the contractors decided to improve their dedication to safety. Analysis of the individual contractors (Appendix 2) show that not all of them changed their practice over the course of the study, and it is possible that some were already moving in the direction of improved safety practice.
2. Frequent site visits and follow-up contact with the companies. The interviews showed that the workers believed that these site visits were the intervention, and there is no way to show that this was not the case. In combination with the already heightened attention of the management these site visits proved as important as (or more important than) the initiation of the written safety program.

In order for the overall average safety of the 21 contractors to have improved, most of the individual contractors safety practice had to have improved. This was, in fact, the case, as is shown by the reports to the individual contractors (Appendix 2) and by the statistical analysis of Dr. Waddoups (Appendix 3).

B. Injury Rates Over Time

The initial goal of the study was to gather OSHA 200 injury report logs, carpenter hours worked, and insurance experience modification ratio (EMR), and calculate injury rate and lost-time injury rate for each company for each year. Then the EMR and injury rates would be compared to safety practice.

Figure 4 shows the lost time injury rate result over time. On first glance this figure is quite impressive - showing a decline in lost time injury rate of almost 50% from the first year to the average of the other three.

Unfortunately, the EMR and injury rate data are not sufficient to be certain of a real drop in injuries. The data is not as useful as it could be because:

1. Five companies have not reported their OSHA 200 logs, and four have not sent their EMR for all four years. This leaves 16 companies, too small a sample for usefulness.
2. There are problems in the reporting of the OSHA log, hours worked and EMRs:
 - A. In some of the OSHA logs, the trade of the injured worker cannot be discerned. In order to get a carpenter injury measure, one needs carpenter injuries.
 - B. In some of the reporting of the hours worked, the company reports hours for all workers not just carpenters.
 - C. Some of the hours worked are reported by the companies, and some are from union records. Union reports vary from one time to another in a few cases.
 - D. The EMR for two companies includes shop work as well as carpenter work. In all cases, the EMR includes all trades.
3. The drop in figure 4 could be an artifice - 1996 may have been an anomalously high injury year.
 - A. Sixteen firms is not enough.
 - B. The EMR (shown in figure 5) rises slightly in the years following 1996. Since the EMR is based on a three year average of insurance costs of the previous years, the injury rate before 1996 should have been lower than it was in 1996, in order for the rate to rise in 1997 and 1998. Only in 1999 did it start to fall again, as the hypothesized peak of 1996 got averaged in with the lower injury years of 1997-98. The average EMR is based on 17 firms reporting, 15 of them the same as in the injury figures.

It would be nice to think that the implementation of the safety plan at the start of 1997 led to an immediate drop in injuries, but there is not sufficient data to support this belief.

The overall injury rate is even less useful than the lost time injury rate, as some firms did not report non-lost time injuries at all, and there was less uniformity on what constituted a non-lost time injury than there was on lost time.

Finally, it is impossible to correlate the injury rate result to the safety practice result. The study group contractors are engaged in five distinct areas of work. These areas of work have considerably different safety climates both in practice and in rates. For example, formwork is a relatively dangerous area of work, and it is also an area in which safety practice is strong, while finish carpentry is an area that is relatively low-injury, and has correspondingly low safety practice rates.

Comparison of figure 4 on injury rate to the figures on safety practice (figures 1, 2, and 3) show no correlation. If it was improved safety practice that led to lower injury rates, then the injury rate should have continued downward as the safety practice went up. Of course, the injury rate data is insufficient to draw strong conclusions.

C. Correlation of Safety Practice to Other Variables

The worksite checklist included information on many other variables. The checklist is shown in Appendix 1. Among these variables are foreman's OSHA training, geography, site size, and many others. Many of these are discussed by coworkers in Appendices 3, 4 & 5. Here, the discussion is limited to those variables studied in-house at CPWR.

Safety Practice and Site Size

The relationship of hardhat use to site size is shown in figure 6. There is a correlation between site size and hardhat use - as site size increases so does hardhat use. Above a certain size, there is no further increase in use. It is not obvious to us that there is any practical significance to this knowledge - can this be used to design an intervention to improve safety? Nevertheless, it shows that the methodology of this study - to concentrate on small contractors, could be a good one. And it serves as a proxy for a conclusion reached heuristically by the observers, that overall management (project owner, construction manager) has an enormous

impact on site safety. The larger sites are more likely to be managed by firms that are conscientious about safety than are the smaller ones.

D. Injury Rates Union vs. Non-Union

Figures 7 and 8 show a comparison of union and non-union safety practice in hardhats and eye protection. While non-union sites were not a part of the study protocol, it turned out that 12 of them were visited in the last two years of the study, in a convenience sample based on proximity to study and control visits. These non-union sites were limited to three areas of work. Figure 7 shows the results of an analysis of union vs. non-union hardhat use. There were 12 observations of non-union sites - all in 1999-2000, and in the worktypes of wood framing and roofing, renovation, and interior systems only. So for comparison, 1999-2000 worksites in those worktypes were used. The results are not significant (by a t-test for the difference between independent means) due to the small number of non-union observations.

Figure 8 shows the union/non-union analysis for eye protection usage. Again, the sites were limited to 1999-2000 and wood framing, renovation and interior systems work, with the additional limitation of the observer being "Ken", due to interobserver differences on eye protection need. Again, a striking difference is shown, but is not statistically significant. Further research in this area is needed.

Table 4 shows the average site size of the sites visited over time. We believe that the pattern of safety practice shown by the control group - rising from 1998 to 1999 then falling, is dominated by this effect. But the study group continued to rise even on smaller sites.

Table 4: Site Size

Year	Avg Carpenters	Avg Site Size
1997	6.16	30.57
1998	6.84	56.55
1999	11.41	77.02
2000	7.66	55.98

Table 5: Site Size by Study/Control/Non-union and Year

Group	Year	Avg Carpenters	Avg Site Size
Control	1998	5.43	57.86
Control	1999	4.53	87.88
Control	2000	7.56	64.14
Non-Union	1999	7.5	35

Non-Union	2000	3.623	51.13
Study	1997	6.16	30.57
Study	1998	8.19	55.29
Study	1999	7.66	65.41
Study	2000	8.09	50.66

Table 5 shows the site size by year for Control, Non-Union and Study sites. As can be seen, the control sites were generally larger than the study sites.

Safety practice and type of work

Table 3 lists the areas of work that the firms are engaged in, with the number of site visits in each area. Figure 9 shows the hardhat usage by type of work for study and control contractors. In addition to these areas, a few control contractors were engaged in four other areas. The type of work has a large effect on safety practice. Part of this is due to need - floorlayers and finish carpenters simply don't need hardhats to the extent that some other areas do. But another part of it is due to culture - finish carpenters do need eye protection but have a tendency not to wear it. This complexity in the jobs done by union carpenters has led us to understand the need to control for type of work in future research - a project now underway with NIOSH on eye protection is limited to interior systems work due to the outcome of this project.

E. Explanation of the Success of the Program

The improvement in hardhat use, eye protection use and fall protection for the study group contractors over time is reasonable proof that something happened. The program was a success. We cannot say with certainty, though, that the intervention as written was the cause of the success. Roelefs and Siqueira maintain in their analysis of the steward interviews (Appendix 4) that the real intervention was the site visits and follow-up letters concerning those visits. Some combination of the contractors' health and safety program, the site visits, the letters, and other steps that the contractors may have taken is the cause of the increased safety practice among the study group contractors. Because of the control methodology it is possible to say that the study group contractors safety practice did change in ways that were not related to secular trends. In other words, concentrating on safety at the management level works to improve safety practice.

V. Conclusions

The program was a success in safety practice. Small contractors can take steps to improve the safety practice of their workers.

Injury rates could not be shown to have changed, due to the small size of the sample.

Tables

TABLE I A: VISITS TO CARPENTER WORKSITES BY YEAR AND STUDY/CONTROL GROUP STATUS

Year	Study	Control	Non-Union	Total
1997	63	none	none	63
1998	75	72	none	147
1999	80	101	4	185
2000	91	64	8	163
Total	309	237	12	558

Study: a worksite of one of the 22 union carpentry companies in the study. One company went out of business in 1997, and one company dropped out of the study in 1999.

Control: a worksite of any other union carpentry firm. This control methodology was not introduced until 1998.

Non-Union: a worksite of a non-union carpentry firm.

TABLE I B: VISITS TO CARPENTER WORKSITES BY YEAR AND STATE

Year	CT	MA	(Boston Inner)*	RI	Total
1997	14	14	[6]	35	63
1998	36	60	[26]	51	147
1999	51	65	[61]	69	185
2000	57	60	[32]	46	163
Total	158	199	[125]	201	558

There are four carpenters locals in Boston Inner: 33,40,67 and 218.

* Included in MA totals

Table 2		Company Data Reports, List of Companies by Year				
	Year	EMR	Hours	All Injuries	Lost Time Injuries	Notes
Company A	1996	1.01	55000	5	4	
Company A	1997	0.96	98230.75	8	7	hours from their office. Union shows 43782
Company A	1998	0.96	98600	1	1	hours from their office. Union shows 92064
Company A	1999	1.04	99200	2	2	hours from their office. Union shows 106134
Apparently they don't report non-lost day						
Company B	1996	0.83	73697	3	0	
Company B	1997	1	85892	8	0	hours from union records
Company B	1998	0.8	117101.5	7	0	hours from company
Company B	1999					this company dropped out of the study at this point
Company C	1996	0.76	39327.5	6	6	
Company C	1997	0.97	45084	2	1	received 9/98
Company C	1998	1.04	64157.5	4	1	received 3/10/99
Company C	1999	1.07	63312	14	5	received 1/00, all from office
Company D	1996	0.77	88082	16	8	
Company D	1997	0.89	155912	7	4	20 days lost from work
Company D	1998	0.89	69616	7	6	93 days lost from work
Company D	1999	1.05	70573	8	5	193 days away from work
Company F	1996	1.15	80847	18	7	
Company F	1997	0.92	80307.5	5	2	hours could have been 40919.5 from union logs
Company F	1998	0.89	156485	12	9	
Company F	1999	0.9	189076	18	9	received mary vogel 5/00
Company G	1996	0.79	52642	1	1	
Company G	1997	0.94	69520	7	3	from union, hours were 3283, way wrong
Company G	1998	1.09	75697	3	2	

Table 2	Year	EMR	Hours	All Injuries	Lost Time Injuries	Notes
Company G	1999	1.26	87145	2	1	
Company H	1996	1.37	134000	16	7	
Company H	1997	1.72	121259			hours from union records. 2nd report 125620
Company H	1998	2.45	87044			hours from union
Company H	1999	2.22	130266			hours from union
Company I	1996					
Company I	1996		36903			2477 was first union hours, totally wrong. This is second union hours
Company I	1998		63671			hours from union
Company I	1999		72118			hours from union
Company J	1996	1	35547.5	4	2	
Company J	1997	1	84365	17	4	hours from union. some injuries can't tell if carpenter or laborer. Proportionalized
Company J	1998	1.22	87805	11	0	hours from union
Company J	1999	1.19	39637	4	2	hours from union
Company K	1996	0.97	42515	8	5	
Company K	1997	0.78	45248	2	0	hours from office
Company K	1998	0.76	48818	3	0	all from office
Company K	1999	0.76	53803.5	5	3	all from office
Company L	1996	0.71	13512	8	1	
Company L	1997	0.73	8720	0	0	carpenters only. Received Cliff 9/98
Company L	1998	0.78	14174.5	3	2	EMR all trades, hours carpenters only, received 3/10/99
Company L	1999	0.85	12297	0	0	EMR all trades, hours carpenters only, no injuries to carps
Company M	1996	0.92	21000	1	1	
Company M	1997	0.89	22178	4	1	received 9/98, still need EMR
Company M	1998	0.89	56087	1	0	received Mary Vogel 5/00. Injury logs not by trade

Table 2	Year	EMR	Hours	All Injuries	Lost Time Injuries	Notes
Company M	1999	0.98	60153	13	5	received Mary Vogel 5/00. Injury logs not by trade
Company N	1996	0.76	34054	17	4	
Company N	1997	60097				hours from union. 2nd report 60097 1st report 29442
Company N	1998	108792				hours from union
Company N	1999	115775				hrs from union
Company O	1996	0.89	23804.5	2	1	hours from union
Company O	1997	0.95	11185	0	0	hours from union, 11130 2nd rpt. Really no injuries in 97
Company O	1998	0.95	20356	1	1	hours from union
Company O	1999	0.95	25310	1	1	hours from union
Company P	1996	0.68	21956	6	2	
Company P	1997	0.77	26320	1	1	received by Cliff 9/98
Company P	1998	0.77	60000	3	2	received Mary Vogel 5/00
Company P	1999	0.75	75000	4	1	received Mary Vogel 5/00
Company Q	1996	0.93	67096	5	4	
Company Q	1997	0.82	86682	9	0	received by Cliff, 9/98. Hrs from union 9854
Company Q	1998	0.9	25500			from letter 8/18/00. Where is rest? Hours from union 5405
Company Q	1999	1.06	49969			see 1998. Note EMR includes shop floor hours from union 20300
Company R	1996	0.85	92919	14	3	
Company R	1997	1.02	28324.5	6	1	hours from union. 24944 hours from union in later report
Company R	1998	1.27	25391	13	1	hours from union. 2nd hrs from union same
Company R	1999	1.35	25310	6	1	hours from union.. 2nd hours from union 29762
Company S	1996	0.99	81466	11	5	
Company S	1997	0.92	99782.5	4	3	hours wrong, includes carps, labs, masons. Injuries carpenters only

Table 2	Year	EMR	Hours	All Injuries	Lost Time Injuries	Notes
Company S	1998	1.13	113458	18	10	injuries carps only. Hours unclear, prob all
Company S	1999	0.91	147891	13	8	injuries carps only. Hours unclear, prob all
	1996	0.95	50000	3		this company went out of business after the 1st year
	1997	17106	0	0		hours from union, probably wrong
Company U	1996	1	9735.5			
Company U	1997	21850				hrs from union
Company U	1998	297575				hrs from union
Company U	1999	19061				hrs from union
Company V	1996	0.77	33333	6	2	
Company V	1997	0.77	26989.5	5	3	earlier had 40000 from company on carps
Company V	1998	0.75	21727.5	3	1	carps earlier from company 36448
Company V	1999	0.67	46138.5	5	0	received Mary Vogel 5/00
Company W	1996	1	24915	6	2	
Company W	1997	1	88455	8	1	hours could be 25946.5 from union records, or this from union records
Company W	1998	0	67654	12	1	hours submitted by company but from union records
Company W	1999	0	57390	9	1	hours submitted by company but from union records
Company E and Company T are control group companies, from whom this data was not collected.						

TABLE 3

Company Site Visit Averages, Type of Work

	hardhats	eye protection	hearing	gfc	fall protection	average	avg excluding	# of visits	# of	type of work
							hearing		carps.	
Company A	66.67	45.78	0	81.82	75	53.85	67.32	15	97	Interior
Company B	38.1	47.37	66.67	85.71	0	47.57	42.8	9	79	Finish
Company C	81.82	6.25	0	90	45.45	44.7	55.88	18	121	Formwork
Company D	85.44	79.82	0	72.22	71.43	61.78	77.23	20	140	Formwork
Company E	82.26	63.08	66.67	100	81.82	78.76	81.79	17	612	Interior
Company F	89.81	40.85	7.89	89.66	47.62	55.17	66.99	31	289	Interior
Company G	33.33	33.33	50	57.14	66.67	48.09	47.62	10	37	Interior
Company H	91.8	80.81	0	91.67	87.5	70.35	87.95	17	318	Wood Framing
Company I	43.48	12.82	0	100	71.43	45.54	56.93	13	50	Interior
Company J	94.25	42.36	11.43	100	76.47	64.9	78.27	19	316	Interior
Company K	58.57	45.45	0	93.33	75	54.47	68.09	20	68	Finish, Formwork, Interior, Renov. Wood Frmg
Company L	92.59	96	0	100	75	72.72	90.9	11	26	Formwork
Company M	80.51	24.14	0	80	64.29	49.79	62.24	19	156	Framing
Company N	99.2	81.75	75	100	83.33	87.86	91.07	17	175	Formwork
Company O	91.3	48.84	57.14	87.5	60	68.96	71.91	9	64	Interior
Company P	90.91	52	0	100		60.73	60.73	10	32	Formwork
Company Q	31.25	46	0	62.5	50	37.95	47.44	10	55	Finish
Company R	81.08	86.11	82.61	100	0	69.96	66.8	10	49	Formwork, Heavy Hwy.
Company S	100	76.27	0	100	100	75.25	94.07	12	65	Formwork
Company T	92.63	33.33	90.91	100	80	79.37	76.49	15	209	Interior
Company U	76.19	48.48		55.56	42.86	55.77	55.77	14	44	Formwork Heavy Hwy.
Company V	54.84	72	90.91	100		79.44	56.71	11	43	Interior
Company W	83.91	77.27	0	100	83.33	68.89	86.13	12	118	Finish, some Formwork
study	0.82	0.55	0.21	0.87	0.75	0.64	0.75	309	2351	
control	0.84	0.51	0.24	0.89	0.8	0.66	0.76	237	2343	
non-union	0.55	0.3	0	1	0.67	0.5	0.63	12	59	
union	0.83	0.56	0.22	0.88	0.77	0.65	0.76			
*Companies E and T are control group companies										
**Hard hats, eye protection, hearing protection are % of carpenters										
***gfc and fall protection are % of site										

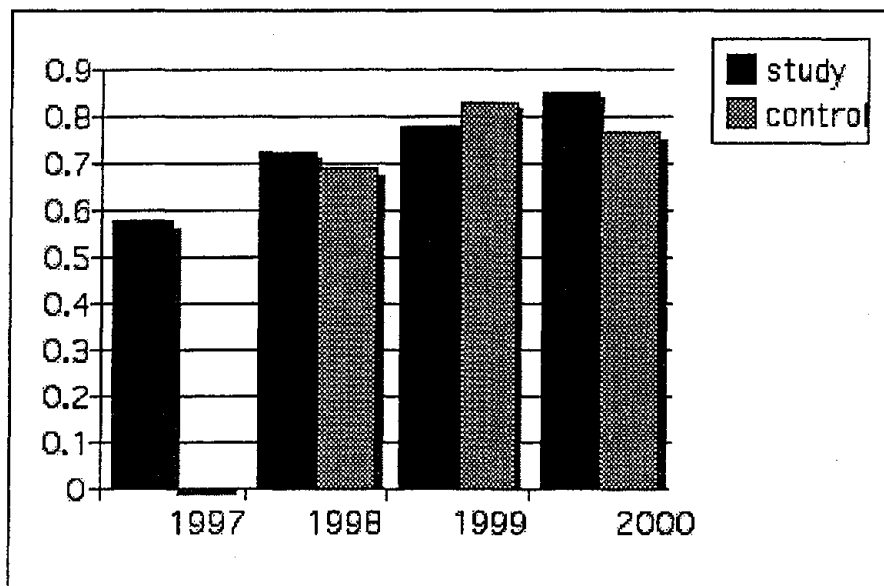
Figures

Figure 1

Injury Intervention for Small Carpentry Firms

Hardhat Usage by Year

Average of
site hardhat
use
percentages



Year

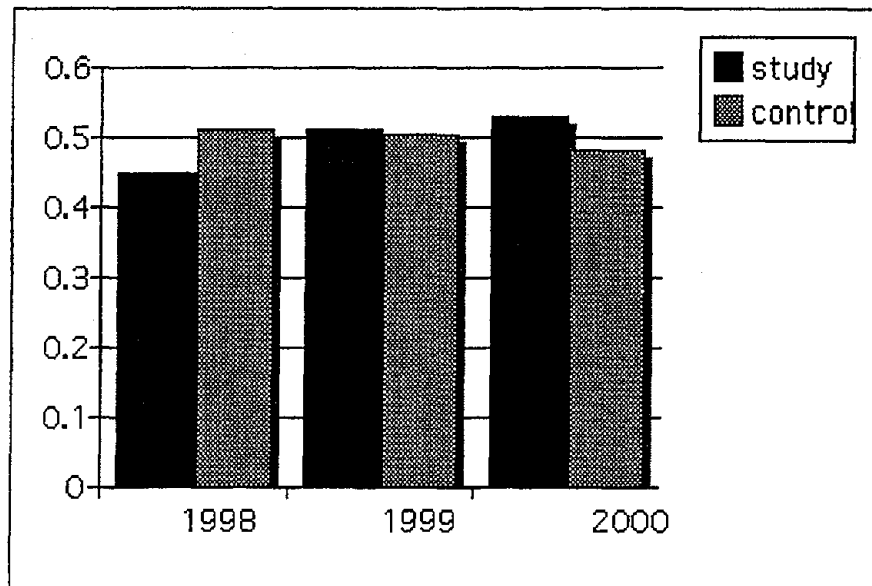
n = 63 75 72 80 101 93 62
total union sites = 546 (total workers counted = 2969)

Figure 2

Injury Intervention for Small Carpentry Firms

Eye Protection Usage by Year

Average of
site eye
compliance
percentages



Year

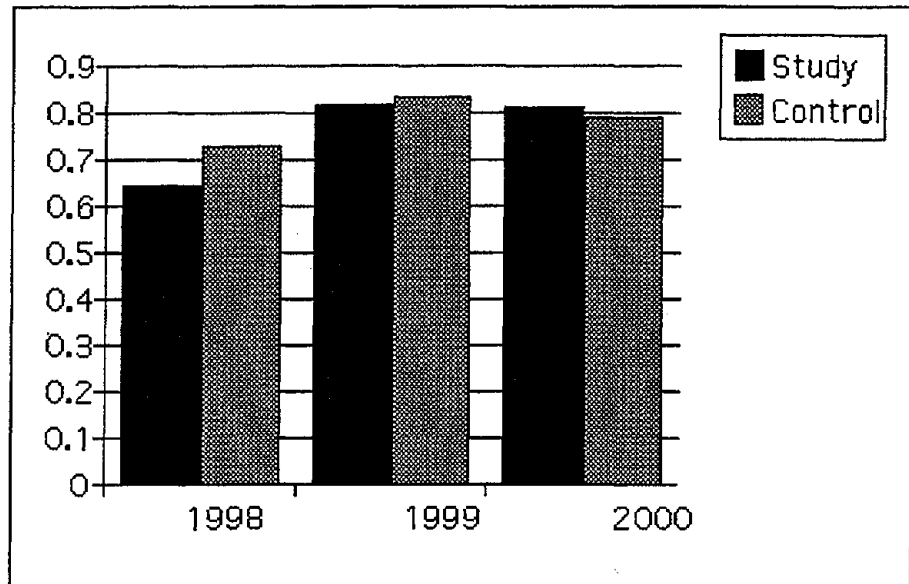
n = 60 61 64 68 84 53
98-00 union sites inspected by ken = 390 (total workers counted = 1677)

Figure 3

Injury Intervention for Small Carpentry Firms

Fall Protection by Year

Percentage of sites at which all workers were properly fall protected



Year

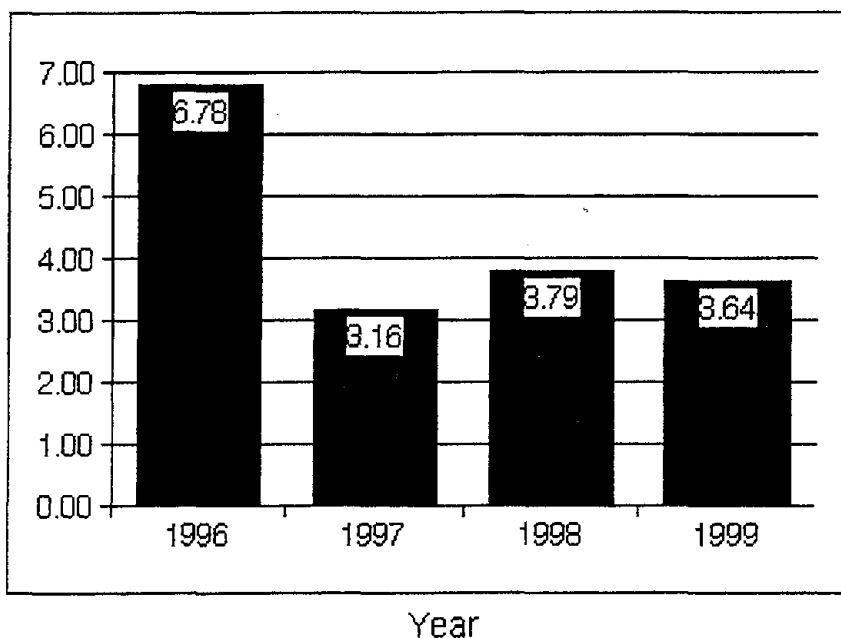
n = 31 22 38 30 48 20
total union sites observed by "ken" = 189

Figure 4

Injury Intervention for Small Carpentry Firms

Lost Time Injury Rates by Year

Lost time
injuries per
100,000
worker hours,
16 study
group firms
that supplied
data



lost time injuries =			
50	31	37	44
hours = 780,583.5	976,403.75	1,099,128	1,052,236
avg hrs per firm =			
48,785.2	61,030.9	68,695.5	65,764.8

Figure 5

Injury Intervention for Small Carpentry Firms

Insurance EMR by Year

Experience
modification
ratio, 17
study group
firms that
supplied data

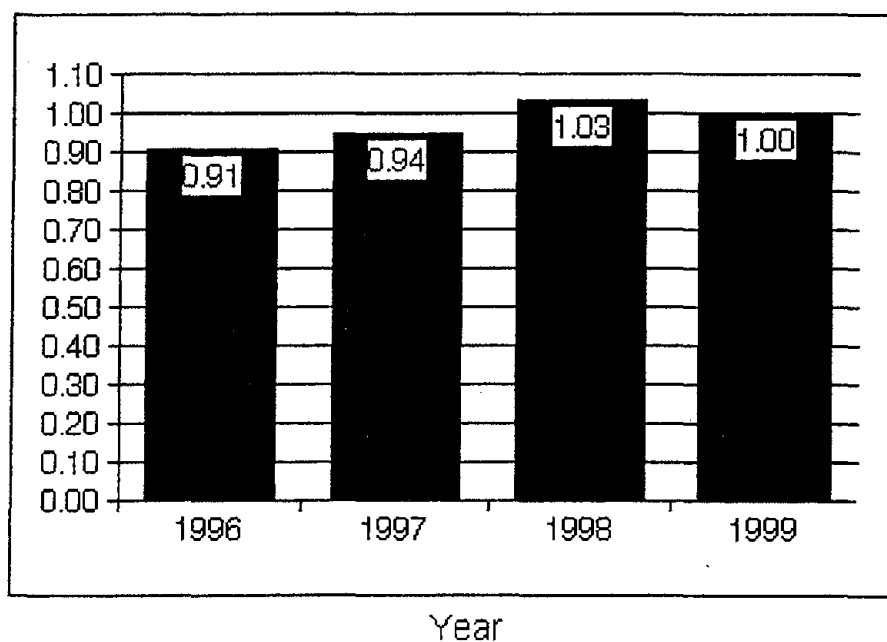


Figure 6

Injury Intervention for Small Carpentry Firms

Hardhat Usage by Site Size

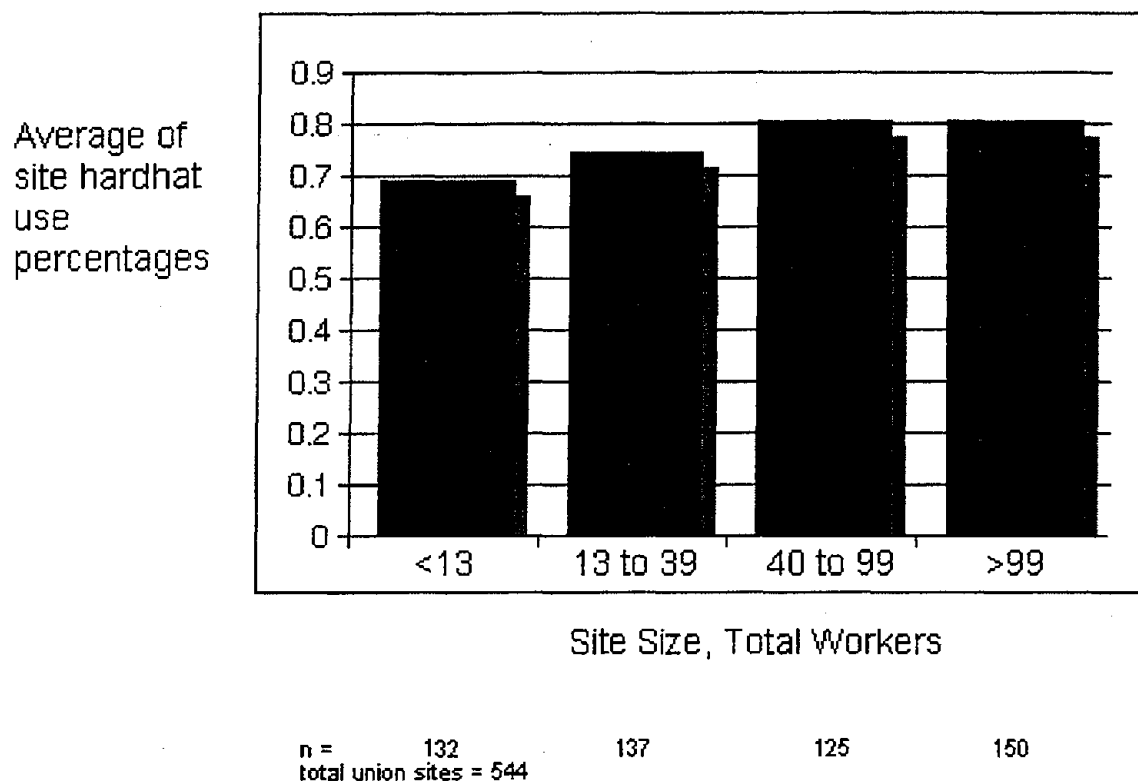
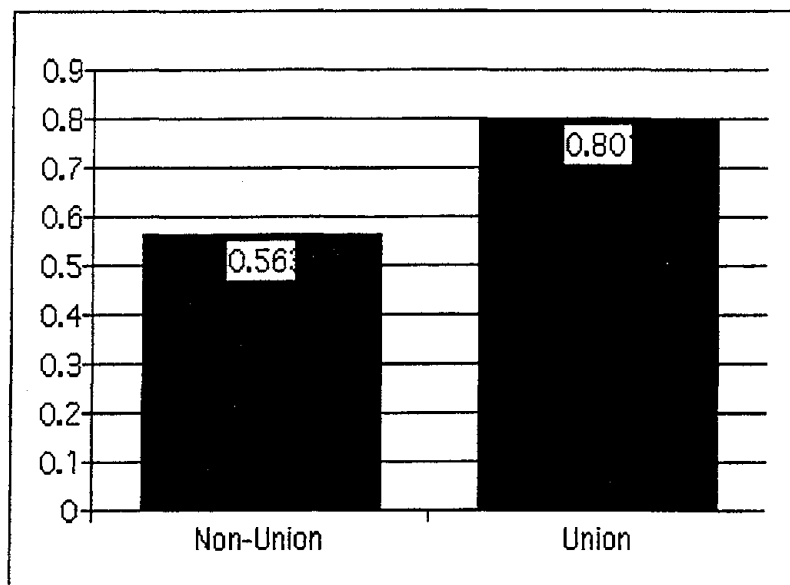


Figure 7

Injury Intervention for Small Carpentry Firms

Hardhat Usage Union/Non-Union

Average of
site hardhat
compliance
percentages
1999-2000,
wood-
framing,
renovation,
and interior



Non-union or Union Carpenters

n = 12
no. of workers 59

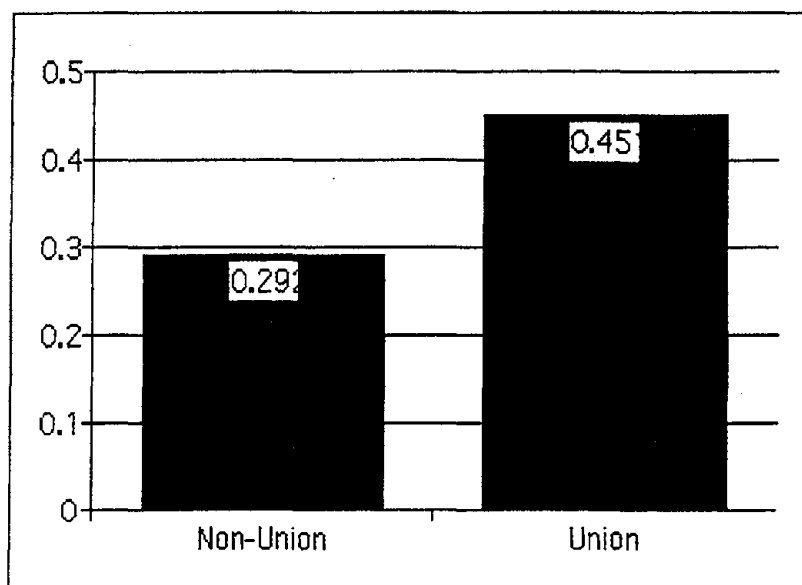
190
2226

Figure 8

Injury Intervention for Small Carpentry Firms

Eye Protection Union/Non-Union

Average of site eye protection compliance percentages 1999-2000, wood-framing, renovation, and interior



Non-union or Union Carpenters

n = 12
no. of workers 59
inspected by ken only

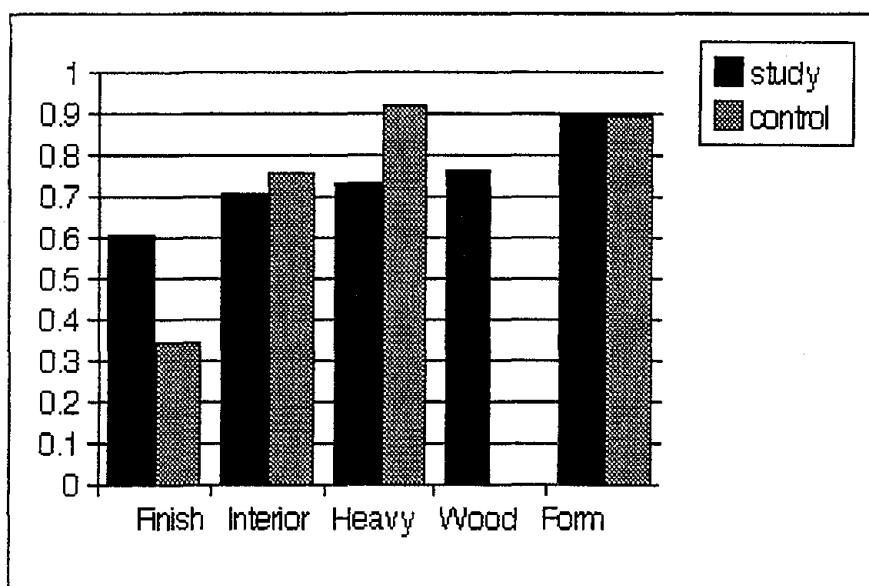
149
1674

Figure 9

Injury Intervention for Small Carpentry Firms

Hardhat Usage by Work Type

Average of
site hardhat
use
percentages



Work Type

n = 36 21 123 136 19 14 39 (5) 88 44
total union sites = 525. not shown: flooring (5) pile (4) renovation (6) scaffold (5)

Appendix 1 - Forms

Checklist for Worksites
for NIOSH/CPWR Fund Project
Inspected by _____ Date _____
Safety Plan on Site? Yes _____ No _____ Where? _____
Gen. Cont./Const. Man. _____ Owner _____

Part I: General and Safety

Contractor _____ Site _____ City, State _____

Check one: Heavy & Highway _____ Commercial _____ Residential _____

If Commercial: Formwork _____ Drywall _____ Studs _____ Wood Framing _____ Ceiling _____ Flooring _____

Roof _____ Finish _____ Doors/Windows _____ Cleanup/Punchlist _____ Foundation _____ Trim _____

Other _____

Number of carpenters present _____ Number of other workers _____

Other trades present _____

Carpenter foreman, OSHA 10 Yes _____ No _____ OSHA 30 Yes _____ No _____

Steward Local _____ OSHA 10 Yes _____ No _____ OSHA 30 Yes _____ No _____

Serious Safety and Health Problems Observed (continue on back if needed):

1) _____

Brought to attention of (who?) _____ (position) _____

2) _____

Brought to attention of (who?) _____ (position) _____

3) _____

Brought to attention of (who?) _____ (position) _____

Housekeeping _____

Your impression of safety of site _____

continue on back

Part II: Sentinels (among the Carpenters)

Hardhats: # in compliance _____ # not in compliance _____

Hardhat notes: _____

Eye protection: Required: Yes _____ No _____. # in compliance _____ # not in compliance _____

Eye protection notes: _____

Hearing protection: Required: Yes _____ No _____. # in compliance _____ # not in compliance _____

Hearing protection notes: _____

Ground fault protection hazard noted (continue on back if needed):

GF protection present Yes (type) _____ No _____

Ground fault protection notes: _____

Fall protection hazard noted (continue on back if needed):

Fall protection present Yes (type) _____ No _____

Fall protection notes: _____

Laniard/Harness _____ Safety Rails _____ Scaffolds _____ Bakers _____

Scissors Lifts _____ Basket Lifts _____ Roof Edging(Deck) _____

Other comments _____

Foreman Questionnaire

INTERVIEW QUESTIONNAIRE FOR FOREMAN

Date of Interview: _____

Site Location: _____

Contractor Name: _____

Person Completing Questionnaire: _____

1. Does the company have a written policy on safety?

yes ____ no ____ don't know ____

2. Who is responsible for safety in the company?

_____ don't know ____

3. To whom is safety responsibility delegated at the job site?

_____ don't know ____

4. Does the company give instructions to new workers on the company safety policy and requirements?

yes ____ no ____

5. Are there job safety meetings held at this job site?

yes ____ no ____

6. IF YES:

a. How often are they given?

weekly____
two times a month____
monthly____
no set meeting____
other (SPECIFY)_____

b. Who handles the meetings?

foreman____
superintendent____
union personnel____
fellow worker____
outside speaker____
other (SPECIFY)_____

c. What are the topics discussed?

safety hazards at the jobsite____
safe work practices____
OSHA regulations____
other (SPECIFY)_____

7. As far as compliance with OSHA requirements is concerned, is top management of this company insisting on:

sometimes less than meeting OSHA standards____
meeting the minimum OSHA requirements only____
meeting all the OSHA requirements____
a safety program which exceeds OSHA standards____

8. When the pressure is on, will top management permit minor trade-offs between safety and cost or safety and schedule requirements?

never____
almost never____
sometimes____
regularly____

Worker Questionnaire

Date of Interview: _____

Site Location: _____

1. Current Employer _____
2. Were you given any formal safety training? yes____ no____ (SKIP to 3)

IF YES:

- a. Were you given any of the following types of safety training?

Formal safety training through the apprenticeship program _____
Safety training sponsored by your employer _____
Safety training sponsored by the union _____
Other (PLEASE STATE) _____

- b. Did the safety training include the following:

Information on safety hazards in the construction industry _____
Instruction on specific safe work practices _____
Information on OSHA safety regulations _____
Other (PLEASE STATE) _____

3. Did you ever learn safe work practices from:

The foreman _____
More experienced workers _____
Your own experience on the job _____
Other (PLEASE STATE) _____

4. How did you learn your current occupation?

Trade school _____
Apprenticeship program _____
On-the-job experience _____
Military _____
High school vocational training _____

5. When you were hired by your present employer, were you given instructions on the safety policy and safety requirements of the company? yes _____ no _____

6. Are there regular job safety meetings at your present job site?

yes _____ no _____ (SKIP TO 7)

IF YES:

a. How frequently do you attend them?

Always _____
Often _____
Occasionally _____
Never _____

b. What are the issues addressed?

Safety hazards at the job site _____
Safe work practices _____
OSHA regulations _____
Other (PLEASE STATE) _____

7. How important do you think safety practices are to the management of your company? **PLEASE CHECK ONE ANSWER.**

Very important _____
Relatively important _____
Slightly important _____
Not at all important _____

8. How much emphasis does the union place on worker safety practices? **PLEASE CHECK ONE ANSWER.**

A great deal _____
About average _____
Very little _____
None _____

9. How much do supervisors and other top management seem to care about your safety? **PLEASE CHECK ONE ANSWER.**

They do as much as possible to make the job safe. _____

They are concerned about safety but they could do more than they are doing to make the job safe. _____

They are really only interested in getting the job done as fast as and as cheaply as possible. _____

10. How much emphasis does the foreman place on safety practices on the job? **PLEASE CHECK ONE ANSWER.**

He regularly and frequently makes us aware of dangerous work practices and conditions, and praises us for safe conduct. _____

He regularly and frequently makes us aware of dangerous work practices and conditions. _____

He occasionally points out the most dangerous work practices and conditions. _____

He seldom mentions dangers or safety practices. _____

He never mentions danger or safety practices. _____

New Contractor Info Sheet

April 2, 1998

To be filled out on the New Contractor Worksite:

Date of visit: _____

Location of visit: _____

Name of New Contractor: _____

Name of Study Group Contractor to which this visit was matched: _____

To be filled out by asking the foreman, contacting the local, or using our lists:

Address of New Contractor: _____

Name of Contact at Contractor: _____

Office phone number of Contact: _____

Field phone number(s) of Contact - pager, mobile phone, etc. _____

Worker Questionnaire Handout

Dear Brother Carpenter:

Thank you for taking the time to help with the worker questionnaire about construction safety.

As you know, construction is dangerous work. The study you have helped with is a government funded attempt to show that construction can be made safer by helping management to pay more attention to safety. The UBC Health and Safety Fund is performing the work, in cooperation with your employer and other small contractors in New England.

Please rest assured:

***The questionnaire is anonymous.**

***Your answers on the questionnaire will be kept completely confidential.**

Please answer each question in light of the above, knowing that only staff of the UBC Health and Safety Fund will see the answers, and only anonymously. As it is your own answer we are interested in, please do not discuss the questions with your fellow workers.

If you have any further questions about the project, feel free to call:

Ken Halperin
UBC Health & Safety Fund
101 Constitution Ave., NW
Washington, DC 20001
1-202-546-6206 x349

Protocol

April 3, 1998 - replaces all previous protocols.

- 1. Worksite visits to the study group.** Each member of the study group must have a worksite visit once every two months. At that visit, fill out:
 - a. A Worksite Checklist.
 - b. Two or more Worker Questionnaires. Give each volunteer a copy of the Worker Questionnaire Handout.
 - c. The Foreman Questionnaire.
 - d. Followup letter to contractors for serious hazards- attach the Serious Health & Safety Problem Report.
- 2. Worksite visits to the control group.** On the same day as the worksite visit, visit another contractor who is doing similar work in the area, but is not a part of the study group. Fill out:
 - a. A Worksite Checklist.
 - b. A New Contractor Info Sheet.
- 3. Collecting data from the study group.** Once each year, collect the data from the members of the study group. You need to get:
 - a. the OSHA log for the previous year.
 - b. the EMR.
 - c. the total person-hours worked.
- 4. Collecting data from the control group.** Contact each control who you visited in part 2 above. If the contractor is willing to participate, collect from them:
 - a. the OSHA log for 1996, 1997, 1998, 1999 - as many as you can get.
 - b. the EMR for the same years.
 - c. the total person-hours worked (UBC carpenters) for the same years.
- 5. Contractor phone calls and Contractor visits to the study group.** After each worksite visit, send each contractor the Contractor Report which I (Ken Halperin) will give you. Follow this report up with a phone call. Use the phone call to schedule an appointment with them. When you get a phone call, fill out a Phone Contact Log. When you get a visit, fill out a Contractor Visit Report. Be persistent! Call them on their mobile phones, take them to lunch, do whatever it takes to get steps 4 and 5 done. If you have a phone contact or visit with a control group contractor, fill out the right form for them, also.
- 6. Paperwork.** Send in photocopies of whatever you have got, weekly. I will promptly enter the data and send you back various reports showing what needs to be done, as well as reports for the contractors.

Center to Protect Workers' Rights

NIOSH/UBC Health & Safety Programs Project

Worker Questionnaire Handout

Dear Brother Carpenter:

Thank you for taking the time to help with the worker questionnaire about construction safety.

As you know, construction is dangerous work. The study you have helped with is a government funded attempt to show that construction can be made safer by helping management to pay more attention to safety. The Center to Protect Workers' Rights of the AFL-CIO Building and Construction Trades Department is performing the work, in cooperation with your employer and other small contractors in New England.

Please rest assured:

***The questionnaire is anonymous.**

***Your answers on the questionnaire will be kept completely confidential.**

Please answer each question in light of the above, knowing that only staff and authorized personnel of the Center to Protect Workers' Rights will see the answers, and only anonymously. As it is your own answer we are interested in, please do not discuss the questions with your fellow workers.

If you have any further questions about the project, feel free to call:

Ken Halperin

Center to Protect Workers' Rights

111 Massachusetts Ave.

Washington, DC 20001

1-202-962-8490

users\ken\neproj\workrrf1.wpd in wordperfect format. also workerrf.txt. version of Jan. 3, 2000

UBC Health & Safety Fund
NIOSH/UBC Health & Safety Proms Project

Phone Contact Log

This form should be used in recording important information from telephone follow-up calls to participating contractors.

Contractor: _____

Individual contacted: _____

Date of contact: _____

Is the contractor generally following their new Health & Safety Program? _____

Do they tell you about any developments that they see connected to the Program? _____

Any problems or hitches in implementing the program? _____

Any successes to report? _____

Have they begun any new job(s) since the last contact? Please list them _____

Is so, have they developed a job-specific safety and health plan for that job? _____

Any other news of noterelated to this project? _____

Serious Health & Safety Problem Report

to be given to the Contractor

This form should be used to alert a contractor to serious health & safety problems found on a worksite inspection. The foreman should be alerted, if possible, at the time of the inspection, then this form is to be filled out and mailed to the contractor immediately after the inspection. A copy is to be kept for our records.

Contractor: _____

Site: _____

Date of visit: _____

Foreman: _____ Told of problems? Yes _____ No _____

Inspected by: _____

Serious Safety and Health Problems Observed:

1) _____

2) _____

3) _____

this file is superseded by wforeman.wpd.

UBC Health & Safety Fund
NIOSH/UBC Health & Safety Programs Project

Contractor Questionnaire

INTERVIEW QUESTIONNAIRE FOR SUPERINTENDENT

Date of Interview: _____

Site Location: _____

Contractor Name: _____

Person Completing Questionnaire: _____

1. Does the company have a written policy on safety?

yes ____ no ____ don't know ____

2. Who is responsible for safety in the company?

_____ don't know ____

3. To whom is safety responsibility delegated at the job site?

_____ don't know ____

4. Does the company give instructions to new workers on the company safety policy and requirements?

yes ____ no ____

5. Are there job safety meetings held at this job site?

yes ____ no ____

2

6. IF YES:

a. How often are they given?

weekly _____
 two times a month _____
 monthly _____
 no set meeting _____
 other (SPECIFY) _____

b. Who handles the meetings?

foreman _____
 superintendent _____
 union personnel _____
 fellow worker _____
 outside speaker _____
 other (SPECIFY) _____

c. What are the topics discussed?

safety hazards at the jobsite _____
 safe work practices _____
 OSHA regulations _____
 other (SPECIFY) _____

7. As far as compliance with OSHA requirements is concerned, is top management of this company insisting on:

sometimes less than meeting OSHA standards _____
 meeting the minimum OSHA requirements only _____
 meeting all the OSHA requirements _____
 a safety program which exceeds OSHA standards _____

8. When the pressure is on, will top management permit minor trade-offs between safety and cost or safety and schedule requirements?

never _____
 almost never _____
 sometimes _____
 regularly _____

Contractor Visit Report

This form should be used in recording important information from bi-monthly personal visits to participating contractors.

Contractor: _____

Individual interviewed: _____

Date of Interview: _____

Is the contractor generally following their new Health & Safety Program? _____

Are any changes or adjustments needed in the company's Health & Safety Program, based on their recent experience? _____

Do they tell you about any developments that they see connected to the Program? _____

Any problems or hitches in implementing the program? _____

Any successes to report? _____

Does the Contractor ask for any assistance as a result of their experience with this H&S Program? _____

Additional comments _____

Appendix 2 - Anonymized Report to Contractors

THE CENTER TO PROTECT WORKERS' RIGHTS

EDWARD C. SULLIVAN, PRESIDENT

December 22, 2000

Company A

Dear:

Enclosed is the final report to Company A concerning what we learned about safety practice at your company over the four years of the study. I hope this is helpful to you.

We visited 15 of your sites, and observed 97 carpenters at work. The first attachment reports everything we saw on those 15 visits. The most important things are: serious safety problems, and then the percentages of use of different safety measures - hard hats, eye protection, hearing protection, gfci, and fall protection. At the end of this report there is a section that shows your average experience over the four years. As you probably know, there is a different standard of safety practice in different areas of carpentry. For this reason, there is another attachment which measures your work in each area, which for you is Interior Systems.

Starting with serious safety problems, we observed 89 such violations total in 558 total site visits. Two of them were yours, on Aug 15, 1997 and June 16, 1998. Fall protection problems such as these are among the most serious of all problems, and I hope that they no longer occur for you.

Hard hat use averaged 83% for all union carpenters over the entire study, and averaged 82% for all interior work. At Company A, the percentage was 67%. On the face of it, this seems bad. But when you look at the second half of all visits, Company A had a hard hat percent use of 90% - above the average. Keep up the good work!

Eye protection usage when required was 46% for Company A for the whole time period, but went from 35% in the first half to 59.5% in the second half. Again, the second half number is above the average for the study - you closed the gap. And you are now above the overall average for interior work of 44.4%. You are in fact doing the best on eye protection of all the interior companies in the study. Again, keep up the good work, and make it better yet.

Your fall protection average was 75% overall, 71% before and 100% after, albeit based on very few measurements. You are right on the overall average of 77%, but you did have a few serious problems on this when I was first looking at you. Overall, interior systems work is pretty fall-safe (91%) and it looks like you are right on target now.

The other two measures are not as useful. Hearing protection was 0% for your workers throughout the study. But this is based on very few times in which it was needed but not being

Company A
Page Two

used. Overall hearing protection is used 22% of the time it is needed, with interior systems work averaging 25%. It is a tough thing for a company to emphasize, as there is no financial payback for you and the guys don't recognize the long-term hazards. But its worth considering.

Ground fault protection was only eye-balled, and so its not a great measure either - many situations could look good but not really be good. Your apparent use of gfci was 82%, compared to a union average of 88% and an interior systems average of 91%. But again, your average improved from 75% in the first half to 83% in the second half of the study.

Finally, I am not sure whether an average of all this matters, but I have made two averages, to give Company A a sort of overall score - one averaging all five measures (hard hats, eye protection, hearing protection, gfci and fall protection) and the other without hearing protection. On the overall average, Company A stood at 54% for the whole study. BUT, this is an average of 46% in the first half and 66% in the second half, an improvement of 44%. Excluding hearing protection, Company A had an overall average of 67%, going from 58% in the first half of the study to 83% in the second half. The overall average of all site visits for the whole study was 76% - so you can see that you are above average for all union carpentry firms in all lines of work in New England. The overall average for interior systems was 80% excluding hearing, and you were above that as well by the end.

Overall, the safety at Company A improved in every measure over the course of time, by 80% in hard hat compliance, 71% in eye protection compliance, and 40% in fall protection compliance. This is a record to be proud of. I wish you every success in the future both in business and in safety. Please let me know if there is anything else I can help you with. If you want a copy of our report to the government, please let me know that as well.

Thank you again for your participation in this, an important step in protecting the lives of workers.

Yours sincerely,

Ken Halperin
for CPWR

Enclosures

Worksite Checklists Finals by Type Of Work, with averages of Protective Measures

Contractor: Company A

Contractor and Type Of Work: Company A Interior

Count Of Sites: 15 **Number of Carpenters:** 97

Hardhats: Yes: 48 No: 23 **Percent Of Hardhats Yes:** 66.67%

Eye Compliance: Yes: 38 No: 45 **Percent of Eye Compliance Yes:** 45.78%

Hearing Compliance: Yes: 0 No: 8 **Percent of Hearing Compliance Yes:** 0.00%

Ground Fault Compliance: Yes: 9 No: 2 **Percent of GF Compliance Yes:** 81.82%

Fall Protection Compliance: Yes: 6 No: 2 **Percent of FP Compliance Yes:** 75.00%

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

December 22, 2000

Company B

Dear:

Enclosed is the final report to Company B concerning what we learned about safety practice at your company over the four years of the study. I hope this is helpful to you.

We visited 9 of your sites, and observed 79 carpenters at work. I am sorry you dropped out a year before the end, as we would have been able to give you more up-to-date reports. The first attachment reports everything we saw on those visits. The most important things are: serious safety problems, and then the percentages of use of different safety measures - hard hats, eye protection, hearing protection, gfci, and fall protection. At the end of this report there is a section that shows your average experience over the four years. As you probably know, there is a different standard of safety practice in different areas of carpentry. For this reason, there is another attachment which measures your work in each area, which for you is finish work.

Starting with serious safety problems, we observed 89 such violations total in 558 total site visits. One of them was yours, on April 15, 1997. Fall protection problems are among the most serious of all problems, and I hope that they no longer occur for you. A guy on the top step of a ladder can definitely cause himself harm and cost you money.

Hard hat use averaged 83% for all union carpenters over the entire study, but averaged only 56% for finish work. At Company B, the percentage was 38% - third lowest of all companies in the study. This is low even for your industry. But when you look at the second half of all visits, Company B had a hard hat percent use of 47%, compared to 30% in the first half. This is a major improvement, although it is based on very few second half visits.

Eye protection usage when required was 47% for Company B for the whole time period, but went from 60% in the first half to 23% in the second half. The overall average was 56% for union carpenters in the study, and 52% for finish.

Fall protection in the form of scaffolding and lifts was not an issue for you in the site visits we made. Only the ladder issue was important.

The other two measures are not as useful. Hearing protection was 67% for your workers throughout the study. But this is based on very few observations. Overall hearing protection is

Company B
Page Two

used 22% of the times it is needed, with finish work averaging 15%. It is a tough thing for a company to emphasize, as there is no financial payback for you and the guys don't recognize the long-term hazards. But its nice that your guys were doing a good job on hearing protection when needed, keep up the good work!

Ground fault protection was only eye-balled, and so its not a great measur either - many situations could look good but not really be good. Your apparent use of gfci e was 86%, compared to a union average of 88% and a finish average of 87%.

Finally, I am not sure whether an average of all this matters, but I have made two averages, to give a company a sort of overall score - one averaging all five measures (hard hats, eye protection, hearing protection, gfci and fall protection) and the other without hearing protection. On the overall average, Company B stood at 48% for the whole study, 4th lowest. Excluding hearing protection, Company B had an overall average of 43%, the lowest in the study. The overall average of all site visits for the whole study was 76% excluding hearing - so you can see that you are below average for all union carpentry firms in all lines of work in New England. The overall average for finish work was 46% excluding hearing.

Overall, the safety at Company B was low, even for finish carpentry. I hope that you are able to improve it over time.

I wish you every success in the future both in business and in safety. Please let me know if there is anything else I can help you with. If you want a copy of our report to the government, please let me know that as well.

Thank you again for your participation in this, an important step in protecting the lives of workers.

Yours sincerely,

Ken Halperin
for CPWR

Enclosures

Worksite Checklists Finals by Type Of Work, with averages of Protective Measures

Contractor: Company B

Contractor and Type Of Work: Company B Finish

Count Of Sites: 9 **Number of Carpenters:** 79

Hardhats: Yes: 16 No: 26 **Percent Of Hardhats Yes:** 38.10%

Eye Compliance: Yes: 18 No: 20 **Percent of Eye Compliance Yes:** 47.37%

Hearing Compliance: Yes: 6 No: 3 **Percent of Hearing Compliance Yes:** 66.67%

Ground Fault Compliance: Yes: 6 No: 1 **Percent of GF Compliance Yes:** 85.71%

Fall Protection Compliance: Yes: 0 No: 2 **Percent of FP Compliance Yes:** 0.00%

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

THE CENTER TO PROTECT WORKERS' RIGHTS

EDWARD C. SULLIVAN, PRESIDENT

December 22, 2000

Company C

Dear:

Enclosed is the final report to Company C concerning what we learned about safety practice at your company over the four years of the study. I hope this is helpful to you.

We visited 18 of your sites, and observed 121 carpenters at work. The first attachment reports everything we saw on those visits. The most important things are: serious safety problems, and then the percentages of use of different safety measures - hard hats, eye protection, hearing protection, gfci, and fall protection. At the end of this report there is a section that shows your average experience over the four years. As you probably know, there is a different standard of safety practice in different areas of carpentry. For this reason, there is another attachment which measures your work in each area, which for you in our site visits is mostly form work, although we categorized one job as finish, and may have mis-categorized a few others especially early on.

Starting with serious safety problems, we observed 89 such violations total in 558 total site visits. Six of them were yours, the third most of any company. But two of these are housekeeping, and may not have been as serious as all that. Fall protection problems such three of the other four, and trenching problems like the last one are among the most serious of all problems, and I hope that you will pay serious attention to these issues going forward.

Hard hat use averaged 83% for all union carpenters over the entire study, and averaged 92% for all form work. At Company C, the percentage was 82%. Worse yet, your hard hat percentage fell from 88% in the first half of the study to 63% in the second half! I would urge you to pay attention to hard hats, as this is among the lowest percentages of any company in the second half of the study.

Eye protection usage when required was 6% for Company C for the whole time period, by far the lowest in the study. The overall average for union carpenters in New England is 56%, for form work alone its 67%. This has to be costing you money - eye injuries are a common thing.

Your fall protection average was 45% overall, but appears to have gone up over time to 75% at the end, albeit based on very few measurements. You are below the overall average of 77%, and you continue to have a few serious problems on this. Form work has an overall average of 77%,

Company C
Page Two

the same as the whole carpentry average. It appears that you are making progress in fall protection; I hope so.

The other two measures are not as useful. Hearing protection was 0% for your workers throughout the study. But this is based on very few times in which it was needed but not being used. Overall hearing protection is used 22% of the time it is needed, with interior systems work averaging 25%. It is a tough thing for a company to emphasize, as there is no financial payback for you and the guys don't recognize the long-term hazards. But its worth considering.

Ground fault protection was only eye-balled, and so its not a great measure either - many situations could look good but not really be good. Your apparent use of gfci was 90%, compared to a union average of 88% and a form work average of 87%. Your average improved from 89% in the first half to 100% in the second half of the study. Keep up the good work.

Finally, I am not sure whether an average of all this matters, but I have made two averages, to give a company a sort of overall score - one averaging all five measures (hard hats, eye protection, hearing protection, gfci and fall protection) and the other without hearing protection. On the overall average, Company C stood at 45% for the whole study. BUT, your average is 60% in the second half, a substantial improvement. Excluding hearing protection, Company C had an overall average of 56%. The overall average of all site visits for the whole study was 76% excluding hearing. The overall average for form work was 80% excluding hearing.

Overall, the safety at Company C improved over the course of time. But you fell by 29% in hard hat compliance and by 42% in eye protection compliance, offset by a rise of 35% in fall protection compliance. I wish you every success in the future both in business and in safety. Please let me know if there is anything else I can help you with. If you want a copy of our report to the government, please let me know that as well.

Thank you again for your participation in this, an important step in protecting the lives of workers.

Yours sincerely,

Ken Halperin
for CPWR

Enclosures

Worksite Checklists Finals by Type Of Work, with averages of Protective Measures

Contractor: Company C

Contractor and Type Of Work: Company C Finish

Count Of Sites: 1 **Number of Carpenters:** 1

Hardhats: Yes: 0 No: 0 **Percent Of Hardhats Yes:** #Num!

Eye Compliance: Yes: 0 No: 1 **Percent of Eye Compliance Yes:** 0.00%

Hearing Compliance: Yes: 0 No: 0 **Percent of Hearing Compliance Yes:** #Num!

Ground Fault Compliance: Yes: 0 No: 0 **Percent of GF Compliance Yes:** #Num!

Fall Protection Compliance: Yes: 0 No: 1 **Percent of FP Compliance Yes:** 0.00%

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them:

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

Contractor and Type Of Work: Company C Formwork

Count Of Sites: 17 **Number of Carpenters:** 120

Hardhats: Yes: 81 No: 18 **Percent Of Hardhats Yes:** 81.82%

Eye Compliance: Yes: 5 No: 74 **Percent of Eye Compliance Yes:** 6.33%

Hearing Compliance: Yes: 0 No: 42 **Percent of Hearing Compliance Yes:** 0.00%

Ground Fault Compliance: Yes: 9 No: 1 **Percent of GF Compliance Yes:** 90.00%

Fall Protection Compliance: Yes: 5 No: 5 **Percent of FP Compliance Yes:** 50.00%

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

December 22, 2000

Company D

Dear:

Enclosed is the final report to Company D concerning what we learned about safety practice at your company over the four years of the study. I hope this is helpful to you.

We visited 20 of your sites, and observed 140 carpenters at work. The first attachment reports everything we saw on those visits. The most important things are: serious safety problems, and then the percentages of use of different safety measures - hard hats, eye protection, hearing protection, gfci, and fall protection. At the end of this report there is a section that shows your average experience over the four years. As you probably know, there is a different standard of safety practice in different areas of carpentry. For this reason, there is another attachment which measures your work in each area, which for you in our site visits is mostly formwork, although we categorized one job each in three other categories, and may have mis-categorized a few others especially early on.

Starting with serious safety problems, we observed 89 such violations total in 558 total site visits. Two of them were yours, both in 1997. One of these was a problem with saws, and may not have been as serious as all that. The other one included a fall protection problem, which as you know could pose a serious risk to everyone working around it. I hope the serious problems found on that site don't occur to you anymore.

Hard hat use averaged 83% for all union carpenters over the entire study, and averaged 92% for all form work. At Company D, the percentage was 85%, a very nice percentage for the whole study. Better yet, your hard hat percentage rose from 48% in the first half of the study to 96% in the second half! This is a great improvement, and I hope you keep it up.

Eye protection usage when required was 80% for Company D for the whole time period, fifth highest for all the firms in the study. The overall average for union carpenters in New England is 56%, for form work alone its 67%. Again, your average went from 48% in the first half of the study to 91% in the second half, an astonishing and heartening improvement. Keep up the good work!

Your fall protection average was 71% overall, it appears to have gone up over time from 57% in the beginning to 91% at the end. You were above the overall average of 77% by the end. Again, this is great - this letter is among the most pleasant to write in the whole writeup.

The other two measures are not as useful. Hearing protection was 0% for your workers throughout the study. But this is based on very few times in which it was needed but not being used. Overall hearing protection is used 22% of the time it is needed, with interior systems work averaging 25%. It is a tough thing for a company to emphasize, as there is no financial payback for you and the guys don't recognize the long-term hazards. But its worth considering.

Ground fault protection was only eye-balled, and so its not a great measure either - many situations could look good but not really be good. Your apparent use of gfci was 72%, compared to a union average of 88% and a form work average of 87%. BUT - Your average improved from 58% in the first half to 92% in the second half of the study. Keep up the good work.

Finally, I am not sure whether an average of all this matters, but I have made two averages, to give a company a sort of overall score - one averaging all five measures (hard hats, eye protection, hearing protection, gfci and fall protection) and the other without hearing protection. On the overall average, Company D stood at 62% for the whole study. BUT, your average is 74% in the second half, a substantial improvement. Excluding hearing protection, Company D had an overall average of 77%, going from 53% in the first half to 93% in the second half. The overall average of all site visits for the whole study was 76% excluding hearing. The overall average for form work was 80% excluding hearing.

Overall, the safety at Company D improved over the course of time in every measure. You improved by 101% in hard hat compliance and by 89% in eye protection compliance, by 57% in gfci and by a rise of 59% in fall protection compliance. This is a record to be proud of. I wish you every success in the future both in business and in safety. Please let me know if there is anything else I can help you with. If you want a copy of our report to the government, please let me know that as well.

Thank you again for your participation in this, an important step in protecting the lives of workers.

Yours sincerely,

Ken Halperin
for CPWR

Enclosures

Worksite Checklists Finals by Type Of Work, with averages of Protective Measures

Contractor: Company D

Contractor and Type Of Work: Company D Finish

Count Of Sites: 1 Number of Carpenters: 5
Hardhats: Yes: 5 No: 0 Percent Of Hardhats Yes: 100.00%
Eye Compliance: Yes: 5 No: 0 Percent of Eye Compliance Yes: 100.00
Hearing Compliance: Yes: 0 No: 0 Percent of Hearing Compliance Yes: #Num!
Ground Fault Compliance: Yes: 1 No: 0 Percent of GF Compliance Yes: 100.00
Fall Protection Compliance: Yes: 1 No: 0 Percent of FP Compliance Yes: 100.00

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

Contractor and Type Of Work: Company D Formwork

Count Of Sites: 17 Number of Carpenters: 119
Hardhats: Yes: 68 No: 15 Percent Of Hardhats Yes: 81.93%
Eye Compliance: Yes: 68 No: 21 Percent of Eye Compliance Yes: 76.40%
Hearing Compliance: Yes: 0 No: 12 Percent of Hearing Compliance Yes: 0.00%
Ground Fault Compliance: Yes: 10 No: 5 Percent of GF Compliance Yes: 66.67%
Fall Protection Compliance: Yes: 7 No: 4 Percent of FP Compliance Yes: 63.64%

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

Contractor and Type Of Work: Company D Interior

Count Of Sites: 1 Number of Carpenters: 4
Hardhats: Yes: 3 No: 0 Percent Of Hardhats Yes: 100.00%
Eye Compliance: Yes: 3 No: 0 Percent of Eye Compliance Yes: 100.00
Hearing Compliance: Yes: 0 No: 0 Percent of Hearing Compliance Yes: #Num!
Ground Fault Compliance: Yes: 1 No: 0 Percent of GF Compliance Yes: 100.00
Fall Protection Compliance: Yes: 1 No: 0 Percent of FP Compliance Yes: 100.00

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

Contractor and Type Of Work: Company D WoodFramingAndRoofing

Count Of Sites: 1 Number of Carpenters: 12
Hardhats: Yes: 12 No: 0 Percent Of Hardhats Yes: 100.00%
Eye Compliance: Yes: 11 No: 1 Percent of Eye Compliance Yes: 91.67%
Hearing Compliance: Yes: 0 No: 0 Percent of Hearing Compliance Yes: #Num!
Ground Fault Compliance: Yes: 1 No: 0 Percent of GF Compliance Yes: 100.00
Fall Protection Compliance: Yes: 1 No: 0 Percent of FP Compliance Yes: 100.00

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

December 22, 2000

Company E

Dear:

As we discussed on the phone, Company E was observed at work over a three year period as part of a government funded study on carpenter safety.

Enclosed is the final report to Company E concerning what we learned about safety practice at your company over the four years of the study. I hope this is helpful to you.

We visited 17 of your sites, where 612 carpenters were at work. The first attachment reports everything we saw on those visits. The most important things are: serious safety problems, and then the percentages of use of different safety measures - hard hats, eye protection, hearing protection, gfci, and fall protection. At the end of this report there is a section that shows your average experience over the four years. As you probably know, there is a different standard of safety practice in different areas of carpentry. For this reason, there is another attachment which measures your work in each area, which for you is Interior Systems.

Starting with serious safety problems, we observed 89 such violations total in 558 total site visits. I am happy to report that we saw NO serious violations for Company E on any site. This is actually a very remarkable record, only four of the companies that we observed as much as yours had no serious safety problems.

Hard hat use averaged 83% for all union carpenters over the entire study, and averaged 82% for all interior work. At Company E, the percentage was 82% - right on target. This number improved from 75% in the first half of the study to 83% at the end. Keep up the good work!

Eye protection usage when required was 63% for Company E for the whole time period, but fell from 71% in the first half to 61% in the second half. You are still above the overall average for interior work of 44.4%. Keep up the good work, and make it better yet.

Your fall protection average was 81% overall, 75% before and 89% after, albeit based on very few measurements. You are above the overall average of 77%. Overall, interior systems work is pretty fall-safe (91%) and it looks like you are right on target now.

Company E
Page Two

The other two measures are not as useful. Hearing protection was 67% for your workers throughout the study. But this is based on very few times in which it was observed as being needed. Overall hearing protection is used 22% of the time it is needed, with interior systems work averaging 25%. It is a tough thing for a company to emphasize, as there is no financial payback for you and the guys don't recognize the long-term hazards. So it is very nice that your workers are doing well on it.

Ground fault protection was only eye-balled, and so its not a great measure either - many situations could look good but not really be good. Your apparent use of gfci was 100%, compared to a union average of 88% and an interior systems average of 91%. 100% is of course a very nice number, I hope that it reflects the actual electrical safety of your company.

Finally, I am not sure whether an average of all this matters, but I have made two averages, to give a company a sort of overall score - one averaging all five measures (hard hats, eye protection, hearing protection, gfci and fall protection) and the other without hearing protection. On the overall average, Company E stood at 82% for the whole study. This is an average of 64% in the first half and 84% in the second half, an improvement of 30%. Excluding hearing protection, Company E had an overall average of 79%, going from 80% in the first half of the study to 83% in the second half. The overall average of all site visits for the whole study was 76% excluding hearing - so you can see that you are above average for all union carpentry firms in all lines of work in New England. The overall average for interior systems was 74% excluding hearing, and you were above that as well.

Overall, the safety at Company E improved overall over the course of time, by 11% in hard hat compliance, and 18% in fall protection compliance. This is a record to be proud of. I wish you every success in the future both in business and in safety. Please let me know if there is anything else I can help you with. If you want a copy of our report to the government, please let me know that as well.

Thank you again for your participation in this, an important step in protecting the lives of workers.

Yours sincerely,

Ken Halperin
for CPWR

Enclosures

Worksite Checklists Finals by Type Of Work, with averages of Protective Measures

Contractor: Company E

Contractor and Type Of Work: Company E Interior

Count Of Sites: 17 **Number of Carpenters:** 612

Hardhats: Yes: 102 No: 22 **Percent Of Hardhats Yes:** 82.26%

Eye Compliance: Yes: 41 No: 24 **Percent of Eye Compliance Yes:** 63.08%

Hearing Compliance: Yes: 6 No: 3 **Percent of Hearing Compliance Yes:** 66.67%

Ground Fault Compliance: Yes: 9 No: 0 **Percent of GF Compliance Yes:** 100.00

Fall Protection Compliance: Yes: 9 No: 2 **Percent of FP Compliance Yes:** 81.82%

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

December 22, 2000

Company F

Dear:

Enclosed is the final report to Company F concerning what we learned about safety practice at your company over the four years of the study. I hope this is helpful to you.

We visited 31 of your sites (the most of any company), where 289 carpenters were at work. The first attachment reports everything we saw on those visits. The most important things are: serious safety problems, and then the percentages of use of different safety measures - hard hats, eye protection, hearing protection, gfci, and fall protection. At the end of this report there is a section that shows your average experience over the four years. As you probably know, there is a different standard of safety practice in different areas of carpentry. For this reason, there is another attachment which measures your work in each area, which for you is Interior Systems.

Starting with serious safety problems, we observed 89 such violations total in 558 total site visits. I count ten of these being yours - the most of any company in the study. Most of these are fall protection problems, which in general lead to the most serious injuries. The ten occurred throughout the study, which leads me to recommend to you that you place a policy on fall protection among your priorities.

Hard hat use averaged 83% for all union carpenters over the entire study, and averaged 82% for all interior work. At Company F, the percentage was 89% - nicely above average. However, this number fell from 95% in the first half of the study to 83% at the end.

Eye protection usage when required was 41% for Company F for the whole time period, but fell from 48% in the first half to 33% in the second half. You are no longer above the overall average for interior work of 44.4%.

Your fall protection average was 48% overall, but appears to have risen to 83% in the second half of the study, albeit based on very few measurements. You are now above the overall average of 77%. Overall, interior systems work is pretty fall-safe (91%) and it looks like you are heading for the target now, but given the serious violation problem in this area, you still have work to do.

The other two measures are not as useful. Hearing protection was 8% for your workers throughout the study. But this is based on very few times in which it was observed as being needed. Overall hearing protection is used 22% of the time it is needed, with interior systems

Company F
Page Two

work averaging 25%. It is a tough thing for a company to emphasize, as there is no financial payback for you and the guys don't recognize the long-term hazards.

Ground fault protection was only eye-balled, and so its not a great measure either - many situations could look good but not really be good. Your apparent use of gfci was 90%, compared to a union average of 88% and an interior systems average of 91%. 90% is right on target. Keep up the good work.

Finally, I am not sure whether an average of all this matters, but I have made two averages, to give a company a sort of overall score - one averaging all five measures (hard hats, eye protection, hearing protection, gfci and fall protection) and the other without hearing protection. On the overall average, Company F stood at 55% for the whole study. Your average in the second half of the study was 73%, an improvement of 29%. Excluding hearing protection, Company F had an overall average of 67%, going to 83% in the second half. The overall average of all site visits for the whole study was 76% excluding hearing - so you can see that you are now above average for all union carpentry firms in all lines of work in New England. The overall average for interior systems was 74% excluding hearing, and you were above that as well by the end.

Overall, the safety at Company F improved overall over the course of time, falling by 13% in hard hat compliance, and 30% in fall protection compliance but offset by improvements of 21% in gfci and 51% in fall protection. I wish you every success in the future both in business and in safety. Please let me know if there is anything else I can help you with. If you want a copy of our report to the government, please let me know that as well.

Thank you again for your participation in this, an important step in protecting the lives of workers.

Yours sincerely,

Ken Halperin
for CPWR

Enclosures

Worksite Checklists Finals by Type Of Work, with averages of Protective Measures

Contractor: Company F

Contractor and Type Of Work: Company F Interior

Count Of Sites: 31 **Number of Carpenters:** 289

Hardhats: Yes: 185 No: 21 **Percent Of Hardhats Yes:** 89.81%

Eye Compliance: Yes: 58 No: 84 **Percent of Eye Compliance Yes:** 40.85%

Hearing Compliance: Yes: 3 No: 35 **Percent of Hearing Compliance Yes:** 7.89%

Ground Fault Compliance: Yes: 26 No: 3 **Percent of GF Compliance Yes:** 89.66%

Fall Protection Compliance: Yes: 10 No: 11 **Percent of FP Compliance Yes:** 47.62%

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

December 22, 2000

Company G

Dear:

Enclosed is the final report to Company G concerning what we learned about safety practice at your company over the four years of the study. I hope this is helpful to you.

We visited 10 of your sites, and observed 37 carpenters at work. The first attachment reports everything we saw on those visits. The most important things are: serious safety problems, and then the percentages of use of different safety measures - hard hats, eye protection, hearing protection, gfci, and fall protection. At the end of this report there is a section that shows your average experience over the four years. As you probably know, there is a different standard of safety practice in different areas of carpentry. For this reason, there is another attachment which measures your work in each area, which for you is Interior Systems.

Starting with serious safety problems, we observed 89 such violations total in 558 total site visits. I count one real one for you - on September 2, 1998. Fall protection problems such as this are among the most serious of all problems. That one was the fault of the general, but your guys were exposed and I hope no one got hurt. I was impressed with the way the foreman dealt with the chemical hazard at Northeast Generator, again someone else's fault.

Hard hat use averaged 83% for all union carpenters over the entire study, and averaged 82% for all interior work. At Company G, the percentage was 33%. On the face of it, this seems bad. But when you look at the second half of all visits, Company G had a hard hat percent use of 100% - above the average. Keep up the good work!

Eye protection usage when required was 33% for Company G for the whole time period, but went from 15% in the first half to 86% in the second half. Again, the second half number is above the average for the study of 56%. And you are now above the overall average for interior work of 44.4%. You are in fact doing among the best on eye protection of all the interior companies in the study. Again, keep up the good work, and make it better yet.

Your fall protection average was 67% overall. You are below the overall average of 77%. Overall, interior systems work is pretty fall-safe (91%) and it looks like you need to consider strengthening your efforts in this area.

Company G
Page Two

The other two measures are not as useful. Hearing protection was 50% for your workers throughout the study. But this is based on very few times in which it was needed. Overall hearing protection is used 22% of the time it is needed, with interior systems work averaging 25%. It is a tough thing for a company to emphasize, as there is no financial payback for you and the guys don't recognize the long-term hazards. But its worth considering.

Ground fault protection was only eye-balled, and so its not a great measure either - many situations could look good but not really be good. Your apparent use of gfci was 57%, compared to a union average of 88% and an interior systems average of 91%.

Finally, I am not sure whether an average of all this matters, but I have made two averages, to give a company a sort of overall score - one averaging all five measures (hard hats, eye protection, hearing protection, gfci and fall protection) and the other without hearing protection. On the overall average, Company G stood at 48% for the whole study. BUT, this is an average of 35% in the first half and 90% in the second half, an improvement of 161%. Excluding hearing protection, Company G had an overall average of 48%, going from 43% in the first half of the study to 88% in the second half. The overall average of all site visits for the whole study was 76% excluding hearing - so you can see that you are above average for all union carpentry firms in all lines of work in New England. The overall average for interior systems was 74% excluding hearing, and you were above that as well by the end.

Overall, the safety at Company G improved in many measures over the course of time, by 550% in hard hat compliance, 471% in eye protection compliance, and 60% in gfci protection compliance, accompanied by a slight fall in your fall protection record of 17%. This is a record to be proud of. I wish you every success in the future both in business and in safety. Please let me know if there is anything else I can help you with. If you want a copy of our report to the government, please let me know that as well.

Thank you again for your participation in this, an important step in protecting the lives of workers.

Yours sincerely,

Ken Halperin
for CPWR

Enclosures

Worksite Checklists Finals by Type Of Work, with averages of Protective Measures

Contractor: Company G

Contractor and Type Of Work: Company G Interior

Count Of Sites: 10 **Number of Carpenters:** 37

Hardhats: Yes: 11 No: 22 **Percent Of Hardhats Yes:** 33.33%

Eye Compliance: Yes: 9 No: 18 **Percent of Eye Compliance Yes:** 33.33%

Hearing Compliance: Yes: 3 No: 3 **Percent of Hearing Compliance Yes:** 50.00%

Ground Fault Compliance: Yes: 4 No: 3 **Percent of GF Compliance Yes:** 57.14%

Fall Protection Compliance: Yes: 4 No: 2 **Percent of FP Compliance Yes:** 66.67%

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

December 22, 2000

Company H

Dear:

Enclosed is the final report to Company H concerning what we learned about safety practice at your company over the four years of the study. I hope this is helpful to you.

We visited 17 of your sites, and observed 318 carpenters at work. The first attachment reports everything we saw on those visits. The most important things are: serious safety problems, and then the percentages of use of different safety measures - hard hats, eye protection, hearing protection, gfci, and fall protection. At the end of this report there is a section that shows your average experience over the four years. As you probably know, there is a different standard of safety practice in different areas of carpentry. For this reason, there is another attachment which measures your work in each area, which for you is mostly wood framing, although I categorized one job as finish carpentry.

Starting with serious safety problems, we observed 89 such violations total in 558 total site visits. We found three of these of these for you - all before September of 1998. Fall protection problems such as these are among the most serious of all problems. In your line of work, they are very common, and it is impressive that you have had none of them since you instituted your new policies. Keep up the good work.

Hard hat use averaged 83% for all union carpenters over the entire study, and averaged 85% for all wood framing and roofing. At Company H, the percentage was 92%. Even more impressively, your hard hat percentage went from 70% in the first half of the study to 100% in the second half. Keep up the good work!

Eye protection usage when required was 81% for Company H for the whole time period, going from 50% in the first half to 93% in the second half - the second highest of any firm. Again, the second half number is above the average for the study of 56%. And you are well above the overall average for wood framing and roofing work of 61% - excluding Company H, this average would be around 40%. Again, keep up the good work, and make it better yet.

Company H
Page Two

Your fall protection average was 87.5% overall. Again, this shows improvement from 71% (first half) to 100% in the second half. You are now way above the overall average of 77%. Overall, wood framing work is at 80%.

The other two measures are not as useful. Hearing protection was 0% for your workers throughout the study. But this is based on very few times in which it was needed. Overall hearing protection is used 22% of the time it is needed, with interior systems work averaging 25%. It is a tough thing for a company to emphasize, as there is no financial payback for you and the guys don't recognize the long-term hazards. But its worth considering.

Ground fault protection was only eye-balled, and so its not a great measure either - many situations could look good but not really be good. Your apparent use of gfci was 91%, compared to a union average of 88% and a wood framing average of 90%.

Finally, I am not sure whether an average of all this matters, but I have made two averages, to give a company a sort of overall score - one averaging all five measures (hard hats, eye protection, hearing protection, gfci and fall protection) and the other without hearing protection. On the overall average, Company H stood at 70% for the whole study. BUT, this is an average of 69% in the first half and 79% in the second half, an improvement of 14%. Excluding hearing protection, Company H had an overall average of 88%, going from 69% in the first half of the study to 98% in the second half. The overall average of all site visits for the whole study was 76% excluding hearing - so you can see that you are above average for all union carpentry firms in all lines of work in New England. The overall average for wood framing was 79% excluding hearing, and you were above that as well by the end.

Overall, the safety at Company H improved in all the measures over the course of time, by 43% in hard hat compliance, 87% in eye protection compliance, 20% in gfci protection compliance, and 40% in fall protection. This is a record to be proud of. I wish you every success in the future both in business and in safety. Please let me know if there is anything else I can help you with. If you want a copy of our report to the government, please let me know that as well.

Thank you again for your participation in this, an important step in protecting the lives of workers.

Yours sincerely,

Ken Halperin
for CPWR

Enclosures

Worksite Checklists Finals by Type Of Work, with averages of Protective Measures

Contractor: Company H

Contractor and Type Of Work: Company H Finish

Count Of Sites: 1 **Number of Carpenters:** 24

Hardhats: Yes: 17 No: 0 **Percent Of Hardhats Yes:** 100.00%

Eye Compliance: Yes: 12 No: 5 **Percent of Eye Compliance Yes:** 70.59%

Hearing Compliance: Yes: 0 No: 0 **Percent of Hearing Compliance Yes:** #Num!

Ground Fault Compliance: Yes: 1 No: 0 **Percent of GF Compliance Yes:** 100.00

Fall Protection Compliance: Yes: 1 No: 0 **Percent of FP Compliance Yes:** 100.00

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

Contractor and Type Of Work: Company H WoodFramingAndRoofing

Count Of Sites: 16 **Number of Carpenters:** 294

Hardhats: Yes: 151 No: 15 **Percent Of Hardhats Yes:** 90.96%

Eye Compliance: Yes: 127 No: 28 **Percent of Eye Compliance Yes:** 81.94%

Hearing Compliance: Yes: 0 No: 5 **Percent of Hearing Compliance Yes:** 0.00%

Ground Fault Compliance: Yes: 10 No: 1 **Percent of GF Compliance Yes:** 90.91%

Fall Protection Compliance: Yes: 13 No: 2 **Percent of FP Compliance Yes:** 86.67%

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

December 22, 2000

Company I

Dear:

Enclosed is the final report to Company I concerning what we learned about safety practice at your company over the four years of the study. I hope this is helpful to you.

We visited 13 of your sites, and observed 50 carpenters at work. The first attachment reports everything we saw on those visits. The most important things are: serious safety problems, and then the percentages of use of different safety measures - hard hats, eye protection, hearing protection, gfci, and fall protection. At the end of this report there is a section that shows your average experience over the four years. As you probably know, there is a different standard of safety practice in different areas of carpentry. For this reason, there is another attachment which measures your work in each area, which for you is Interior Systems.

Starting with serious safety problems, we observed 89 such violations total in 558 total site visits. I count one real one for you - on November 25, 1998. Fall protection problems such as this are among the most serious of all problems.

Hard hat use averaged 83% for all union carpenters over the entire study, and averaged 82% for all interior work. At Company I, the percentage was 43%. Although you improved over time from 35 to 48%, this is still a very low percentage.

Eye protection usage when required was 13% for Company I for the whole time period, the second lowest in the study. Your eye protection usage actually fell in the time of the study, from 18% in the first half to 10% in the second half.

Your fall protection average was 71% overall. You are below the overall average of 77%. Overall, interior systems work is pretty fall-safe (91%) and it looks like you need to consider strengthening your efforts in this area.

The other two measures are not as useful. Hearing protection was 0% for your workers throughout the study. But this is based on very few times in which it was needed. Overall hearing protection is used 22% of the time it is needed, with interior systems work averaging 25%. It is a tough thing for a company to emphasize, as there is no financial payback for you and the guys don't recognize the long-term hazards. But its worth considering.

Company I
Page Two

Ground fault protection was only eye-balled, and so its not a great measure either - many situations could look good but not really be good. Your apparent use of gfci was 100%, compared to a union average of 88% and an interior systems average of 91%. Congratulations on this, and keep up the good work.

Finally, I am not sure whether an average of all this matters, but I have made two averages, to give a company a sort of overall score - one averaging all five measures (hard hats, eye protection, hearing protection, gfci and fall protection) and the other without hearing protection. On the overall average, Company I stood at 46% for the whole study. Excluding hearing protection, Company I had an overall average of 57%. The overall average of all site visits for the whole study was 76% excluding hearing - so you can see that you are below average for all union carpentry firms in all lines of work in New England. The overall average for interior systems was 74% excluding hearing, and you were below that as well.

Overall, the safety at Company I was among the lowest in the study, but did show improvement in some measures over the course of time, by 31% in hard hat compliance, and 50% in fall protection compliance, accompanied by a fall in your eye compliance record of 41%. I wish you every success in the future both in business and in safety. Please let me know if there is anything else I can help you with. If you want a copy of our report to the government, please let me know that as well.

Thank you again for your participation in this, an important step in protecting the lives of workers.

Yours sincerely,

Ken Halperin
for CPWR

Enclosures

Worksite Checklists Finals by Type Of Work, with averages of Protective Measures

Contractor: Company I

Contractor and Type Of Work: Company I Interior

Count Of Sites: 13 **Number of Carpenters:** 50

Hardhats: Yes: 20 No: 26 **Percent Of Hardhats Yes:** 43.48%

Eye Compliance: Yes: 5 No: 34 **Percent of Eye Compliance Yes:** 12.82%

Hearing Compliance: Yes: 0 No: 2 **Percent of Hearing Compliance Yes:** 0.00%

Ground Fault Compliance: Yes: 11 No: 0 **Percent of GF Compliance Yes:** 100.00

Fall Protection Compliance: Yes: 5 No: 2 **Percent of FP Compliance Yes:** 71.43%

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

December 22, 2000

Company J

Dear:

Enclosed is the final report to Company J concerning what we learned about safety practice at your company over the four years of the study. I hope this is helpful to you.

We visited 19 of your sites, and observed 318 carpenters at work. The first attachment reports everything we saw on those visits. The most important things are: serious safety problems, and then the percentages of use of different safety measures - hard hats, eye protection, hearing protection, gfci, and fall protection. At the end of this report there is a section that shows your average experience over the four years. As you probably know, there is a different standard of safety practice in different areas of carpentry. For this reason, there is another attachment which measures your work in each area, which for you is Interior Systems.

Starting with serious safety problems, we observed 89 such violations total in 558 total site visits. I count seven real ones for you - the second most of any contractor in the study, from 1998 through 2000. Fall protection problems such as this are among the most serious of all problems. I hope you will institute a plan to deal with fall protection issues.

Hard hat use averaged 83% for all union carpenters over the entire study, and averaged 82% for all interior work. At Company J, the percentage was 94%, the third highest in the study. Remarkably, this number reflects a slight drop over time, from 96% in the first half of the study to 92% in the second half. Nevertheless, keep up the good work!

Eye protection usage when required was 42% for Company J for the whole time period, and went from 69% in the first half to 20% in the second half. The second half number is well below the average for the study of 56%. And you are now below the overall average for interior work of 44.4%. I hope you will choose to reverse this decline.

Your fall protection average was 76% overall. You are around the overall average of 77%. Overall, interior systems work is pretty fall-safe (91%) and it looks like you need to consider strengthening your efforts in this area.

The other two measures are not as useful. Hearing protection was 11% for your workers throughout the study. But this is based on very few times in which it was needed. Overall hearing protection is used 22% of the time it is needed, with interior systems work averaging

Company J
Page Two

25%. It is a tough thing for a company to emphasize, as there is no financial payback for you and the guys don't recognize the long-term hazards. But its worth considering.

Ground fault protection was only eye-balled, and so its not a great measure either - many situations could look good but not really be good. Your apparent use of gfci was 100%, compared to a union average of 88% and an interior systems average of 91%. 100% is a very nice number, keep up the good work.

Finally, I am not sure whether an average of all this matters, but I have made two averages, to give a company a sort of overall score - one averaging all five measures (hard hats, eye protection, hearing protection, gfci and fall protection) and the other without hearing protection. On the overall average, Company J stood at 65% for the whole study. BUT, this is an average of 69% in the first half and 61% in the second half, a slight decline. Excluding hearing protection, Company J had an overall average of 78%, going from 83% in the first half of the study to 76% in the second half. The overall average of all site visits for the whole study was 76% excluding hearing - so you can see that you are around average for all union carpentry firms in all lines of work in New England. The overall average for interior systems was 74% excluding hearing.

Overall, the safety at Company J declined in many measures over the course of time, by 4% in hard hat use, by 71% in eye protection use, but offset by an improvement of 37.5% in fall protection.

I wish you every success in the future both in business and in safety. Please let me know if there is anything else I can help you with. If you want a copy of our report to the government, please let me know that as well.

Thank you again for your participation in this, an important step in protecting the lives of workers.

Yours sincerely,

Ken Halperin
for CPWR

Enclosures -

Worksite Checklists Finals by Type Of Work, with averages of Protective Measures

Contractor: Company J

Contractor and Type Of Work: Company J Interior

Count Of Sites: 19 **Number of Carpenters:** 316

Hardhats: Yes: 213 No: 13 **Percent Of Hardhats Yes:** 94.25%

Eye Compliance: Yes: 61 No: 83 **Percent of Eye Compliance Yes:** 42.36%

Hearing Compliance: Yes: 4 No: 31 **Percent of Hearing Compliance Yes:** 11.43%

Ground Fault Compliance: Yes: 18 No: 0 **Percent of GF Compliance Yes:** 100.00

Fall Protection Compliance: Yes: 13 No: 4 **Percent of FP Compliance Yes:** 76.47%

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

December 22, 2000

Company K

Dear:

Enclosed is the final report to Company K concerning what we learned about safety practice at your company over the four years of the study. I hope this is helpful to you.

We visited 20 of your sites, and observed 68 carpenters at work. The first attachment reports everything we saw on those visits. The most important things are: serious safety problems, and then the percentages of use of different safety measures - hard hats, eye protection, hearing protection, gfci, and fall protection. At the end of this report there is a section that shows your average experience over the four years. As you probably know, there is a different standard of safety practice in different areas of carpentry. For this reason, there is another attachment which measures your work in each area, which for you is the most diverse of any company in the study. I may have mis-categorized some, but I find you in every area of carpentry except pile-driving and floorlaying. In what follows, I will comment on your average against that in interior systems, a sort of mid-range. But bear in mind that formwork usually has better safety practice, and wood framing and finish work usually worse.

Starting with serious safety problems, we observed 89 such violations total in 558 total site visits. I count two real ones for you - in October, 1997 and November, 1998. Fall protection problems such as this are among the most serious of all problems. I hope that you really no longer have such problems.

Hard hat use averaged 83% for all union carpenters over the entire study, and averaged 82% for all interior work. At Company K, the percentage was 59%. This number reflects a rise from 54% in the first half of the study to 66% in the second half. I hope this improvement continues.

Eye protection usage when required was 45% for Company K for the whole time period, and went from 37% in the first half to 66% in the second half. The second half number is now above the average for the study of 56%. And you are now below the overall average for interior work of 44.4%, and on target for the formwork average of 67%. Keep up the good work.

Your fall protection average was 75% overall, and 86% in the second half of the study. You are around the overall average of 77%. Overall, interior systems work is pretty fall-safe (91%) and it looks like you need to consider strengthening your efforts in this area.

Company K
Page Two

The other two measures are not as useful. Hearing protection was 0% for your workers throughout the study. But this is based on very few times in which it was needed. Overall hearing protection is used 22% of the time it is needed, with interior systems work averaging 25%. It is a tough thing for a company to emphasize, as there is no financial payback for you and the guys don't recognize the long-term hazards. But its worth considering.

Ground fault protection was only eye-balled, and so its not a great measure either - many situations could look good but not really be good. Your apparent use of gfci was 93%, compared to a union average of 88% and an interior systems average of 91%. 93% is a very nice number, keep up the good work.

Finally, I am not sure whether an average of all this matters, but I have made two averages, to give a company a sort of overall score - one averaging all five measures (hard hats, eye protection, hearing protection, gfci and fall protection) and the other without hearing protection. On the overall average, Company K stood at 55% for the whole study. BUT, this is an average of 51% in the first half and 61% in the second half, a nice improvement. Excluding hearing protection, Company K had an overall average of 68%, going from 63% in the first half of the study to 76% in the second half. The overall average of all site visits for the whole study was 76% excluding hearing - so you can see that you are around average for all union carpentry firms in all lines of work in New England. The overall average for interior systems was 74% excluding hearing.

Overall, the safety at Company K improved in every measure over the course of time, by 22% in hard hat use, by 45% in eye protection use, and by 14% in fall protection. Keep going in this direction! It is efforts like yours that made this project a success.

I wish you every success in the future both in business and in safety. Please let me know if there is anything else I can help you with. If you want a copy of our report to the government, please let me know that as well.

Thank you again for your participation in this, an important step in protecting the lives of workers.

Yours sincerely,

Ken Halperin
for CPWR

Enclosures

Worksite Checklists Finals by Type Of Work, with averages of Protective Measures

Contractor: Company K

Contractor and Type Of Work: Company K Finish

Count Of Sites: 3 Number of Carpenters: 6

Hardhats: Yes: 1 No: 5 Percent Of Hardhats Yes: 16.67%

Eye Compliance: Yes: 2 No: 4 Percent of Eye Compliance Yes: 33.33%

Hearing Compliance: Yes: 0 No: 1 Percent of Hearing Compliance Yes: 0.00%

Ground Fault Compliance: Yes: 2 No: 0 Percent of GF Compliance Yes: 100.00

Fall Protection Compliance: Yes: 1 No: 1 Percent of FP Compliance Yes: 50.00%

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

Contractor and Type Of Work: Company K Formwork

Count Of Sites: 6 Number of Carpenters: 18

Hardhats: Yes: 19 No: 3 Percent Of Hardhats Yes: 86.36%

Eye Compliance: Yes: 9 No: 8 Percent of Eye Compliance Yes: 52.94%

Hearing Compliance: Yes: 0 No: 2 Percent of Hearing Compliance Yes: 0.00%

Ground Fault Compliance: Yes: 4 No: 0 Percent of GF Compliance Yes: 100.00

Fall Protection Compliance: Yes: 3 No: 1 Percent of FP Compliance Yes: 75.00%

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

Contractor and Type Of Work: Company K Interior

Count Of Sites: 5 Number of Carpenters: 21

Hardhats: Yes: 11 No: 8 Percent Of Hardhats Yes: 57.89%

Eye Compliance: Yes: 7 No: 9 Percent of Eye Compliance Yes: 43.75%

Hearing Compliance: Yes: 0 No: 3 Percent of Hearing Compliance Yes: 0.00%

Ground Fault Compliance: Yes: 3 No: 1 Percent of GF Compliance Yes: 75.00%

Fall Protection Compliance: Yes: 3 No: 0 Percent of FP Compliance Yes: 100.00

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

Contractor and Type Of Work: Company K Renovation

Count Of Sites: 2 Number of Carpenters: 5

Hardhats: Yes: 2 No: 3 Percent Of Hardhats Yes: 40.00%

Eye Compliance: Yes: 1 No: 3 Percent of Eye Compliance Yes: 25.00%

Hearing Compliance: Yes: 0 No: 0 Percent of Hearing Compliance Yes: #Num!

Ground Fault Compliance: Yes: 2 No: 0 Percent of GF Compliance Yes: 100.00

Fall Protection Compliance: Yes: 0 No: 0 Percent of FP Compliance Yes: #Num!

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

Worksite Checklists Finals by Type Of Work, with averages of Protective Measures

Contractor and Type Of Work: Company K WoodFramingAndRoofing

Count Of Sites: 4 **Number of Carpenters:** 18

Hardhats: Yes: 8 No: 10 **Percent Of Hardhats Yes:** 44.44%

Eye Compliance: Yes: 6 No: 6 **Percent of Eye Compliance Yes:** 50.00%

Hearing Compliance: Yes: 0 No: 3 **Percent of Hearing Compliance Yes:** 0.00%

Ground Fault Compliance: Yes: 3 No: 0 **Percent of GF Compliance Yes:** 100.00

Fall Protection Compliance: Yes: 2 No: 1 **Percent of FP Compliance Yes:** 66.67%

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

December 22, 2000

Company L

Dear:

Enclosed is the final report to Company L concerning what we learned about safety practice at your company over the four years of the study. I hope this is helpful to you.

We visited 11 of your sites, and observed 26 carpenters at work. The first attachment reports everything we saw on those visits. The most important things are: serious safety problems, and then the percentages of use of different safety measures - hard hats, eye protection, hearing protection, gfci, and fall protection. At the end of this report there is a section that shows your average experience over the four years. As you probably know, there is a different standard of safety practice in different areas of carpentry. For this reason, there is another attachment which measures your work in each area, which for you in our site visits was formwork.

Starting with serious safety problems, we observed 89 such violations total in 558 total site visits. You had one, in 1997. This was a trenching problem, which can be quite serious. Since then I have always been impressed by your work both in confined spaces and in scaffolding, but I would urge you to always pay extreme caution to trenching issues.

Hard hat use averaged 83% for all union carpenters over the entire study, and averaged 92% for all formwork. At Company L, the percentage was 93%, fifth highest in the study but lagging two other formwork companies. However, your hard hat percentage rose from 83% in the first half of the study to 100% in the second half! You can't do better than 100%, so keep up the good work!

Eye protection usage when required was 96% for Company L for the whole time period, by far the highest in the study - the second highest was 86%. The overall average for union carpenters in New England is 56%, for formwork alone its 67%. This has to be saving you money - eye injuries are very common. Congratulations, you are a model for them all.

Your fall protection average was 75% overall, but appears to have gone up over time to 100% at the end. You are now above the overall average of 77%, and you appear to have no serious problems on this. Formwork has an overall average of 77%, the same as the whole carpentry average. Again, this is a wonderful record.

Company L
Page Two

The other two measures are not as useful. Hearing protection was 0% for your workers throughout the study. But this is based on very few times in which it was needed but not being used. Overall hearing protection is used 22% of the time it is needed, with interior systems work averaging 25%. It is a tough thing for a company to emphasize, as there is no financial payback for you and the guys don't recognize the long-term hazards. But its worth considering.

Ground fault protection was only eye-balled, and so its not a great measure either - many situations could look good but not really be good. Your apparent use of gfcı was 100%, compared to a union average of 88% and a formwork average of 87%. Keep up the good work.

Finally, I am not sure whether an average of all this matters, but I have made two averages, to give a company a sort of overall score - one averaging all five measures (hard hats, eye protection, hearing protection, gfcı and fall protection) and the other without hearing protection. On the overall average, Company L stood at 73% for the whole study. Excluding hearing protection, Company L had an overall average of 91%, third highest in the study. Your overall average excluding hearing was 98% in the second half of the study, in a three way tie for best. The overall average of all site visits for the whole study was 76% excluding hearing. The overall average for formwork was 80% excluding hearing.

Overall, the safety at Company L improved over the course of time. You improved by 20% in hard hat compliance and by 100% in fall protection compliance. This is a great record in safety, and I know from talking to your foremen that you are proud of it. I wish you every success in the future both in business and in safety. Please let me know if there is anything else I can help you with. If you want a copy of our report to the government, please let me know that as well.

Thank you again for your participation in this, an important step in protecting the lives of workers.

Yours sincerely,

Ken Halperin
for CPWR

Enclosures

Worksite Checklists Finals by Type Of Work, with averages of Protective Measures

Contractor: Company L

Contractor and Type Of Work: Company L Formwork

Count Of Sites: 11 **Number of Carpenters:** 26

Hardhats: Yes: 25 No: 2 **Percent Of Hardhats Yes:** 92.59%

Eye Compliance: Yes: 24 No: 1 **Percent of Eye Compliance Yes:** 96.00%

Hearing Compliance: Yes: 0 No: 2 **Percent of Hearing Compliance Yes:** 0.00%

Ground Fault Compliance: Yes: 4 No: 0 **Percent of GF Compliance Yes:** 100.00

Fall Protection Compliance: Yes: 3 No: 1 **Percent of FP Compliance Yes:** 75.00%

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

December 22, 2000

Company M

Dear:

Enclosed is the final report to Company M concerning what we learned about safety practice at your company over the four years of the study. I hope this is helpful to you.

We visited 19 of your sites, and observed 156 carpenters at work. The first attachment reports everything we saw on those visits. The most important things are: serious safety problems, and then the percentages of use of different safety measures - hard hats, eye protection, hearing protection, gfcis, and fall protection. At the end of this report there is a section that shows your average experience over the four years. As you probably know, there is a different standard of safety practice in different areas of carpentry. For this reason, there is another attachment which measures your work in each area, which for you is mostly wood framing, although one job was definitely formwork, and others may have been mis-categorized, especially early on.

Starting with serious safety problems, we observed 89 such violations total in 558 total site visits. We found three of these of these for you - in 1997 and 1999. Fall protection problems such as these are among the most serious of all problems. In your line of work, they are very common, and I hope you will pay serious attention to preventing them.

Hard hat use averaged 83% for all union carpenters over the entire study, and averaged 85% for all wood framing and roofing. At Company M, the percentage was 81%. Even more impressively, your hard hat percentage went from 71% in the first half of the study to 92% in the second half. Keep up the good work!

Eye protection usage when required was 24% for Company M for the whole time period, and did not change over time. This is considerably below the average for the study of 56% and the overall average for wood framing and roofing work of 61%. You should try to improve this, as eye injuries are a major problem for carpenters.

Your fall protection average was 64% overall. Again, this shows improvement from 62% (first half) to 100% in the second half, albeit on a small number of observations. The overall average is 77% and wood framing work is at 80%.

The other two measures are not as useful. Hearing protection was 0% for your workers throughout the study. But this is based on very few times in which it was needed. Overall

Company M
Page Two

hearing protection is used 22% of the time it is needed, with interior systems work averaging 25%. It is a tough thing for a company to emphasize, as there is no financial payback for you and the guys don't recognize the long-term hazards. But its worth considering.

Ground fault protection was only eye-balled, and so its not a great measure either - many situations could look good but not really be good. Your apparent use of gfci was 80%, compared to a union average of 88% and a wood framing average of 90%. Your second-half average was 100% - keep up the good work!

Finally, I am not sure whether an average of all this matters, but I have made two averages, to give a company a sort of overall score - one averaging all five measures (hard hats, eye protection, hearing protection, gfci and fall protection) and the other without hearing protection. On the overall average, Company M stood at 50% for the whole study. BUT, this is an average of 47% in the first half and 79% in the second half, an improvement of 71%. Excluding hearing protection, Company M had an overall average of 62%, going from 58% in the first half of the study to 79% in the second half. The overall average of all site visits for the whole study was 76% excluding hearing - so you can see that you are above average for all union carpentry firms in all lines of work in New England. The overall average for wood framing was 79% excluding hearing, and you were above that as well by the end.

Overall, the safety at Company M improved in all the measures over the course of time, by 29% in hard hat compliance, 3% in eye protection compliance, 33% in gfci protection compliance, and 62% in fall protection. This is a record to be proud of. I wish you every success in the future both in business and in safety. Please let me know if there is anything else I can help you with. If you want a copy of our report to the government, please let me know that as well.

Thank you again for your participation in this, an important step in protecting the lives of workers.

Yours sincerely,

Ken Halperin
for CPWR

Enclosures

Worksite Checklists Finals by Type Of Work, with averages of Protective Measures

Contractor: Company M

Contractor and Type Of Work: Company M Formwork

Count Of Sites: 1 Number of Carpenters: 2

Hardhats: Yes: 2 No: 0 Percent Of Hardhats Yes: 100.00%

Eye Compliance: Yes: 2 No: 0 Percent of Eye Compliance Yes: 100.00

Hearing Compliance: Yes: 0 No: 0 Percent of Hearing Compliance Yes: #Num!

Ground Fault Compliance: Yes: 0 No: 0 Percent of GF Compliance Yes: #Num!

Fall Protection Compliance: Yes: 0 No: 0 Percent of FP Compliance Yes: #Num!

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

Contractor and Type Of Work: Company M WoodFramingAndRoofing

Count Of Sites: 18 Number of Carpenters: 154

Hardhats: Yes: 93 No: 23 Percent Of Hardhats Yes: 80.17%

Eye Compliance: Yes: 19 No: 66 Percent of Eye Compliance Yes: 22.35%

Hearing Compliance: Yes: 0 No: 5 Percent of Hearing Compliance Yes: 0.00%

Ground Fault Compliance: Yes: 8 No: 2 Percent of GF Compliance Yes: 80.00%

Fall Protection Compliance: Yes: 9 No: 5 Percent of FP Compliance Yes: 64.29%

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

THE CENTER TO PROTECT WORKERS' RIGHTS

EDWARD C. SULLIVAN, PRESIDENT

December 22, 2000

Company N

Dear:

Enclosed is the final report to Company N concerning what we learned about safety practice at your company over the four years of the study. I hope this is helpful to you.

We visited 17 of your sites, and observed 175 carpenters at work. The first attachment reports everything we saw on those visits. The most important things are: serious safety problems, and then the percentages of use of different safety measures - hard hats, eye protection, hearing protection, gfci, and fall protection. At the end of this report there is a section that shows your average experience over the four years. As you probably know, there is a different standard of safety practice in different areas of carpentry. For this reason, there is another attachment which measures your work in each area, which for you is formwork.

Starting with serious safety problems, we observed 89 such violations total in 558 total site visits. You had one, in 1997. This was a fall protection problem, which can be quite serious. There was also a lead abatement problem in 1997. Since 1997 we saw no serious problems, which is a good sign - keep up the good work.

Hard hat use averaged 83% for all union carpenters over the entire study, and averaged 92% for all formwork. At Company N, the percentage was 99%, second highest in the study, and close enough to 100% that you can feel confident about hard hats. The percentage was 100% in the second half of the study. You can't do better than 100%, so keep up the good work!

Eye protection usage when required was 82% for Company N for the whole time period. Eye protection usage rose from 62% in the first half to 91% in the second half. The overall average for union carpenters in New England is 56%, for formwork alone its 67%. This has to be saving you money - eye injuries are very common. Congratulations!

Your fall protection average was 83% overall, but appears to have gone up over time to 100% at the end. You are above the overall average of 77%, and you appear to now have no serious problems on this. Formwork has an overall average of 77%, the same as the whole carpentry average. Again, this is a wonderful record.

The other two measures are not as useful. Hearing protection was 75% for your workers throughout the study, fourth highest. But this is based on very few times in which it was needed

Company N
Page Two

but not being used. Overall hearing protection is used 22% of the time it is needed, with interior systems work averaging 25%. It is a tough thing for a company to emphasize, as there is no financial payback for you and the guys don't recognize the long-term hazards. But its worth considering.

Ground fault protection was only eye-balled, and so its not a great measure either - many situations could look good but not really be good. Your apparent use of gfci was 100%, compared to a union average of 88% and a formwork average of 87%. Keep up the good work. Finally, I am not sure whether an average of all this matters, but I have made two averages, to give a company a sort of overall score - one averaging all five measures (hard hats, eye protection, hearing protection, and fall protection) and the other without hearing protection. On the overall average, Company N stood at 88% for the whole study - the highest overall average. Excluding hearing protection, Company N had an overall average of 91%, second highest in the study. In the second half of the study, your overall average excluding hearing was 98%, in a three way tie for best. The overall average of all site visits for the whole study was 76% excluding hearing. The overall average for formwork was 80% excluding hearing.

Overall, the safety at Company N improved over the course of time in all measures. You improved by 2% in hard hat compliance, by 44% in eye protection compliance and by 50% in fall protection compliance. This is a great record in safety. I wish you every success in the future both in business and in safety. Please let me know if there is anything else I can help you with. If you want a copy of our report to the government, please let me know that as well.

Thank you again for your participation in this, an important step in protecting the lives of workers.

Yours sincerely,

Ken Halperin
for CPWR

Enclosures

Worksite Checklists Finals by Type Of Work, with averages of Protective Measures

Contractor: Company N

Contractor and Type Of Work: Company N Formwork

Count Of Sites: 17 **Number of Carpenters:** 175

Hardhats: Yes: 124 No: 1 **Percent Of Hardhats Yes:** 99.20%

Eye Compliance: Yes: 103 No: 23 **Percent of Eye Compliance Yes:** 81.75%

Hearing Compliance: Yes: 3 No: 1 **Percent of Hearing Compliance Yes:** 75.00%

Ground Fault Compliance: Yes: 11 No: 0 **Percent of GF Compliance Yes:** 100.00

Fall Protection Compliance: Yes: 5 No: 1 **Percent of FP Compliance Yes:** 83.33%

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

THE CENTER TO PROTECT WORKERS' RIGHTS

EDWARD C. SULLIVAN, PRESIDENT

December 22, 2000

Company O

Dear:

Enclosed is the final report to Company O concerning what we learned about safety practice at your company over the four years of the study. I hope this is helpful to you.

We visited 9 of your sites, and observed 64 carpenters at work. The first attachment reports everything we saw on those visits. The most important things are: serious safety problems, and then the percentages of use of different safety measures - hard hats, eye protection, hearing protection, gfci, and fall protection. At the end of this report there is a section that shows your average experience over the four years. As you probably know, there is a different standard of safety practice in different areas of carpentry. For this reason, there is another attachment which measures your work in each area, which for you is Interior Systems.

Starting with serious safety problems, we observed 89 such violations total in 558 total site visits. We did not see any real violations for you, just a scaffold training needed violation. Fall protection problems are among the most serious of all problems, and I don't mean to downplay the seriousness of the one scaffold problem, but this is a pretty good record on serious violations. Keep up the good work.

Hard hat use averaged 83% for all union carpenters over the entire study, and averaged 82% for all interior work. At Company O, the percentage was 91%. Remarkably, this number reflects a drop over time, from 100% in the first half of the study to 81% in the second half. I hope you will strengthen your efforts in this area.

Eye protection usage when required was 49% for Company O for the whole time period, and went from 80% in the first half to 22% in the second half. The second half number is well below the average for the study of 56%. And you are now below the overall average for interior work of 44.4%. I hope you will choose to reverse this decline.

Your fall protection average was 60% overall. You are below the overall average of 77%. Overall, interior systems work is pretty fall-safe (91%) and it looks like you need to consider strengthening your efforts in this area.

The other two measures are not as useful. Hearing protection was 57% for your workers throughout the study. But this is based on very few times in which it was needed. Overall

Company O
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hearing protection is used 22% of the time it is needed, with interior systems work averaging 25%. It is a tough thing for a company to emphasize, as there is no financial payback for you and the guys don't recognize the long-term hazards. But its worth considering.

Ground fault protection was only eye-balled, and so its not a great measure either - many situations could look good but not really be good. Your apparent use of gfci was 87.5%, compared to a union average of 88% and an interior systems average of 91%. Keep up the good work.

Finally, I am not sure whether an average of all this matters, but I have made two averages, to give a company a sort of overall score - one averaging all five measures (hard hats, eye protection, hearing protection, gfci and fall protection) and the other without hearing protection. On the overall average, Company O stood at 69% for the whole study. BUT, this is an average of 83% in the first half and 61% in the second half, a decline. Excluding hearing protection, Company O had an overall average of 72%, going from 90% in the first half of the study to 61% in the second half. The overall average of all site visits for the whole study was 76% excluding hearing - so you can see that you are below average for all union carpentry firms in all lines of work in New England. The overall average for interior systems was 74% excluding hearing.

Overall, the safety at Company O declined in many measures over the course of time, by 19% in hard hat use, by 72% in eye protection use, and by 40% in fall protection.

I wish you every success in the future both in business and in safety. Please let me know if there is anything else I can help you with. If you want a copy of our report to the government, please let me know that as well.

Thank you again for your participation in this, an important step in protecting the lives of workers.

Yours sincerely,

Ken Halperin
for CPWR

Enclosures

Worksite Checklists Finals by Type Of Work, with averages of Protective Measures

Contractor: Company O

Contractor and Type Of Work: Company O Interior

Count Of Sites: 9 **Number of Carpenters:** 64

Hardhats: Yes: 42 No: 4 **Percent Of Hardhats Yes:** 91.30%

Eye Compliance: Yes: 21 No: 22 **Percent of Eye Compliance Yes:** 48.84%

Hearing Compliance: Yes: 4 No: 3 **Percent of Hearing Compliance Yes:** 57.14%

Ground Fault Compliance: Yes: 7 No: 1 **Percent of GF Compliance Yes:** 87.50%

Fall Protection Compliance: Yes: 3 No: 2 **Percent of FP Compliance Yes:** 60.00%

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

THE CENTER TO PROTECT WORKERS' RIGHTS

EDWARD C. SULLIVAN, PRESIDENT

December 22, 2000

Company P

Dear:

Enclosed is the final report to Company P concerning what we learned about safety practice at your company over the four years of the study. I hope this is helpful to you.

We visited 10 of your sites, and observed 32 carpenters at work. The first attachment reports everything we saw on those visits. The most important things are: serious safety problems, and then the percentages of use of different safety measures - hard hats, eye protection, hearing protection, gfci, and fall protection. At the end of this report there is a section that shows your average experience over the four years. As you probably know, there is a different standard of safety practice in different areas of carpentry. For this reason, there is another attachment which measures your work in each area, which for you is Interior Systems for most of the sites we visited, and form work for two of them. I may have mis-categorized some of the early ones.

Starting with serious safety problems, we observed 89 such violations total in 558 total site visits. We did not see any serious violations for you, making you one of only 4 companies in the study not to have any serious safety problems. Keep up the good work!

Hard hat use averaged 83% for all union carpenters over the entire study, and averaged 82% for all interior work. At Company P, the percentage was 91%. This number reflects a rise over time, from 88% in the first half of the study to 100% in the second half. 100% is a great number; keep up the good work.

Eye protection usage when required was 52% for Company P for the whole time period, and did not change much over time. The average for the study of 56%. The average for interior work is 44.4%, but for form work is 67%.

We saw no sites on which you needed fall protection.

The other two measures are not as useful. Hearing protection was 0% for your workers throughout the study. But this is based on very few times in which it was needed. Overall hearing protection is used 22% of the time it is needed, with interior systems work averaging 25%. It is a tough thing for a company to emphasize, as there is no financial payback for you and the guys don't recognize the long-term hazards. But its worth considering.

Company P

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Ground fault protection was only eye-balled, and so its not a great measure either - many situations could look good but not really be good. Your apparent use of gfci was 100%, compared to a union average of 88% and an interior systems average of 91%. Keep up the good work.

Finally, I am not sure whether an average of all this matters, but I have made two averages, to give a company a sort of overall score - one averaging all five measures (hard hats, eye protection, hearing protection, gfci and fall protection) and the other without hearing protection. On the overall average, Company P stood at 61% for the whole study. Excluding hearing protection, Company P had an overall average of 61%. The overall average of all site visits for the whole study was 76% excluding hearing - so you can see that you are below average for all union carpentry firms in all lines of work in New England. The overall average for interior systems was 74% excluding hearing, and for form work its 81%.

Overall, the safety at Company P did not change much over the course of time, going up by 11% in hard hat use and down by 4% in eye protection use.

I wish you every success in the future both in business and in safety. Please let me know if there is anything else I can help you with. If you want a copy of our report to the government, please let me know that as well.

Thank you again for your participation in this, an important step in protecting the lives of workers.

Yours sincerely,

Ken Halperin
for CPWR

Enclosures

Worksite Checklists Finals by Type Of Work, with averages of Protective Measures

Contractor: Company P

Contractor and Type Of Work: Company P Formwork

Count Of Sites: 2 Number of Carpenters: 4

Hardhats: Yes: 4 No: 0 Percent Of Hardhats Yes: 100.00%

Eye Compliance: Yes: 2 No: 2 Percent of Eye Compliance Yes: 50.00%

Hearing Compliance: Yes: 0 No: 0 Percent of Hearing Compliance Yes: #Num!

Ground Fault Compliance: Yes: 1 No: 0 Percent of GF Compliance Yes: 100.00

Fall Protection Compliance: Yes: 0 No: 0 Percent of FP Compliance Yes: #Num!

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

Contractor and Type Of Work: Company P Interior

Count Of Sites: 8 Number of Carpenters: 28

Hardhats: Yes: 16 No: 2 Percent Of Hardhats Yes: 88.89%

Eye Compliance: Yes: 11 No: 10 Percent of Eye Compliance Yes: 52.38%

Hearing Compliance: Yes: 0 No: 3 Percent of Hearing Compliance Yes: 0.00%

Ground Fault Compliance: Yes: 6 No: 0 Percent of GF Compliance Yes: 100.00

Fall Protection Compliance: Yes: 0 No: 0 Percent of FP Compliance Yes: #Num!

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

December 22, 2000

Company Q

Dear:

Enclosed is the final report to Company Q concerning what we learned about safety practice at your company over the four years of the study. I hope this is helpful to you.

We visited 10 of your sites, and observed 55 carpenters at work. The first attachment reports everything we saw on those visits. The most important things are: serious safety problems, and then the percentages of use of different safety measures - hard hats, eye protection, hearing protection, gfci, and fall protection. At the end of this report there is a section that shows your average experience over the four years. As you probably know, there is a different standard of safety practice in different areas of carpentry. For this reason, there is another attachment which measures your work in each area, which for you is finish work.

Starting with serious safety problems, we observed 89 such violations total in 558 total site visits. Three of them was yours. Two of these were electrical problems in 1997, hopefully those things don't happen to you anymore. The last one was a fall protection exposure at the Providence Mall. While it was someone else's fault, your guys were exposed. Fall protection problems are among the most serious of all problems, and I hope you will continue to be on guard against them.

Hard hat use averaged 83% for all union carpenters over the entire study, but averaged only 56% for finish work. At Company Q, the percentage was 31% - the lowest of all companies in the study. This is low even for your industry (finish carpentry - 56%). But when you look at the second half of all visits, Company Q had a hard hat percent use of 48%, compared to 0% in the first half. This is a major improvement, keep up the good work.

Eye protection usage when required was 46% for Company Q for the whole time period, but went from 60% in the first half to 23% in the second half. The overall average was 56% for union carpenters in the study, and 52% for finish.

Fall protection was at 50% for Company Q for the study. The overall average for union carpenters in the study was 77%, for finish work it was 69%. You rarely get into it, but do take it seriously when you do.

Company Q
Page Two

The other two measures are not as useful. Hearing protection was 0% for your workers throughout the study. But this is based on very few observations. Overall hearing protection is used 22% of the times it is needed, with finish work averaging 15%. It is a tough thing for a company to emphasize, as there is no financial payback for you and the guys don't recognize the long-term hazards. But do think about it.

Ground fault protection was only eye-balled, and so its not a great measure either - many situations could look good but not really be good. Your apparent use of gfci was 100%, compared to a union average of 88% and a finish average of 87%. You can't get better than 100% - congratulations!

Finally, I am not sure whether an average of all this matters, but I have made two averages, to give a company a sort of overall score - one averaging all five measures (hard hats, eye protection, hearing protection, gfci and fall protection) and the other without hearing protection. On the overall average, Company Q stood at 38% for the whole study, second lowest. Excluding hearing protection, Company Q had an overall average of 47%, the second lowest in the study. The overall average of all site visits for the whole study was 76% excluding hearing - so you can see that you are below average for all union carpentry firms in all lines of work in New England. The overall average for finish work was 46% excluding hearing - which means you are on average for your work.

Nevertheless, your improvement in four years is impressive - from 0 to 48% hard hat use, a 89% improvement in eye protection use, and a 50% improvement in fall protection use. I recognize that a lot of finish work may not require hard hats, but all work requires fall safety if needed, and eye protection as well. You are moving in the right direction, keep up the good work.

I wish you every success in the future both in business and in safety. Please let me know if there is anything else I can help you with. If you want a copy of our report to the government, please let me know that as well.

Thank you again for your participation in this, an important step in protecting the lives of workers.

Yours sincerely,

Ken Halperin
for CPWR

Enclosures

Worksite Checklists Finals by Type Of Work, with averages of Protective Measures

Contractor: Company Q

Contractor and Type Of Work: Company Q Finish

Count Of Sites: 10 **Number of Carpenters:** 55

Hardhats: Yes: 15 No: 33 **Percent Of Hardhats Yes:** 31.25%

Eye Compliance: Yes: 23 No: 27 **Percent of Eye Compliance Yes:** 46.00%

Hearing Compliance: Yes: 0 No: 6 **Percent of Hearing Compliance Yes:** 0.00%

Ground Fault Compliance: Yes: 5 No: 3 **Percent of GF Compliance Yes:** 62.50%

Fall Protection Compliance: Yes: 2 No: 2 **Percent of FP Compliance Yes:** 50.00%

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

THE CENTER TO PROTECT WORKERS' RIGHTS

EDWARD C. SULLIVAN, PRESIDENT

December 22, 2000

Company R

Dear:

Enclosed is the final report to Company R concerning what we learned about safety practice at your company over the four years of the study. I hope this is helpful to you.

We visited 10 of your sites, and observed 49 carpenters at work. The first attachment reports everything we saw on those visits. The most important things are: serious safety problems, and then the percentages of use of different safety measures - hard hats, eye protection, hearing protection, gfci, and fall protection. At the end of this report there is a section that shows your average experience over the four years. As you probably know, there is a different standard of safety practice in different areas of carpentry. For this reason, there is another attachment which measures your work in each area, which for you is formwork, heavy and highway, and pile driving. Below, I will concentrate on heavy and highway and formwork.

Starting with serious safety problems, we observed 89 such violations total in 558 total site visits. You had two, in May, 1999. These were fall protection problems, which can be quite serious. I hope you will develop a policy to deal with these.

Hard hat use averaged 83% for all union carpenters over the entire study, and averaged 92% for all formwork and for heavy and highway. At Company R, the percentage was 81%, and did not change over time. Since your pile driving operations were higher than that, this number is higher than your actual form work/heavy hard hat use.

Eye protection usage when required was 86% for Company R for the whole time period. Eye protection usage dropped from 88% in the first half to 84% in the second half. The overall average for union carpenters in New England is 56%, for form work alone its 67%. For heavy and highway its 78%, for pile driving 92%. Eye injuries are very common - your good eye protection record is the best of any company in the study. Congratulations!

Your fall protection average was 0% overall - on every site where you needed it your fall protection effort was inadequate! You are way below the overall average of 77%. Form work has an overall average of 77%, the same as the whole carpentry average.

The other two measures are not as useful. Hearing protection was 83% for your workers throughout the study, third highest. But this is based on very few times in which it was needed,

Company R
Page Two

mostly in pile driving. Overall hearing protection is used 22% of the time it is needed, with interior systems work averaging 25%. It is a tough thing for a company to emphasize, as there is no financial payback for you and the guys don't recognize the long-term hazards.

Ground fault protection was only eye-balled, and so its not a great measure either - many situations could look good but not really be good. Your apparent use of gfci was 100%, compared to a union average of 88% and a form work average of 87%. Keep up the good work!

Finally, I am not sure whether an average of all this matters, but I have made two averages, to give a company a sort of overall score - one averaging all five measures (hard hats, eye protection, hearing protection, gfci and fall protection) and the other without hearing protection. On the overall average, Company R stood at 70% for the whole study - compared to a study-wide average of 65%. Excluding hearing protection, Company R had an overall average of 67%, second highest in the study. The overall average of all site visits for the whole study was 76% excluding hearing. The overall average for form work was 81% excluding hearing; heavy and highway was 79%.

Overall, the safety at Company R declined slightly over the course of time in all measures. You declined by 5% in hard hat compliance, and by 5% in eye protection compliance and stayed at zero for fall protection compliance. While your eye protection record is great, I would like to see you work on the other things as well.

I wish you every success in the future both in business and in safety. Please let me know if there is anything else I can help you with. If you want a copy of our report to the government, please let me know that as well.

Thank you again for your participation in this, an important step in protecting the lives of workers.

Yours sincerely,

Ken Halperin
for CPWR

Enclosures

Worksite Checklists Finals by Type Of Work, with averages of Protective Measures

Contractor: Company R

Contractor and Type Of Work: Company R Formwork

Count Of Sites: 2 Number of Carpenters: 6

Hardhats: Yes: 5 No: 1 Percent Of Hardhats Yes: 83.33%

Eye Compliance: Yes: 5 No: 0 Percent of Eye Compliance Yes: 100.00

Hearing Compliance: Yes: 0 No: 0 Percent of Hearing Compliance Yes: #Num!

Ground Fault Compliance: Yes: 0 No: 0 Percent of GF Compliance Yes: #Num!

Fall Protection Compliance: Yes: 0 No: 1 Percent of FP Compliance Yes: 0.00%

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

Contractor and Type Of Work: Company R HeavyAndHighway

Count Of Sites: 6 Number of Carpenters: 38

Hardhats: Yes: 21 No: 6 Percent Of Hardhats Yes: 77.78%

Eye Compliance: Yes: 22 No: 5 Percent of Eye Compliance Yes: 81.48%

Hearing Compliance: Yes: 17 No: 2 Percent of Hearing Compliance Yes: 89.47%

Ground Fault Compliance: Yes: 2 No: 0 Percent of GF Compliance Yes: 100.00

Fall Protection Compliance: Yes: 0 No: 2 Percent of FP Compliance Yes: 0.00%

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

Contractor and Type Of Work: Company R Pile

Count Of Sites: 2 Number of Carpenters: 5

Hardhats: Yes: 4 No: 0 Percent Of Hardhats Yes: 100.00%

Eye Compliance: Yes: 4 No: 0 Percent of Eye Compliance Yes: 100.00

Hearing Compliance: Yes: 2 No: 2 Percent of Hearing Compliance Yes: 50.00%

Ground Fault Compliance: Yes: 2 No: 0 Percent of GF Compliance Yes: 100.00

Fall Protection Compliance: Yes: 0 No: 0 Percent of FP Compliance Yes: #Num!

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

THE CENTER TO PROTECT WORKERS' RIGHTS

EDWARD C. SULLIVAN, PRESIDENT

December 22, 2000

Company S

Dear:

Enclosed is the final report to Company S concerning what we learned about safety practice at your company over the four years of the study. I hope this is helpful to you.

We visited 12 of your sites, and observed 65 carpenters at work. The first attachment reports everything we saw on those visits. The most important things are: serious safety problems, and then the percentages of use of different safety measures - hard hats, eye protection, hearing protection, gfci, and fall protection. At the end of this report there is a section that shows your average experience over the four years. As you probably know, there is a different standard of safety practice in different areas of carpentry. For this reason, there is another attachment which measures your work in each area, which for you is form work and heavy and highway.

Starting with serious safety problems, we observed 89 such violations total in 558 total site visits. You had two, in 1998. These were ladder and access problems, which can be quite serious. I hope you will develop a policy to deal with these.

Hard hat use averaged 83% for all union carpenters over the entire study, and averaged 92% for all form work and for heavy and highway. At Company S, the percentage was 100%, and did not change over time. You had the only 100% hard hat use record of any company in the study - this is great!

Eye protection usage when required was 76% for Company S for the whole time period. Eye protection usage rose from 59% in the first half to 93% in the second half of the study. The overall average for union carpenters in New England is 56%, for form work alone its 67%. For heavy and highway its 78%. Eye injuries are very common - your good eye protection record should save you money. Keep up the good work.

Your fall protection average was 100% overall - on every site where you needed it your fall protection effort was good. Again, Company S had the only 100% fall protection record of any company in the study. You are way above the overall average of 77%. Form work has an overall average of 77%, the same as the whole carpentry average.

The other two measures are not as useful. Hearing protection was 0% for your workers throughout the study, third highest. But this is based on very few times in which it was needed.

Company S
Page Two

Overall hearing protection is used 22% of the time it is needed, with interior systems work averaging 25%. It is a tough thing for a company to emphasize, as there is no financial payback for you and the guys don't recognize the long-term hazards.

Ground fault protection was only eye-balled, and so its not a great measure either - many situations could look good but not really be good. Your apparent use of gfcı was 100%, compared to a union average of 88% and a form work average of 87%. Keep up the good work!

Finally, I am not sure whether an average of all this matters, but I have made two averages, to give a company a sort of overall score - one averaging all five measures (hard hats, eye protection, hearing protection, gfcı and fall protection) and the other without hearing protection. On the overall average, Company S stood at 75% for the whole study - compared to a study-wide average of 65%. Excluding hearing protection, Company S had an overall average of 94%, the highest in the study. The overall average of all site visits for the whole study was 76% excluding hearing. The overall average for form work was 81% excluding hearing; heavy and highway was 79%.

Overall, the safety at Company S started high, and increased where it could, by 59% in eye protection. This is a great safety record, I hope it is soon reflected in your injury rates as well.

I wish you every success in the future both in business and in safety. Please let me know if there is anything else I can help you with. If you want a copy of our report to the government, please let me know that as well.

Thank you again for your participation in this, an important step in protecting the lives of workers.

Yours sincerely,

Ken Halperin
for CPWR

Enclosures

Worksite Checklists Finals by Type Of Work, with averages of Protective Measures

Contractor: Company S

Contractor and Type Of Work: Company S Formwork

Count Of Sites: 10 **Number of Carpenters:** 49

Hardhats: Yes: 43 No: 0 **Percent Of Hardhats Yes:** 100.00%

Eye Compliance: Yes: 33 No: 10 **Percent of Eye Compliance Yes:** 76.74%

Hearing Compliance: Yes: 0 No: 4 **Percent of Hearing Compliance Yes:** 0.00%

Ground Fault Compliance: Yes: 4 No: 0 **Percent of GF Compliance Yes:** 100.00

Fall Protection Compliance: Yes: 3 No: 0 **Percent of FP Compliance Yes:** 100.00

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

Contractor and Type Of Work: Company S HeavyAndHighway

Count Of Sites: 2 **Number of Carpenters:** 16

Hardhats: Yes: 16 No: 0 **Percent Of Hardhats Yes:** 100.00%

Eye Compliance: Yes: 12 No: 4 **Percent of Eye Compliance Yes:** 75.00%

Hearing Compliance: Yes: 0 No: 3 **Percent of Hearing Compliance Yes:** 0.00%

Ground Fault Compliance: Yes: 2 No: 0 **Percent of GF Compliance Yes:** 100.00

Fall Protection Compliance: Yes: 1 No: 0 **Percent of FP Compliance Yes:** 100.00

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

December 22, 2000

Company T

Dear:

As we discussed on the phone, Company T was observed at work over a four year period as part of a government funded study on carpenter safety.

Enclosed is the final report to Company T concerning what we learned about safety practice at your company over the four years of the study. I hope this is helpful to you.

We visited 15 of your sites, where 209 carpenters were at work. The first attachment reports everything we saw on those visits. The most important things are: serious safety problems, and then the percentages of use of different safety measures - hard hats, eye protection, hearing protection, gfci, and fall protection. At the end of this report there is a section that shows your average experience over the four years. As you probably know, there is a different standard of safety practice in different areas of carpentry. For this reason, there is another attachment which measures your work in each area, which for you is Interior Systems.

Starting with serious safety problems, we observed 89 such violations total in 558 total site visits. I am happy to report that we saw NO serious violations for Company T on any site. This is actually a very remarkable record, only four of the companies that we observed as much as yours had no serious safety problems.

Hard hat use averaged 83% for all union carpenters over the entire study, and averaged 82% for all interior work. At Company T, the percentage was 93% - well above average and the 4th highest in the study. This number improved from 91.7% in the first half of the study to 92.8% at the end. Keep up the good work!

Eye protection usage when required was 33% for Company T for the whole time period, but rose from 27% in the first half to 34% in the second half. Eye injuries are a major problem for carpenters and must be costing you money - you may want to strengthen your efforts in this area.

Your fall protection average was 80% overall. You are right around the overall average of 77%. Overall, interior systems work is pretty fall-safe (91%) and it looks like you are on the low end for drywall companies.

Company T
Page Two

The other two measures are not as useful. Hearing protection was 91% for your workers throughout the study. But this is based on very few times in which it was observed as being needed. Overall hearing protection is used 22% of the time it is needed, with interior systems work averaging 25%. It is a tough thing for a company to emphasize, as there is no financial payback for you and the guys don't recognize the long-term hazards. So it is very nice that your workers are doing well on it - the best of any company in the study.

Ground fault protection was only eye-balled, and so its not a great measure either - many situations could look good but not really be good. Your apparent use of gfci was 100%, compared to a union average of 88% and an interior systems average of 91%. 100% is of course a very nice number, I hope that it reflects the actual electrical safety of your company.

Finally, I am not sure whether an average of all this matters, but I have made two averages, to give a company a sort of overall score - one averaging all five measures (hard hats, eye protection, hearing protection, gfci and fall protection) and the other without hearing protection. On the overall average, Company T stood at 79% for the whole study. This is an average did not change over time. Excluding hearing protection, Company T had an overall average of 77%, again effectively unchanged over time. The overall average of all site visits for the whole study was 76% excluding hearing - so you can see that you are at the average for all union carpentry firms in all lines of work in New England. The overall average for interior systems was 74% excluding hearing, and you were just above that.

Overall, the safety at Company T improved overall over the course of time, by 1% in hard hat compliance, and by 26% in eye protection compliance, but fell 20% in fall protection compliance. It is a good solid safety record of which you can be proud, and you can strengthen it by a stronger policy in eye protection and fall protection. I wish you every success in the future both in business and in safety. Please let me know if there is anything else I can help you with. If you want a copy of our report to the government, please let me know that as well.

Thank you again for your participation in this, an important step in protecting the lives of workers.

Yours sincerely,

Ken Halperin
for CPWR

Enclosures

Worksite Checklists Finals by Type Of Work, with averages of Protective Measures

Contractor: Company T

Contractor and Type Of Work: Company T Interior

Count Of Sites: 15 **Number of Carpenters:** 209

Hardhats: Yes: 88 No: 7 **Percent Of Hardhats Yes:** 92.63%

Eye Compliance: Yes: 28 No: 56 **Percent of Eye Compliance Yes:** 33.33%

Hearing Compliance: Yes: 10 No: 1 **Percent of Hearing Compliance Yes:** 90.91%

Ground Fault Compliance: Yes: 13 No: 0 **Percent of GF Compliance Yes:** 100.00

Fall Protection Compliance: Yes: 4 No: 1 **Percent of FP Compliance Yes:** 80.00%

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

THE CENTER TO PROTECT WORKERS' RIGHTS

EDWARD C. SULLIVAN, PRESIDENT

December 22, 2000

Company U

Dear:

Enclosed is the final report to Company U concerning what we learned about safety practice at your company over the four years of the study. I hope this is helpful to you.

We visited 14 of your sites, and observed 44 carpenters at work. The first attachment reports everything we saw on those visits. The most important things are: serious safety problems, and then the percentages of use of different safety measures - hard hats, eye protection, hearing protection, gfci, and fall protection. At the end of this report there is a section that shows your average experience over the four years. As you probably know, there is a different standard of safety practice in different areas of carpentry. For this reason, there is another attachment which measures your work in each area, which for you is form work and heavy and highway.

Starting with serious safety problems, we observed 89 such violations total in 558 total site visits. You had four, all in 1997. These were mostly scaffolding problems, which can be quite serious. The fact that you have had no serious fall protection problems since then leads me to hope you have developed a policy to deal with these, and are insisting on it.

Hard hat use averaged 83% for all union carpenters over the entire study, and averaged 92% for all form work and for heavy and highway. At Company U, the percentage was 76%, going from 70% in the first half of the study to 84% in the second half. This is a good improvement, but you still have a ways to go to reach the levels of your industry.

Eye protection usage when required was 48% for Company U for the whole time period. Eye protection usage fell from 60% in the first half to 31% in the second half of the study. The overall average for union carpenters in New England is 56%, for form work alone its 67%. For heavy and highway its 78%. Eye injuries are very common - a good eye protection policy would save you money.

Your fall protection average was 43% overall - but went up to 67% in the second half of the study. There is still room for improvement: form work has an overall average of 77%, the same as the whole carpentry average.

The other two measures are not as useful. We had no observations of your workers being in situations where they needed hearing protection. Overall hearing protection is used 22% of the

Company U
Page Two

time it is needed, with interior systems work averaging 25%. It is a tough thing for a company to emphasize, as there is no financial payback for you and the guys don't recognize the long-term hazards.

Ground fault protection was only eye-balled, and so its not a great measure either - many situations could look good but not really be good. Your apparent use of gfci was 56%, compared to a union average of 88% and a form work average of 87%. This could be improved.

Finally, I am not sure whether an average of all this matters, but I have made two averages, to give a company a sort of overall score - one averaging all five measures (hard hats, eye protection, hearing protection, gfci and fall protection) and the other without hearing protection. On the overall average, Company U stood at 56% for the whole study - compared to a study-wide average of 65%. Excluding hearing protection, Company U had an overall average of 56%, the highest in the study. The overall average of all site visits for the whole study was 76% excluding hearing. The overall average for form work was 81% excluding hearing; heavy and highway was 79%.

Overall, the safety at Company U could be better. Your use of hard hats improved by 21%, but your use of eye protection fell 49% and your gfci use declined 33%. I hope you will make safety a higher priority.

I wish you every success in the future both in business and in safety. Please let me know if there is anything else I can help you with. If you want a copy of our report to the government, please let me know that as well.

Thank you again for your participation in this, an important step in protecting the lives of workers.

Yours sincerely,

Ken Halperin
for CPWR

Enclosures

Worksite Checklists Finals by Type Of Work, with averages of Protective Measures

Contractor: Company U

Contractor and Type Of Work: Company U Formwork

Count Of Sites: 3 **Number of Carpenters:** 11

Hardhats: Yes: 12 No: 3 **Percent Of Hardhats Yes:** 80.00%

Eye Compliance: Yes: 2 No: 2 **Percent of Eye Compliance Yes:** 50.00%

Hearing Compliance: Yes: 0 No: 0 **Percent of Hearing Compliance Yes:** #Num!

Ground Fault Compliance: Yes: 2 No: 0 **Percent of GF Compliance Yes:** 100.00

Fall Protection Compliance: Yes: 0 No: 0 **Percent of FP Compliance Yes:** #Num!

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

Contractor and Type Of Work: Company U HeavyAndHighway

Count Of Sites: 11 **Number of Carpenters:** 33

Hardhats: Yes: 20 No: 7 **Percent Of Hardhats Yes:** 74.07%

Eye Compliance: Yes: 14 No: 15 **Percent of Eye Compliance Yes:** 48.28%

Hearing Compliance: Yes: 0 No: 0 **Percent of Hearing Compliance Yes:** #Num!

Ground Fault Compliance: Yes: 3 No: 4 **Percent of GF Compliance Yes:** 42.86%

Fall Protection Compliance: Yes: 3 No: 4 **Percent of FP Compliance Yes:** 42.86%

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

THE CENTER TO PROTECT WORKERS' RIGHTS

EDWARD C. SULLIVAN, PRESIDENT

December 22, 2000

Company V

Dear:

Enclosed is the final report to Company V concerning what we learned about safety practice at your company over the four years of the study. I hope this is helpful to you.

We visited 11 of your sites, and observed 43 carpenters at work. The first attachment reports everything we saw on those visits. The most important things are: serious safety problems, and then the percentages of use of different safety measures - hard hats, eye protection, hearing protection, gfcis, and fall protection. At the end of this report there is a section that shows your average experience over the four years. As you probably know, there is a different standard of safety practice in different areas of carpentry. For this reason, there is another attachment which measures your work in each area, which for you includes a few different areas. I categorized most of your sites as interior systems, but may have mis-categorized some, especially early on.

Starting with serious safety problems, we observed 89 such violations total in 558 total site visits. We did not see any serious violations for you. You are one of only four companies in the study to have no serious problems during the site visits - a great record. Keep up the good work.

Hard hat use averaged 83% for all union carpenters over the entire study, and averaged 82% for all interior work. At Company V, the percentage was 54%. Remarkably, this number reflects a huge rise over time, from 7% in the first half of the study to 94% in the second half. Keep up the good work!

Eye protection usage when required was 72% for Company V for the whole time period, and went from 62% in the first half to 83% in the second half. The second half number is well above the average for the study of 56%. And you are now way above the overall average for interior work of 44.4%. I hope you will continue to do this well on eye protection.

We observed no sites where you needed fall protection. The overall average of fall protection at union carpenter sites in the study was 77%. Overall, interior systems work is pretty fall-safe (91%). I am sure you occasionally do need to consider fall protection, and hope you take it as seriously as you are now taking other areas of safety.

The other two measures are not as useful. Hearing protection was 91% for your workers throughout the study. But this is based on very few times in which it was needed. Overall

Company V
Page Two

hearing protection is used 22% of the time it is needed, with interior systems work averaging 25%. It is a tough thing for a company to emphasize, as there is no financial payback for you and the guys don't recognize the long-term hazards. So it is nice that your guys are doing well on it. Your hearing protection record is the highest in the study.

Ground fault protection was only eye-balled, and so its not a great measure either - many situations could look good but not really be good. Your apparent use of gfci was 100%, compared to a union average of 88% and an interior systems average of 91%. You can't beat 100%: keep up the good work.

Finally, I am not sure whether an average of all this matters, but I have made two averages, to give a company a sort of overall score - one averaging all five measures (hard hats, eye protection, hearing protection, gfci and fall protection) and the other without hearing protection. On the overall average, Company V stood at 79% for the whole study. BUT, this is an average of 56% in the first half and 92.5% in the second half, a fine increase and now the fourth highest in the study. Excluding hearing protection, Company V had an overall average of 56%, going from 44% in the first half of the study to 92.5% in the second half. The overall average of all site visits for the whole study was 76% excluding hearing - so you can see that you are now above average for all union carpentry firms in all lines of work in New England. The overall average for interior systems was 74% excluding hearing.

Overall, the safety at Company V improved dramatically in every measure over the course of time, by 1217% (!!) in hard hat use, and by 35% in eye protection use. This is a record to be proud of.

I wish you every success in the future both in business and in safety. Please let me know if there is anything else I can help you with. If you want a copy of our report to the government, please let me know that as well.

Thank you again for your participation in this, an important step in protecting the lives of workers.

Yours sincerely,

Ken Halperin
for CPWR

Enclosures

Worksite Checklists Finals by Type Of Work, with averages of Protective Measures

Contractor: Company V

Contractor and Type Of Work: Company V Finish

Count Of Sites: 1 Number of Carpenters: 7

Hardhats: Yes: 5 No: 0 Percent Of Hardhats Yes: 100.00%

Eye Compliance: Yes: 1 No: 0 Percent of Eye Compliance Yes: 100.00

Hearing Compliance: Yes: 0 No: 0 Percent of Hearing Compliance Yes: #Num!

Ground Fault Compliance: Yes: 1 No: 0 Percent of GF Compliance Yes: 100.00

Fall Protection Compliance: Yes: 0 No: 0 Percent of FP Compliance Yes: #Num!

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

Contractor and Type Of Work: Company V Interior

Count Of Sites: 9 Number of Carpenters: 33

Hardhats: Yes: 10 No: 13 Percent Of Hardhats Yes: 43.48%

Eye Compliance: Yes: 15 No: 7 Percent of Eye Compliance Yes: 68.18%

Hearing Compliance: Yes: 10 No: 1 Percent of Hearing Compliance Yes: 90.91%

Ground Fault Compliance: Yes: 8 No: 0 Percent of GF Compliance Yes: 100.00

Fall Protection Compliance: Yes: 0 No: 0 Percent of FP Compliance Yes: #Num!

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

Contractor and Type Of Work: Company V Renovation

Count Of Sites: 1 Number of Carpenters: 3

Hardhats: Yes: 2 No: 1 Percent Of Hardhats Yes: 66.67%

Eye Compliance: Yes: 2 No: 0 Percent of Eye Compliance Yes: 100.00

Hearing Compliance: Yes: 0 No: 0 Percent of Hearing Compliance Yes: #Num!

Ground Fault Compliance: Yes: 1 No: 0 Percent of GF Compliance Yes: 100.00

Fall Protection Compliance: Yes: 0 No: 0 Percent of FP Compliance Yes: #Num!

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

December 22, 2000

Company W

Dear:

Enclosed is the final report to Company W concerning what we learned about safety practice at your company over the four years of the study. I hope this is helpful to you.

We visited 12 of your sites, and observed 118 carpenters at work. The first attachment reports everything we saw on those visits. The most important things are: serious safety problems, and then the percentages of use of different safety measures - hard hats, eye protection, hearing protection, gfci, and fall protection. At the end of this report there is a section that shows your average experience over the four years. As you probably know, there is a different standard of safety practice in different areas of carpentry. For this reason, there is another attachment which measures your work in each area, which for you is finish work, except for two form work jobs in the last half of the study.

Starting with serious safety problems, we observed 89 such violations total in 558 total site visits. Two of them was yours. One of these was a housekeeping problem that you happened to be exposed to at Pequot. The other was your own foreman acting without proper fall protection on one of the form work jobs, in July 2000. Fall protection problems are among the most serious of all problems, and I hope you will continue to be on guard against them.

Hard hat use averaged 83% for all union carpenters over the entire study, but averaged only 56% for finish work, as opposed to 92% for form work. At Company W, the percentage was 83% - very high for finish. Your form work average was even higher. Overall, you went from 72% in the first half of the study to 95% in the second half. This is a major improvement, keep up the good work.

Eye protection usage when required was 77% for Company W for the whole time period, but went from 47% in the first half to 100% in the second half. The overall average was 56% for union carpenters in the study, and 52% for finish, and 67% for form work. So you are doing extremely well on eye protection by any standard.

Fall protection was at 83% for Company W for the study. The overall average for union carpenters in the study was 77%, for finish work it was 69%, and for form

Company W

Page Two

work it was 77%. So your record on this score was very good overall. But it fell over time, from 100% in the first half of the study to 75% in the second half.

The other two measures are not as useful. Hearing protection was 0% for your workers throughout the study. But this is based on very few observations. Overall hearing protection is used 22% of the times it is needed, with finish work averaging 15%. It is a tough thing for a company to emphasize, as there is no financial payback for you and the guys don't recognize the long-term hazards. But do think about it.

Ground fault protection was only eye-balled, and so its not a great measure either - many situations could look good but not really be good. Your apparent use of gfci was 100%, compared to a union average of 88% and a finish average of 87%. You can't get better than 100% - congratulations!

Finally, I am not sure whether an average of all this matters, but I have made two averages, to give a company a sort of overall score - one averaging all five measures (hard hats, eye protection, hearing protection, gfci and fall protection) and the other without hearing protection. On the overall average, Company W stood at 69% for the whole study, just above the overall union average of 65%. Excluding hearing protection, Company W had an overall average of 86% - fifth highest in the study. The overall average of all site visits for the whole study was 76% excluding hearing - so you can see that you are above average for all union carpentry firms in all lines of work in New England. The overall average for finish work was 46% excluding hearing - which means you are way above average for your work. The overall average for form work excluding hearing was 66%. Your average excluding hearing went from 80% in the first half of the study to 93% in the second half.

Overall, your improvement in four years is impressive - 32% in hard hat use, 112.5% improvement in eye protection use, and a slight drop in fall protection use. You are moving in the right direction, keep up the good work!

I wish you every success in the future both in business and in safety. Please let me know if there is anything else I can help you with. If you want a copy of our report to the government, please let me know that as well.

Thank you again for your participation in this, an important step in protecting the lives of workers.

Yours sincerely,

Ken Halperin
for CPWR

Enclosures

Worksite Checklists Finals by Type Of Work, with averages of Protective Measures

Contractor: Company W

Contractor and Type Of Work: Company W Finish

Count Of Sites: 10 **Number of Carpenters:** 100

Hardhats: Yes: 59 No: 14 **Percent Of Hardhats Yes:** 80.82%

Eye Compliance: Yes: 47 No: 18 **Percent of Eye Compliance Yes:** 72.31%

Hearing Compliance: Yes: 0 No: 9 **Percent of Hearing Compliance Yes:** 0.00%

Ground Fault Compliance: Yes: 10 No: 0 **Percent of GF Compliance Yes:** 100.00

Fall Protection Compliance: Yes: 4 No: 1 **Percent of FP Compliance Yes:** 80.00%

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

Contractor and Type Of Work: Company W Formwork

Count Of Sites: 2 **Number of Carpenters:** 18

Hardhats: Yes: 14 No: 0 **Percent Of Hardhats Yes:** 100.00%

Eye Compliance: Yes: 14 No: 0 **Percent of Eye Compliance Yes:** 100.00

Hearing Compliance: Yes: 0 No: 0 **Percent of Hearing Compliance Yes:** #Num!

Ground Fault Compliance: Yes: 1 No: 0 **Percent of GF Compliance Yes:** 100.00

Fall Protection Compliance: Yes: 1 No: 0 **Percent of FP Compliance Yes:** 100.00

Hardhats are for all carpenters. Eye and Hearing are percents of carpenters judged to need them.

Ground fault and fall protection are evaluated by site: either the site had proper fall protection or it did not.

Appendix 3 - Statistical and Economic Report

by Jeffrey Waddoups

Safe Work Practices on Construction Sites: A Study of
Small Union Carpentry Firms in New England

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The report was sponsored by The Center to Protect Workers' Rights, a research center of the Building and Construction Trades Department of the AFL-CIO and funded through a grant from the National Institute of Occupational Safety and Health. The findings and conclusions are my own and do not necessarily represent the views of The Center to Protect Workers Rights or the National Institute of Occupational Health and Safety. I would also like to acknowledge the invaluable assistance and insights of Ken Halperin of The Center to Protect Workers' Rights.

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Abstract

The Center to Protect Workers' Rights (CPWR) of the Building and Construction Trades Department of the AFL-CIO in cooperation with the National Institute of Occupational Safety and Health (NIOSH) introduced a safety program to 21 small contractors who employ union carpenters in the New England Area (Massachusetts, Rhode Island, and Connecticut). After the program was introduced, officials from the CPWR inspected participating contractors' construction sites over a three year period. During the same period, inspectors also observed construction sites of nonparticipating contractors who employed union carpenters. Data were gathered on the necessity and incidence of safe work practices such as fall protection, hard hat usage, eye protection, proper housekeeping procedures, proper ground fault (GF) procedures, and hearing protection, along with other characteristics, of 542 construction sites.

The aim of the NIOSH/CPWR study was to determine if the safety program affected the observed incidence of safe work practices among the carpenters employed by the participating contractors. The overall results revealed no statistically significant difference in safe work practices of carpenters employed by participating contractors compared to their counterparts employed by those not participating. Other notable findings suggested a trend of less compliance with fall protection guidelines in the winter months and a higher probability of compliance during periods of more unemployment in the regions. Hard hats were more likely to be worn if a formal safety plan was located on the site -- perhaps a proxy of how conscientious the contractors followed the safety plan -- and proper eye protection procedures were more likely to be observed when the carpenter foremen had received OSHA training and unemployment rates were higher than average. The analysis also discovered substantial heterogeneity between contractors with

respect to the six safety practices, implying that managements' safety policies and/or attitudes toward safe work must be seriously addressed if safety improvements are to occur on construction sites. Finally, the ancillary surveys of foremen and carpenters cast doubt on the degree to which important elements of the safety plan were adopted by participating contractors. Such findings may explain the findings of similar safety behaviors between the study and the control groups.

Executive Summary

The Center to Protect Workers' Rights (CPWR) of the Construction and Building Trades Department of the AFL-CIO in cooperation with the National Institute for Occupational Health and Safety (NIOSH) designed a safety program and introduced it to 21 unionized contractors who employed carpenters on construction sites in Massachusetts, Rhode Island, and Connecticut. The program consisted of a number of procedures to increase workplace safety. Among the procedures were 1) regular safety meetings, which were meant to facilitate discussion of safety hazards and raise the safety consciousness of workers and employers; 2) an inspection procedure to find and eliminate safety hazards; 3) procedures to provide first aid to a worker if an injury occurs, and, if required, to contact emergency professionals; and 4) an injury reporting procedure listing the cause or causes of an accident so that similar incidents could be prevented in the future.

To assess the effectiveness of the safety program, the participating contractors allowed periodic inspections of their work sites by CPWR officials between 1997-2000. Inspectors from the CPWR gathered data on the incidences of safe work practices among carpenters and other pertinent information about the construction sites. Inspectors also gathered identical data from visits to nonparticipating unionized contractors' sites over the same period. The data on carpenters employed by nonparticipating contractors and their construction sites formed a control group for comparison purposes.

The aim of the study was to determine if the work practices of carpenters employed by contractors participating in the safety program were significantly different than practices of carpenters employed by nonparticipating contractors. All contractors in both groups employed

union carpenters, thus the focus was not on differences in safety in union and nonunion settings. Multivariate statistical analysis revealed that work practices of the study group were not safer than work practices of contractors in the control group. One important exception, however, suggests that if contractors had a plan on site (perhaps a proxy for how conscientiously the plan was being implemented) there was a significantly higher probability of observing proper hard hat usage on the site.

In spite of the disappointing results on the safety plan's overall effectiveness, analysis of the data gathered during the site visits revealed patterns of safety behavior that may be useful to union leaders, government policy makers, contractors, and safety professionals. The data included observations of six specific work practices under the categories of fall protection procedures, hard hat usage, use of eye protection equipment, proper housekeeping procedures, proper ground fault (GF) procedures to prevent exposure to electrical current, and proper use of hearing protection devices.

Protection against Falls from Elevation

Results of multivariate analysis demonstrate a significant increase in appropriate fall protection measures over time. Given that fall protection was necessary at the site, observation during the 12th month yielded a probability of 45 percent that compliance would be observed. A similar inspection in the 36th month was accompanied by an 87 percent probability of compliance. Similarly, substantially more fall protection measures were observed during the Spring, Summer and Fall months, when the probabilities of observing proper procedures moved from 48 percent in the first quarter (January-March) to 75 percent, 78 percent, and 89 percent,

respectively, during the remaining three quarters. In addition, as the unemployment rate fell, so did the probability of observing proper fall protection procedures. It appears as if contractors and workers in a booming construction economy were willing to cut corners on fall protection in the face of economic pressures. When the unemployment rate was 4.2 percent, the predicted probability of observing proper fall protection was 62 percent, but increased to 85 percent with an unemployment rate of 5.2 percent.

Hard Hat Compliance

The analysis of hard hat usage demonstrates that carpenters working on larger sites, as measured by the number of carpenters on site and the number of other workers on the site, were more likely to wear hard hats. In addition, carpenters on sites who were performing finish work were substantially less likely than their counterparts on other types of sites to wear hard hats. The probability of substantial hard hat usage on finish sites was only 46 percent compared to probabilities in the 70 to 80 percent range for formwork, interior, wood framing, and heavy and highway sites. A variable that may proxy the conscientiousness with which the plan was adopted by a contractor in the study group -- whether a copy of the plan was on the site -- was positively correlated with hard hat usage. If a safety plan was located on the site, the probability of observing substantial compliance with hard hat usage was 84 percent compared to 71 percent if the plan was not on the site.

Eye Protection

The analysis of eye protection procedures revealed a strong positive correlation between the OSHA training of the carpenter foreman and use of eye protection. If a given foreman was not trained, the predicted probability of observing compliance was 30 percent, but the probability increased to 50 percent if the foreman had received OSHA training. It also appears the construction sites in Rhode Island were relatively lax with respect to eye protection compared to the other two states. As with fall protection, eye protection procedures were substantially less likely to be observed in the winter months and during a booming economy. When the unemployment rate was 4.2 percent, the predicted probability of observing proper eye protection among carpenters reached a mere 25 percent. At a higher rate of unemployment, 5.2 percent, the probability rose to 49 percent.

Housekeeping

The inspectors found that approximately 79 percent of the sites maintain generally good or excellent housekeeping. The multivariate statistical models were particularly uninformative about the determinants of proper housekeeping. Most of the statistically significant results were on company specific control variables. It appears as if housekeeping procedures, more than the previous safety behaviors discussed, were governed by company specific policies.

GF Compliance

A vast majority (approximately 90 percent) of the sites inspected were judged to be in compliance with GF standards or were at a stage in the project where GF procedures were not

relevant. The model that predicts the probability of GF compliance revealed that having a safety plan on site was a significant positive determinant of compliance, but the impact on the predicted probability remained relatively small (an increase from .90 to .97). A particularly large number of companies in the control group exhibited high levels of compliance along this dimension of safety.

Hearing Protection

Approximately 85 percent of work sites exhibited either proper hearing protection procedures or were at a stage in the process where hearing protection was not necessary. Sites on which large carpenter crews were working tended to exhibit a lower probability of being working in a hearing-safe manner. The predicted probability for a site with a hypothetical 20 carpenters was .80, but declined to .66 when 40 carpenters were on the site.

Company Specific Effects

Lapses in health and safety procedures are not uniformly distributed across companies in for which company specific effects could be determined. About one-third of contractors were not implicated at all with lapses in safe work practices among its carpenters. At one extreme two contractors had negative marks in three of the six categories, while at the other extreme, three companies had multiple positive marks for the safety behaviors with no negatives recorded. Thus firms' emphasis on safety behaviors appeared to be an important determinant of safety behaviors on the construction sites inspected.

The Degree to which the NIOSH/CPWR Safety Plan was Implemented

Although being a member of the study group itself did not appear to be particularly effective in changing carpenters' safe work practices relative to carpenters employed by companies in the control group, a question remains about whether important elements of the plan were implemented. Results from the Foremen's and Workers' Surveys suggest that one important element of the plan, the weekly safety meetings, was not implemented by most of the contractors. If important elements of the plan were not implemented, perhaps it is not surprising that safety behaviors of the study and control groups were virtually indistinguishable. Thus further investigation into the level of implementation on the part of the participating contractors is indicated. If further research shows that the plan was unworkable in practice, perhaps a more user-friendly health and safety plan could be devised based on the results of the investigation.

Introduction

On-the-job accidents kill workers at a greater rate in the U.S. construction industry than in most other industries according to data from the Bureau of Labor Statistics (BLS). With a rate of 14.7 deaths per 100,000 workers, the construction industry's fatality rate was exceeded only by mining and agriculture in 1995 (The Center to Protect Workers Rights (CPWR), 1997, pg. 28). In New England alone, accidents on the job killed 39 construction workers in 1998. In fact, the fatality rates in the construction industry were higher than in any other industry in New England during five of the six years that preceded 1998 (BLS, 1999a).

Compared to workers in other industries, construction workers also disproportionately suffered from nonfatal accidents on the job. The accident rate in construction across the U.S. was second highest of all industries at 9.5 per 100 workers, just below manufacturing's 10.5 per 100 workers (BLS, 1999b). Work related accidents or illnesses that were severe enough for workers to lose work days occurred at a rate of 4.4 per 100 full time equivalent workers in the construction sector, and averaged a slightly lower rate of 4.1 percent in the states of Massachusetts, Rhode Island, and Connecticut, the states in New England where the study was conducted (BLS, 1999b).

In contrast to the relatively high risk of fatal and nonfatal diseases and injuries suffered by construction workers in the U.S., their counterparts in many other advanced industrialized countries tend to face less risk of injury or death on the job. For example, in a study that compared death rates of construction workers from accidents on the job in different countries, researchers found The Netherlands' on the job fatality rate was only 3.3 deaths per 100,000 workers, while Sweden's and Canada's construction workers were killed at rates of only 6 and

7.4 per 100,000 workers, respectively. Over the same period in the U.S., a substantially higher 18.6 workers per 100,000 were killed on construction sites (CPWR, 1997, pg 28).¹

High rates of fatality in the U.S. construction industry compared to other advanced industrialized countries should be of particular concern to construction firms, government policy makers, building and construction trades unions, and construction workers. At the very least, the relatively high death rates suggest that the current level of risk faced by U.S. workers is not just inherent in construction work itself, but likely originates from the way in which the construction industry in the U.S. is organized. An organization with a particular set of institutional, socio-economic, and political factors unique to the U.S., which interact to make construction sites here some of the most dangerous in the industrialized world. The fact that inordinately dangerous jobs exist in the U.S. construction industry presents a pressing challenge for policy makers and researchers to search for and eliminate causes of the inordinately high fatality and injury rates plaguing U.S. construction sites.

The present study is part of such an effort. In particular, the CPWR with financial support from the National Institute of Occupational Safety and Health (NIOSH) established a health and safety plan for carpenters. The effectiveness of the NIOSH/CPWR plan was tested in a three year experiment conducted in Connecticut, Massachusetts, and Rhode Island with the cooperation of 21 small union carpentry contractors and the New England Building Trades Regional Council. The safety intervention was an attempt to establish a process that, if followed, may increase the incidence of safe work practices and reduce the number and severity of accidents and injuries on construction sites. It relies on the notion that norms of safe work can be

¹Compare the higher rate in 1992 cited here with the lower rate in 1995 mentioned above.

improved if they are lacking, maintained if they currently exist, and raised, if managers and workers incorporate the suggested guidelines into their work routines. Furthermore, the fact that the safety plan has been accepted by the contractor, is sponsored by the union, and supported by NIOSH (a government agency) is meant to communicate to all parties concerned that safe work practices are a serious concern emanating from multiple sources.

Presumably, an increase in the incidence of safe work practices will accompany a reduction in the incidence of injuries and/or fatalities on the job. Several safe work practices were observed among carpenters on construction sites. The practices fall under six categories: 1) fall protection, 2) hard hat usage, 3) use of eye protection equipment, 4) proper housekeeping, 5) use of appropriate GF procedures to prevent exposure to electrical current, and 6) hearing protection. Although the list certainly does not contain all safety practices relevant to carpentry, it nevertheless provides a manageable cross-section of safe work safe work practices conveniently observable for the purposes of the study.

The six categories of safe work also do not contribute equally to the risks faced by construction workers in general and carpenters in particular. For example, falls from elevation were responsible for 32.1 percent of construction fatalities and 19.1 percent of nonfatal injuries in 1994, which makes falls of particular concern (CPWR, 1997, pg. 31). Two other categories "Contact" and "Exposure" represent another 17.8 percent and 17.9 percent of fatalities and 33.3 percent and 4.5 percent of nonfatal injuries. For example, research on eye injuries among construction workers has demonstrated that approximately 10,600 lost day injuries can be attributed to eye injuries (CPWR, 1998). Such research suggests that the proper use of hard hats, eye protection, and proper ground fault (GF) procedures to prevent electrocution are important

safety behaviors to encourage if construction sites are to be made safer (CPWR, 1997, pg. 31).² And while destructive noise levels on construction sites rarely are implicated in acute injuries that lead to lost work days or fatalities, constant exposure to extreme noises often robs long time construction workers of normal hearing.³ Finally, falls on the same level and slips and trips made up 11.5 percent of lost work day injuries among construction workers, at least some of which could have been avoided by proper housekeeping procedures (CPWR, 1997, pg. 33).

In the remainder of the report, I will briefly sketch how the organization of the construction industry may contribute to what appears to be inordinately hazardous working conditions on constructions sites in the U.S. I will then describe the NIOSH/CPWR safety intervention program in more detail and outline the methodology employed to gather data used to assess the impact of the program. Next, the data will be analyzed, followed by an interpretation of the results and their implications for policy and further research.

Organization of the Construction Industry: A Challenge to Health and Safety

The nature of construction work guarantees that workers will face some risk of injury or fatality on the job. Construction workers often operate, or work in close proximity to, large

²It must be clarified that simply wearing a hard hat or eye protection will not necessarily protect a worker from all accidents classified in the "Contact" category. Although, the Occupational Safety and Health Administration (OSHA) compiled data that unmistakably relates the incidence of head injuries to the lack of hard hat usage. The study indicates that hard hats were worn by only 16 percent of workers who sustained head injuries, while 40 percent of workers who suffered head injuries were not wearing hard hats, but were injured in locations where hard hats should have been worn (U.S. Department of Labor, 2000).

³A study of the Swedish construction workers indicated that only 10 percent had normal hearing in both ears by the time they had reached 50 years of age. Construction workers in British Columbia had also suffered significant hearing loss after 16-25 years on the job.

machinery, manipulate heavy materials, and use potentially dangerous power tools to construct commercial and residential buildings, highways, bridges, tunnels, and other structures. They also work with hazardous materials, in confined spaces, and at high elevations, which expose them to still additional risk.

Besides the nature of the work itself, institutional and organizational factors that characterize the industry have a negative impact on safety.⁴ Construction work is allocated among contractors through a highly competitive bidding process and pervasive use of subcontracting.⁵ Construction work is organized such that several contractors submit bids on a given construction project, while only one bidder obtains the job. The general contractor who wins the bid then usually contracts many -- sometimes all -- of the major portions of the job to subcontractors. Thus even during prosperous times, the uncertainties of the bidding process and the short term nature of many construction projects create a highly variable demand for labor for any given construction firm, which necessarily creates a casual relationship between firms and most of their employees. The casual relationships between firms and workers accompanied by work skills that are not firm specific give individual firms little economic incentive to invest in training its workers in either work skills or techniques of safe work practices.

⁴ Dorman (1996) provides a useful theoretical framework and institutional analysis of how safety is produced at work in general. His views contrast with the mainstream economic analysis contained in works such as Smith (1979) and Viscusi (1992). See also Rebitzer (1995) and Dwyer (1991) for studies of how institutional and organizational factors affect job safety outside the construction sector.

⁵ Allen (1994) and Grob (1999) provide useful and succinct descriptions of the organization of work in the construction industry.

Furthermore, owners often hold general contractors to strict time lines for completion of projects, time lines which are passed on to subcontractors. Especially during periods of economic prosperity, when projects are plentiful and unemployment rates low, time pressures increase for contractors, subcontractors, and workers. Contractors must meet deadlines to avoid financial penalties for late work and to avoid high costs of credit. Workers must work while the jobs are available, which often means overtime and accompanying fatigue on the job. Fatigued workers toiling under time pressures are more prone to accidents. Moreover, when labor markets are tight, employers may resort to using less skilled and less experienced workers who are also likely to be more accident prone than their more skilled counterparts. Under such conditions, construction sites can be hazardous places to work.

Creating the institutional and legal environment conducive to safer working conditions on construction sites has been one of the goals of building and construction trades unions and government agencies like the Occupational Health and Safety Administration (OSHA) and NIOSH. In fact, one branch of economic theory offers solid intellectual support for collective action that takes the form of institutional and legal intervention to create safer workplaces. Freeman and Medoff (1984) recognized that working conditions, such as safety and health conditions on construction sites, are usefully understood as public goods. As such, without some form of collective action, health and safety on the job likely would be produced at less than socially optimal levels and that such suboptimal conditions may persist indefinitely.⁶

⁶Another branch of economic theory suggests that under conditions in which workers face costless entry and exit into an occupation or employment with a given firm and are armed with complete knowledge of the risks associated with his or her employment options, firms would produce the optimal amount of safety to attract a labor force with wages that just compensate workers for bearing any given level of risk (Smith, 1979; Viscusi, 1992). Empirical evidence

The NIOSH/CPWR Health and Safety Plan

Because it is highly unrealistic to expect the labor market for construction workers to create an economically and socially optimal level of safety on construction sites, unions and government agencies have intervened through collective bargaining contracts, safety training, laws, regulations, and promulgation of potential safety hazards on work sites and safe work practices. Along such lines, NIOSH and the CPWR established and sponsored the experimental safety program, the assessment of which is the subject of the present report. The NIOSH/CPWR plan consists of a number of steps meant to increase the incidence of safe work practices on construction sites.

The program includes, 1) Selecting and training a "Competent Person" (usually a supervisor or foreman) for each construction site. The competent person is to receive training according to OSHA standards to identify existing safety hazards at a given construction site. 2) The competent person is to conduct a job hazard analysis weekly, noting hazardous conditions and recommending corrective actions. 3) Besides the regular OSHA reporting, if an accident does occur the safety designee is to file a report on the incident, describing what occurred along with goals and time-tables for corrective actions to prevent similar incidents from occurring in the future. 4) A weekly "Tool Box Safety and Health Meeting" is to be held on each site. A

that workers behave according to the predictions of the model has been mixed. Viscusi and Moore (1991) suggest that workers learn of risks while on the job and quit if not appropriately compensated. Employment relationships with construction firms are generally of such short duration, however, that the model may not adequately describe the construction labor market. Furthermore, empirical evidence that firms pay compensating differentials for risk in general, the backbone of the theory, has been convincingly called into question by Leigh (1991) and Dorman and Hagstrom (1998), who suggest that unobserved and unexplained differences in pay across industries may have been misconstrued as compensating differentials for risk. Appendix A has a more thorough treatment of health and safety on the job from the perspective of economists.

report listing the person conducting the meeting, topics covered, and names of those in attendance is to be filed. 5) For every new job, the contractor is to pre-plan for first aid in the event of an accident. Such preparation requires either a first aid/CPR trained person to be on the job or readily available. The name and information needed to contact the person trained in first aid/CPR is also to be generally known and easily accessible on the site. 6) Safety and health hazards created by other employers on the site that may put the participating contractors' employees at risk are to be noted, and contacts from the other employer are to be listed and notified in the event that such hazards are found.⁷

Twenty-one small unionized contractors who employ carpenters in Connecticut, Massachusetts, and Rhode Island agreed to participate in the study group by implementing the NIOSH/CPWR safety program among its carpenter crews. During the 1997-2000 period, inspectors from the CPWR gathered data on safe work practices of carpenters employed by contractors in the study group, and at the same time, observed work practices of other unionized carpenters employed by nonparticipating contractors, which became the control group. The aim of the study's design was to determine if the safety program was accompanied by a notable increase in the incidence of safe work practices on construction sites among carpenters employed by the study group contractors compared to carpenters in the control group.

In addition to the main study just described, inspectors administered a survey to a sample of carpenter foremen and individual carpenters in the study group. The ancillary questionnaires were designed to elicit responses from foremen and front-line workers about their experiences

⁷See the *Site Safety and Health Plan* (CPWR, 1996) for a more detailed description.

with the NIOSH/CPWR sponsored safety plan and safety at work more generally. Appendixes B and C contain a full report of the survey of foremen and workers, respectively.

Six Safe Work Practices and their Determinants: Hypotheses to be Tested

The main hypothesis to be tested is whether carpenters employed by contractors who had adopted the NIOSH/CPWR program exhibited any differences in the six safe work practices listed above compared to workers employed by nonparticipating contractors. Secondary hypotheses to be tested assess whether other factors independently affect the probability of affecting safety behaviors. Such factors as 1) OSHA training of carpenter foremen, 2) a time trend, 3) the size or composition of the workforce on a site, 4) the type of construction being performed on the site, 5) the degree to which the contractor implements the plan, 6) seasonality, 7) location of the site, and 8) the degree of prosperity in the region as measured by the unemployment rate were also included. In addition, observations on sites of individual firms in the study group (and two firms in the control group) were often sufficient to detect firm specific effects on observed safety practices. Firm specific variables are useful in at least two respects. First, they allow some control for the degree to which managers and workers in individual firms were committed to implementing the safety program; and second, they partially control for otherwise unobserved heterogeneity in the type of work carpenters employed by a given contractor perform.

Methodology: Choosing the Sample

Ideally contractors selected into the study group would have been chosen at random from the population of all small carpentry contractors in the area. In practice, however, the selection process was somewhat less than random. The study group was formed when union officials from the three states were asked to obtain volunteers from contractors in their jurisdictions that employed union carpenters. The officials obtained 21 contractors who agreed to participate as part of the study group.

The sample selection process clearly may not have generated a random sample, which is important if reliable inferences about the population are to be made from statistics calculated from the sample. For example, it is plausible that contractors with safety problems may have been more likely to volunteer, hoping to reduce the number of accidents. A reduction in injury rates could lead to lower insurance premiums and perhaps an increased ability to attract a more highly skilled workforce. Conversely a motivation for not participating may be that contractors with poor safety records did *not* want to run the risk of bad publicity about their safety problems. Alternatively, companies with good safety records may have participated to advertise the fact. Moreover, some contractors may have participated simply to enhance their good will with the union. Thus it is incumbent on the researcher to assess the degree to which the nonrandom selection mechanism may have generated a biased sample.

Three methods were employed to determine the extent to which the sample of study group contractors was representative of the underlying population. First, hypothesis tests were conducted to compare the sample proportions of the probability of compliance in the six safety categories between the study and control groups. The simple t-tests were conducted using only

data gathered in 1997. Observations from only 1997 were used because it may have been early enough in the intervention process that the full effects (if they ever were to exist) of the safety program may not have become fully apparent. The t-tests indicated that differences in sample proportions in none of the six categories of safety behaviors were statistically significant at the .05 level, although two tests -- on fall protection and eye protection -- revealed statistically significant differences between the .05 and .10 levels. The tests indicated that the study group contractors were relatively deficient in the two categories compared to the control group. Comparisons of the other observed safety indicators caused me to tentatively accept the null hypothesis that the companies were drawn from similar populations along the other four indicators of safe work practices. The hypothesis tests, however, did provide some weak evidence that along two dimensions of safety -- fall and eye protection -- contractors in the study group may have been drawn from a different statistical populations than the control group, or stated differently, that there may be sample selection bias in the direction of firms who operate less safely than average being selected into the study group.⁸ In short, the hypothesis tests were not entirely conclusive.

Another indicator that the contractors in the study groups may be considered a random draw from the population relied on likelihood ratio tests. To conduct the tests, I estimated simple probit models that predicted the probability that inspectors judged workers to be substantially complying with safe work practices *or* working in locations where such practices were not required, controlling for a number of independent variables such as the time of year, location,

⁸Sample sizes of the study and control groups for 1997 are $n_s = 72$ and $n_c = 75$, respectively, which are relatively small to test for differences in population proportions.

type of construction, among other factors (see Appendix Table 1). The probits were first estimated using the entire data set with no control for membership in the study or control group, then two additional probits were estimated using disaggregated data according to membership in the study and control groups. Results of likelihood ratio tests for every safe work practice supported the hypothesis that the two samples were drawn from the *same* statistical population. In one sense the results are reassuring, suggesting that the study and control groups were probably representative of population. In another sense, because the data were drawn after the treatment was administered, they do not necessarily test for sample selection bias. Furthermore, the test results foreshadow results discussed below suggesting that the intervention likely did not increase the likelihood that work practices of carpenters from the study group were safer than work practices from the control group.

Yet a third indicator provided additional evidence on whether the study and control groups originate from same statistical population drew on the study groups' Experience Modification Ratings (EMRs). An EMR is an insurance rating that indicates a company's safety relative to the industry standard. A rating of "1" indicates that the company approximates the safety of an average firm in the industry. A rating above "1"one suggests that a company is less safe than average and must pay higher insurance premiums. And a rating below "1" suggests that a company is safer than average. Their were 37 observations on the 21 control groups' EMRs ranging from 1996 to 1999. For 11 of the 21 companies in the study group, EMRs were observed in multiple years. The mean EMR for the study group was .886, below the supposed industry standard of 1.0.

Examination of EMRs from companies with observations in successive years demonstrated that four companies experienced rising EMRs, one company had EMR ratings forming a U shape over time, and five companies' EMRs fell over the time period. The average EMR for 1996 and 1997 period was .892, still below the industry standard and not much higher than .886 -- the average for the entire study period. Data on EMRs suggest that the companies who were part of the study group did not appear to be experiencing major safety problems relative to their industry group, at least as measured by their insurance ratings. Because the mean EMR was below one, the data do *not* suggest that the companies were judged particularly unsafe relative to others in the industry, nor do the data reveal a pattern of improving or deteriorating EMRs over time. Unfortunately the EMRs of contractors in the control group were not observed, making it impossible to compare EMRs between the two groups and thus to draw a more definitive conclusion about the randomness of the sample with respect to safety practices in the two groups.

Combining results of the three methods of assessing the extent to which the study and control groups were drawn from comparable statistical populations, it does not appear completely unreasonable to treat the contractors in the study group as a random draw from the population of unionized contractors employing carpenters in the three-state region. Thus inferences made from the statistical analysis, may tentatively be applied to the population of unionized construction firms in the tri-state area, although it must be emphasized that such inferences should be made with caution.

Methodology: Gathering the Data Through Site Inspections

During the early part of 1997, officials from the CPWR delivered the NIOSH/CPWR safety plan to participating contractors and explained its procedures, which included an agreement by the contractors to allow bi-monthly inspections of its construction sites for a three-year period by officials from the CPWR. When the inspections were to occur, the inspector would call an official at the union local to determine construction sites on which carpenters from participating contractors were working. Once the local union official determined the location or locations, the inspector was informed and visited the site.⁹ In reality over the period from March, 1997 to September, 2000, the inspections, although taking place quite regularly, usually occurred at less than a bi-monthly pace.

Contractors in the control group were chosen opportunistically. When an inspector or inspectors were on participating contractors' construction sites, they inquired if carpenters employed by another nonparticipating contractor happened to be working on the same site or at a nearby location. If so, the inspector(s) would attempt to inspect the safety conditions under which such carpenters were working. The resulting inspections became part of the control group.

⁹The practice of calling the union official before the inspection may have had the unintended consequence of warning the contractor of an impending inspection. Anecdotal evidence suggests that workers on some sites may have been encouraged to be on their best safety behavior during such inspections. In at least one instance, it appeared that a contractor, being forewarned of an inspection at two sites, was given excellent marks for safe work practices on those two sites. When an inspector serendipitously found a third site to inspect where workers employed by same contractor had not been forewarned, the incidence of safe work practices observed was substantially lower. Again, the issue of bias as a result of the methodology emerge. No hard evidence exists, however, that the foregoing anecdote was either an isolated incident or a systematic source of bias.

In all cases but two, there were not enough observations on any individual contractor in the control group to include a variable for company specific effects.¹⁰

The final sample consisted of 542 usable site inspections, 57 percent of which were of inspections of the 21 contractors in the study group, leaving 43 percent in the control group. The descriptive statistics of the data generated by the site visits are located in Table 1.

[Table 1 about here]

Observed Safety Practices on the Construction Sites: The Dependent Variables

The current section contains an analysis and summary statistics of variables representing the six safety practices from the site inspection data.

Fall Protection Procedures

As was noted above, the most common type of accident leading to fatalities on construction sites are falls from elevation (CPWR, 1997, pg 31). Thus compliance with fall protection guidelines is perhaps the most important method to reduce serious injuries and fatalities among construction workers. Comparing the study and control groups, Table 1 shows that approximately one-half of the sites inspected required fall protection of some sort for the carpenters at the time of the inspection. The degree to which the work sites were fall-safe, however, differed somewhat between the two groups. Just over 81 percent of the sites of the study group were judged fall-safe and nearly 91 percent of the control group worked in fall-safe

¹⁰The form used to gather data from site inspections is located at the end of the report.

environments, because they were either adhering to fall protection standards or fall protection was not applicable at their work sites.

Hard Hat Usage

Another cause of traumatic injury and death originates from head injuries caused by falling debris or other objects. Hard hats reduce the likelihood that falling objects striking construction workers will cause serious injury or death. As cited earlier, a BLS study demonstrated that hard hats were being worn by only 16 percent of workers who sustained head injuries, while 40 percent of those injured would have been required to wear a hard hat at the time they were injured. Summary statistics indicate that around 97 percent of the sites comprising the study group and 93 percent of the sites comprising the control group were at stages of construction where hard hat usage was still necessary; however, a slightly greater proportion of carpenters in the control group (74 percent) were judged to be in substantial compliance with hard hat requirements than their counterparts in the study group (68 percent).

Eye Protection

Eye injuries are potentially serious and debilitating accidents that also affect carpenters. When using power tools, doing overhead work, sandblasting, or engaging in a multitude of other common tasks, small pieces of metal, cement, wood, or other materials may lodge in a worker's eye. It is estimated that more than 10,600 construction workers will miss work in a given year because of an eye injury (CPWR, 1998). The CPWR using BLS statistics demonstrate that 9.3 percent of all injuries were to the head or eye (CPWR, 1997, pg 34). Furthermore, construction

workers suffer more eye injuries than workers in any other industry (CPWR, 1998). Although protective equipment like eye goggles or clear plastic masks are extremely effective at preventing eye injuries, such equipment tends to be under used. Results from the sample indicate that roughly the same proportion of sites in the study and control groups had carpenters working at tasks that required eye protection (89 and 86 percent, respectively), but only about 44 percent of the carpenters crews were actually working in an eye-safe manner. It appears that carpenters are particularly prone to neglect eye protection.

Housekeeping Compliance

Poor housekeeping refers to a construction area where debris and unused materials are not properly disposed of or stored and can be another cause of injuries of various sorts ranging from sprains and strains to contusions, cuts, lacerations, and fractures. According to the CPWR's reporting of BLS statistics, falls on the same level are attributable to 8.4 percent of lost work days because of injury. Strains and sprains, contusions, along with cuts and lacerations account for approximately 54 percent of lost work days, while slips and trips add another 3.1 percentage points (CPWR, 1997, pg.33). Although surely not all of these injuries result from poor housekeeping, no doubt a portion do. Table 1 shows that the rates of proper housekeeping were 77 and 82 percent for construction sites in the study and control groups, respectively.

Exposure to Electrical Current

Of course electrically powered tools are vital for construction workers; however, if proper GF procedures are not followed, workers risk potentially deadly exposure to electrical current.

Statistics compiled by the BLS show that 17.9 percent of fatalities in construction work are caused by “exposure,” a category which includes exposure to electrical current -- as well as caustic substances and extreme temperatures. In New England alone, nine deaths on the job were caused by exposure to electrical current in 1998, although the article does not specify the industry or occupation of the workers (BLS, 1999a). Table 1 shows that 89 percent of the study group and 92 percent of the control group worked on sites judged to be substantially free of hazardous exposure to electrical current.

Hearing Protection

Although it is quite rare for construction workers to experience acute injuries caused by exposure to noise, it is very common to find that such exposure gradually impairs construction workers’ hearing. As cited above, a study of the Swedish construction workers indicated that only 10 percent had normal hearing in both ears by the time they had reached 50 years of age. Construction workers in British Columbia had also suffered significant hearing loss after 16-25 years on the job. To protect against hearing loss among construction workers, proper hearing protection devices must be worn at the appropriate times. Results in Table 1 demonstrate that a relatively large majority (82 and 87 percent of the study and control groups, respectively) were not exposed to damaging noise levels on the construction sites at the time of the inspections either because of the lack of significant noise or the use of appropriate hearing protection devices.

Characteristics of the Construction Sites and other Conditions: The Independent Variables

Other summary statistics displayed in Table 1 describe the construction sites that were inspected. Descriptive statistics of other variables that may be correlated with safe work practices are also included. The following discussion addresses such variables.

Carpenter Foreman and OSHA Training

The 10 hour OSHA training course for construction foremen consists of 10 hours of instruction by a certified OSHA trainer. Each hour of training covers a specific safe work practice, including five mandatory topics and five topics that are chosen at the discretion of the instructor. Examples of topics include uses of safety equipment, fall protection, confined space training, and hazardous material control. One may reasonably hypothesize a positive correlation between the incidence of such training and the likelihood that safe work practices will be observed on sites where carpenters workers are supervised by OSHA trained foremen. Table 1 indicates that a similar proportion of sites, 44 percent for the study group and 42 percent for the control group, had carpenter crews whose foremen had received a 10 hour OSHA safety training course.

Timing of the Inspections

An a priori hypothesis that safe work practices among contractors in the study group may improve over time rests on the notion that safe work practices suggested and reinforced by the training program may become habitual. If norms of safe work practices change workers'

understandings about what constitutes safe work, carpenters employed by contractors in the study group may begin to work more safely over time as the program generated its beneficial effects.

Habits of safe work may be adopted more broadly as well because of the casual relationship workers have with any given contractor. For example, if a particular carpenter was employed by a contractor in the study group during the first inspections, in two months s/he may be employed by a contractor receiving a site inspection who is not in the study group. If such were the case, one may expect a gradual dissemination of safe practices across worksites and a secular increase in such practices over time.

Just as reasonable a hypothesis, however, is that a safety program followed by a number of inspections is not enough to sustain a change in workers expectations about the normality of safer work. And although workers may work more safely for a while, they may tend to fall back into less-safe patterns of behavior as time passes or as other exigencies exert themselves. Or alternatively, that safe work practices are so contractor specific that carpenters will adopt work practices of the contractor who currently employs them. While any of the hypotheses seem reasonable, they suggest that time itself may be an important factor in explaining the incidence of safe work practices. The statistics on the time trend variable in Table 1 suggest that the average inspection occurred in the 24th month for the study group and in the 28th month for the control group.

The Number of Carpenters and Workers from other Trades: Size Effects

If only carpenters are working on a construction site, then safety practices may be different than if carpenters are working on the same site with workers from other trades.

Although no a priori reasoning would suggest how such circumstances may affect safety practices, it must nevertheless be controlled for to avoid biased inferences about the impact of other variables. Contractors in the study group had approximately 8 carpenters working on a given site, while the contractors in the study group had approximately 10 according to Table 1. Similarly, the number of other workers on the sites of contractors in the study group was smaller (44 workers on average) than the number in the study group, which contained just over 58 workers from other trades.

The two variables not only serve as controls, but may serve as a proxy for the size of the project, which itself may affect safety practices. One possible effect of working on a larger site is that, almost invariably, safety officers are employed that inspect the site for hazards, develop site specific safety guidelines, and enforce safety policies and procedures.¹¹ On the other hand, large sites may be more difficult to control, which may increase the incidence of unsafe work practices that remain undetected by safety officers, foremen, or managers.

Types of Construction Observed

The type of construction in which the carpenters are engaged may also independently affect the incidence of safe work practices. The types of construction observed on the inspected sites included “Finish Carpentry” (12 percent), which includes installation of shelving and custom cabinets, desks, etc.; “Form Work” (29 percent) which includes building forms into which concrete will be poured and directing the pours; “Interior Work” (39 percent), which

¹¹An interview with one of the inspectors confirmed that most larger contractors either employ their own safety officer or hire safety consultants who regularly offer advice on safety matters.

includes the building of interior walls with wood or metal stud framing, installation of drywall and acoustic tiles; “Wood Framing Work” (13 percent), which includes framing residential and small commercial structures using primarily wood rather than metal and concrete; “Heavy and Highway Work” (6 percent), which includes building the structures that form and support bridges, tunnels, and highways, as well as constructing buildings such as parking garages and sewage treatment plants. Sites where carpenters were renovating existing structures, driving pile or erecting scaffolding were also observed in the study, but not often enough to control for individually. Such sites only represent about 2 percent of the inspections.¹²

Safety Plan on Site: Commitment of the Contractor to the Plan

The degree to which the safety strategies suggested by the NIOSH/CPWR plan were implemented by contractors, managers, foremen, and workers will no doubt vary from one contractor to another. It is reasonable to expect that the more seriously the plan was taken by the contractor, the greater will be the behavioral changes with respect to safe work practices. As a measure of how vigorously contractors were implementing the plan, inspectors sought to determine if a copy of the safety plan (or any safety plan for that matter) was physically located on the construction site. As Table 1 demonstrates, only 52 percent the study group’s construction sites had a copy of the (a) plan on site. Although disappointingly low, it far outstripped the proportion of firms in the control group with a formal safety plan on their construction sites. Only 12 percent of contractors in the control group were found to have such a plan.

¹²The category “Finish Work” was used as a reference group in the multivariate analysis. Carpenters engaged in renovation, scaffold building, and pile driving were included in the variable “Other Carpentry Work.”

Time of Year the Inspection Occurred: Seasonality

Safety equipment and other safe work practices may be uncomfortable and inconvenient to use. In addition, the equipment may be more or less effective according to weather conditions. For example, perhaps during the heat of summer or cold of winter, the discomfort or inconvenience of using personal protective equipment may be magnified. One may reasonably hypothesize that seasonality could affect the incidence of safe work practices, and hence it must be controlled for in a well specified statistical model. The statistics in Table 1 suggest that the inspections were slightly more likely to occur during the Spring and Summer months (Quarters 2 and 3 with 28 and 34 percent of the site inspections, respectively), although they were quite evenly spread throughout the year.

Differences in the Three Regions: Locational Effects

Construction sites from three states were observed in the study. To ensure that locational effects do not contaminate the parameter estimates on the other variables, controls for location were incorporated into the models. The union densities in the construction industries of the three states are similar, thus if locational factors exert measurable effects on the safety variables, it is not a result of differences in union densities (although there may be differences in the political and economic power of unions in the three locations that are not captured by figures on union density). Other unobserved state specific factors may also be captured by the location variables. Such factors may include differences in the degree to which OSHA enforcement procedures are implemented, differences in the level of state spending on construction, or differences among the local unions in attitudes toward safety, among other factors. Table 1 shows that approximately 32

percent of the sites inspections were located in Massachusetts, 42 percent in Rhode Island, and the remainder in Connecticut.

Economic Conditions

Prevailing economic conditions may also affect safety conditions on construction sites. Suppose the unemployment rate drops -- as it did during the 1997-00 period in New England -- then contractors likely are receiving more bids and may be having more difficulty procuring the necessary labor. Under such conditions, they may resort to using less-skilled labor, which is likely to be more accident prone, or they may work the labor already employed longer hours, or at a faster pace, which produces fatigued workers. Fatigued workers are also likely to be more accident prone. On the other hand, it may be that low unemployment rates reduce the costs of quitting one's job -- because another job can be obtained relatively quickly -- if there is pressure to work under unsafe conditions. Thus under conditions of tight labor markets, employers may be obliged to offer safer working conditions simply to keep its supply of skilled labor. Although one cannot say a priori how increasingly tight labor markets of the period may have affected safety behaviors, possibilities that such effects exist suggest that it is important to take economic conditions into account.

A common indicator of the intensity of economic activity in a region is its unemployment rate. Contractors in the study group were located in three New England states, each of which exhibited a relatively steady decline in unemployment rates over the period (BLS, 1999c). Figure 1 shows the movement in unemployment rates over the period in the three locations. Notice a clear downward trend in the data.

[Figure 1 about here]

Company Specific Controls: Heterogeneity among Contractors

Each contractor in the study group was visited a number of times at various sites. All the contractors in the study group had enough observations to be controlled for independently in most of the multivariate regression equations, whereas only two contractors in the control group had sufficient numbers of observations for individual controls. The company specific controls are important because they capture differences among contractors along a number of dimensions. The data already contains observations on the kind of sites that were observed, but it does not contain data on the type of carpentry firms in the study group specialized in. For example, some companies that employ carpenters specialize in interior work like building walls and installing drywall, others focus mainly on installation of custom built furnishings such as desks and shelving, while still others hire carpenters to build concrete forms. Although some contractors tend to specialize in one or two types of tasks commonly performed by carpenters, others are generalists that will perform any of these tasks. Because the mix of carpentry done by individual contractors may have an independent effect on safety practices, company specific controls help control for heterogeneity across firms along this dimension. Moreover, variation in how seriously management officials from a given company emphasize safety may also be picked up by the company specific controls (Cohen, Smith, and Anger, 1991).

Contractors are also heterogenous in their hiring practices, which also may affect how safely work is performed. Some companies keep a relatively large core of full-time year around workers that identify themselves with that company, while others almost exclusively acquire

labor on a project-by-project basis through the union hiring hall. Most contractors fall somewhere in between. One may expect that companies who keep greater attachment to their workers are more likely to emphasize safe work practices, because loss of a worker through injury probably means the loss of its investment in firm-specific human capital embodied in the injured worker. Table 1 lists the contractors (mostly in the study group) who had sufficient observations for company specific effects to be identified and the proportion of the site inspections attributable to each.

Multivariate Analysis: Estimating the Probability of Observing Safe Work Practices

Summary statistics discussed above offer interesting, yet limited, insights into the need and incidence of safe work practices observed on the sites. They also describe characteristics of the sites where carpenters in the study and control groups were working. Estimations of a series of multivariate statistical models allow the two groups to be compared along the six dimensions of safety, while factors that may independently affect the incidence of safe work practices are held constant. In the first three groups of statistical models estimated (fall protection, hard hat usage, and eye protection), separate models confined only to sites where a particular safety behavior was judged necessary were estimated. For example, first the inspector determined if a work practice was necessary on a site, then only if it was necessary was compliance or noncompliance observed.¹³ The other variables, proper housekeeping, GF procedures, and

¹³An empirical model that captures the essence of such a two-stage process is bivariate probit with partial observability (Meng and Schmidt, 1985; Greene, 1997); however, specification tests supported a simpler procedure of simply selecting the sites where a particular type of safety behavior was needed and estimating the probability that the procedure was observed using a simple probit model. Thus all the multivariate models contained in the report

hearing protection were also estimated as simple probits, but the dependent variable was defined as the probability that a site was in substantial compliance with the safety procedure either because it was not necessary at the time of inspection or if it was necessary proper procedures were being followed. Similarly for fall protection, hard hat usage and eye protection, dependent variables defined as the probability that carpenters on the site were working in, for example, a fall-safe manner *or* in a location where fall hazards are not relevant, were also estimated.

The same vector of independent variables is used in the equations describing the six safety behaviors. In one equation for each dependent variable, company specific effects are included and in another equation, the control variable for membership in the control group is substituted for the individual company specific effects.¹⁴

Tables 2 - 7 contain results of probit equations. In addition to the probit models, I constructed simulations generated from the equations in which values of the explanatory variables (independent variables) were allowed to vary while holding the other variables constant at their sample means. Such a procedure provides estimates of how selected changes in individual explanatory variables are predicted to affect the probabilities of observing the six safety behaviors (see Tables 2a-7a). Highlights of the multivariate analysis and the simulations follow.

are simple probits.

¹⁴In some equations, the lack of variability in a particular safe work practice caused variables controlling for specific contractors to be excluded from the equation. In virtually every case the lack of variability was due to every site of a specific contractor being in compliance with a particular safe work practice (see Appendix Table 2). Similarly, in one equation the variable "Other Carpentry Work" was excluded because of lack of variability.

Protection against Falls from Elevation

Results of the multivariate analysis of fall protection on sites where it was required at the time of the inspections revealed a positive and significant time trend as is revealed in Table 2. Table 2a suggests the probability of observing proper fall protection procedures appeared to increase by nearly 38 percentage points from the 12th to the 36th month, holding all other variables constant. In addition, seasonal differences were observed. Workers were substantially more compliant with fall protection procedures during the Spring, Summer, and Fall months (2nd, 3rd and 4th quarters) compared to the Winter months (1st quarter). Furthermore, a striking positive correlation between the unemployment rate and fall protection was also observed in which low unemployment rates were accompanied by *less* use of fall protection procedures. Table 2a demonstrates that as the unemployment rate ranges from 4.2 to 5.2 percent, the predicted use of proper fall protection increases by more than 23 percentage points. Perhaps less time pressure that accompanies a slower economy makes it less likely that workers will cut corners on safety in the interest of speed, or that managers will encourage such behavior.¹⁵

[Table 2 about here]

[Table 2a about here]

The inspectors also detected a number of companies in the study group that appeared particularly lax in their implementation of fall protection measures as evidenced by statistically significant and negative estimates in the fall-safe equation with company controls. The companies with insignificant parameter estimates or for which parameters could not be estimated

¹⁵Results in Appendix B, Figure 9 indicate that foremen almost universally perceive that upper management will tolerate cutting corners on safety when time or financial pressures dictate.

were either substantially in compliance with fall protection procedures or were not working on sites where such procedures were necessary. Thus it is not possible to definitively conclude that such companies were particularly conscientious in maintaining a fall-safe environment. It may be that their carpenters were working in situations where such protections were not required at the time of the inspections.¹⁶

Finally, the insignificant parameter estimate on membership in the study group provides some evidence that the study and control groups were similar in their behaviors involving fall protection. The results are also supported by the likelihood ratio tests reported in Appendix Table 1.

Hard Hat Compliance

A large majority of the sites were inspected when hard hats were required. The equation that estimated the probability that hard hats would be worn given that they were required yielded a number of statistically significant parameter estimates. Coefficients on the time trend variable, the number of workers in the carpenter crew, the number of workers from other crafts, the type of carpentry (relative to “Finish Work”), and having a copy of the safety program located on the site were all positively correlated with the probability of hard hat usage as Table 3 indicates.

[Table 3 about here]

¹⁶See Appendix Table 2 for additional descriptive statistics of the six dependent variables on companies included as control variables. The figures in Appendix Table 2 represent the proportions of sites that were either in substantial compliance with a particular safety procedure or where the procedure was not necessary at the time of the inspection.

The results in Table 3a suggest that if the number of carpenters on the site increases from 20 to 40, hard hat usage is predicted to increase by nearly 9 percent, other things equal. Table 3a also shows that carpenters doing finish work are substantially less likely to wear hard hats, and that having a safety plan on site (most likely the NIOSH/CPWR plan) is associated with nearly a 14 percentage point increase in hard hat usage. The hard hat variable was the only dependent variable where a significant difference was found between the study and control groups. The control group was more likely to wear hard hats when they were required than the study group (.83 for the control group versus .70 for the study group).¹⁷

[Table 3a about here]

The individual company effects are also important determinants of hard hat usage when the dependent variable is defined as the probability of observing substantial usage of hard hats when required *or* observing workers in situations where they are not. Six companies have negative and statistically significant parameter estimates in the second equation in Table 3, while two companies show perfect compliance with hard hat guidelines.

Eye Protection

Carpenters' use of appropriate eye protection equipment where it was deemed necessary was particularly low. Table 4 demonstrates, however, that if the carpenter foreman on a site has received OSHA training the probability increases considerably. Sites on which carpenters were supervised by OSHA trained foremen were nearly 20 percentage points more likely to wear eye

¹⁷The likelihood ratio test, however, is not consistent with a difference in hard hat usage between the two groups.

protective devices (30 percent to 50 percent) as Table 4a demonstrates. The number of workers from other trades on the site as well as the type of work also appears to significantly affect the probability of wearing eye protection equipment. In addition, carpenters appear more likely to wear eye protection during the Spring, Summer, and Fall months relative to Winter. One striking result found in Tables 4 and 4a indicates significantly more use of eye protection when economic activity is slower. When the unemployment rate is hypothetically set at 5.2 percent, the probability of finding a site in substantial compliance with eye protection guidelines is .490, but falls to .247 when the unemployment rate is set at 4.2 percent. Compare these results to the findings on fall protection.

[Table 4 about here]

[Table 4a about here]

When the dependent variable is the probability of working in an “eye-friendly” setting, that is, the probability of working when eye protection is not necessary or wearing the proper equipment when it is, the results differ only slightly. The foremen’s OSHA training remains a positive predictor of working in an “eye-safe” environment. The statistical significance of the type of work, however, fades to insignificance, which may suggest that company specific factors are particularly important with respect to the use of eye equipment. As with the other dependent variables the contractors in the study group exhibited mixed performance in their compliance with eye protection standards. Four contractors were found to be notably deficient in the appropriate use of eye protection equipment among their carpenters.

Housekeeping

The inspectors judged approximately 82 percent of the sites to maintain generally good or excellent housekeeping. The only statistically significant parameter estimates in the equation that included company specific controls were on one type of carpentry ("Form Work") and on a number of company variables, where the findings were mixed. Four of the contractors in the study group were found to be particularly lax in housekeeping (one company in the control group was also found deficient in housekeeping procedures). Four contractors, however, received extraordinarily good marks from the inspectors. In the equation that controlled for membership in the study or control group but not company specific controls, estimates on the foremen's OSHA training, form work, and heavy and highway variables were statistically significant. Table 5a demonstrates, however, that their practical significance appears fairly small.

[Table 5 about here]

[Table 5a about here]

GF Compliance

A vast majority (approximately 91 percent) of the sites inspected were judged to be in compliance with GF standards or were at a stage in the project where GF procedures were not relevant. The models that predicted the probability of proper GF procedures revealed that having a safety plan on site was a significant positive determinant of compliance (see Table 6), even though its actual effect on the probability of compliance is quite small (about 7 percentage points) according to Table 6a.

[Table 6 about here]

[Table 6a about here]

There was very little variation in GF procedures among the companies, which caused many of the company specific effects to be unestimable, but as with the other dependent variables, a number of firms (four) in the study group were found lax in their GF procedures, while many others (nine) had very good records.

Hearing Protection

During the time of their visits, the inspectors judged that only 23 percent of the sites were sufficiently loud that hearing protection devices would have been required (see Table 1). The equations displayed in Table 7 indicate that the number of carpenters on the site reduced the probability of working in a hearing-safe environment. Table 7a demonstrates that varying the number of carpenters from 20 to 40 is predicted to yield a 14 percentage point decline in the probability that carpenters were working in a hearing-safe manner. In addition, location in Rhode Island was negatively related to the probability that carpenters worked on “hearing-friendly” sites. Compared to Massachusetts the likelihood of inappropriate hearing protection on loud sites was nearly 10 percentage points higher for workers in Rhode Island. Estimates on the company specific controls pointed to one company that received perfect marks from the inspectors, while another company *in the control group* was found substantially compliant. Only two companies in the study group appeared to be notably lax with respect to hearing protection.

[Table 7 about here]

[Table 7a about here]

Company Specific Effects

Lapses in health and safety procedures are not uniformly distributed across companies in for which company specific effects could be determined. As Table 8 demonstrates, seven contractors were not implicated at all with lapses in safe work practices among carpenters on its construction sites. Two contractors have negative marks in three of the six categories, while on the other extreme, six companies not only demonstrated no lapses, but exhibited significantly better performance than their counterparts by exhibiting at least one positive mark and no marks in the negative column. In fact one company received four positive marks and two others registered two positives.

[Table 8 about here]

The final row in Table 8 lists the ratio of negative to positive marks. The categories “Hard Hats” and “GF Compliance” are particularly unbalanced, with “Hard Hats” exhibiting substantially more negatives than positives. GF Compliance exhibits the opposite pattern. The other categories are relatively balanced with similar numbers of positive marks and negative marks across firms.

The literature on workplace safety suggests that management’s attitude toward safety matters as a determinant of safe work practices (Cohen, Smith, and Anger, 1991). Evidence in Table 8 is consistent with such a claim. One must remember, however, that a substantial amount of heterogeneity exists among companies with respect to the type of construction done by their carpenters. Although the type of carpentry performed is controlled for in the analysis, perhaps some unobserved differences in carpentry tasks and their relative riskiness are being picked up by

coefficients on the company specific control variables. Of course, additional data would be necessary to definitively test such claims.

Implications for Safety Policy and Future Research

The aim of the experiment was to determine if a direct intervention like the NIOSH/CPWR safety program would affect safety behaviors of carpenters employed by contractors who had adopted the plan. An increase in safe work practices would then reasonably lead to fewer injuries and fatalities on the job.¹⁸ The analysis indicates it is unlikely that contractors in the study group, and thus contractors whose carpenters had presumably been exposed to the NIOSH/CPWR plan, systematically provided safer workplaces for their carpenters or insisted that they work more safely than their counterparts in the control group. The likelihood ratio tests (see Appendix Table 1) indicate that, at least with respect to safety, contractors from the study and control groups were probably drawn from the same statistical population; or said differently, that work practices regarding safety among their carpenters were the same. Furthermore, in the probits used to estimate the probability that the inspectors observed safe work practices, given that they were necessary or that they observed carpenters working in a relatively hazard free environment, the parameter estimates did not indicate safer work among carpenters employed by contractors in the study group. Taken together, the two sets of tests constitute relatively convincing evidence that, on the whole, safe work practices were not more prevalent on sites in the study group of contractors.

¹⁸Though it would be intriguing to take the analysis one step further and relate the safety behaviors to predict changes in actual accident outcomes, to the author's knowledge the data do not exist that would allow such inferences to be made.

Although the overall the results suggest little difference in behavior between the study and control groups, one exception deserves emphasis. It does appear that if the contractor had a copy of the plan on site, it increased the probability that appropriate hard hat usage would be observed by the inspector by about 14 percentage points, which suggests that perhaps the degree to which the contractors were complying with the program had some impact.

Although some heterogeneity among contractors with respect to how conscientiously the program guidelines were followed is to be expected, important evidence also indicates that contractors who agreed to participate in the plan may not have implemented important elements of the program, and that the lack of implementation may have been quite widespread. If important segments of the plan were not integrated into the work processes of participating contractors, then one would not expect to find differences among contractors in the study and control groups. The focus of the analysis accordingly would shift away from why the *procedures* of the plan did not alter safety behavior to why the program appeared to have been essentially unworkable in the everyday work processes encountered by contractors, foremen, and front-line carpenters.

Evidence supporting such a claim is drawn from results of surveys taken from samples of carpenter foremen and carpenters as reported in Appendixes B and C. As part of the assessment process, the questionnaires were administered to a sample of foremen and carpenters employed by participating contractors. Analysis of their responses indicates that one important aspect of the NIOSH/CPWR plan, the weekly safety meetings, was rarely implemented. According to the foremen surveyed, three percent of the contractors held weekly safety meetings as was called for

by the plan.¹⁹ Eighty percent of the respondents reported that such meetings were held on an “as needed” basis, while 7 percent indicated that no meetings were held. Without such meetings, managements’ commitment to safe work practices was less likely to be communicated to foremen and workers, information on potential hazards was less likely to be promulgated, and discussions among workers, foremen, and management officials about safe work practices and OSHA regulations were less likely to occur. The picture is clouded somewhat, however, by responses of workers, 75 percent of whom indicated that “*regular*” safety meetings were held, although 65 percent never attended such meetings and 21 percent indicated that no safety meetings were held. Given the apparent lack of compliance with such an important procedure in the program, perhaps it is not surprising that carpenters employed by contractors in the study group and those employed by contractors in the control group exhibited similar patterns of safe work practices even during the three-year safety intervention period.

A number of other findings from the workers’ and foremen’s questionnaires were consistent with the findings of the site inspection data. For example, both workers and foremen agreed that upper management would tolerate cutting corners on safety when time or financial pressures dictated. Compare such results to the positive relationship between the unemployment rate and the use of appropriate fall and eye protection procedures in equations listed in Tables 2a and 4a. If it is more likely that pressures to finish a job exist when labor markets are tight and unemployment rates are low, then perhaps safe work practices like fall protection and use of eye protection equipment were forgone to increase the pace of the work..

¹⁹Appendixes B and C contain full analyses of the foremen and worker questionnaires.

Not only did carpenters employed by the contractors in the study group indicate that a central piece of the NIOSH/CPWR plan was rarely implemented, but they expressed substantial skepticism of their employers regard for their safety. Foremen were more positive about upper managements' concern for safety, however. One would expect that if the safety program were being seriously implemented by contractors in the study group that workers' virtual unanimous perception of upper managements' apathy toward their safety would not have been found in data from the workers' questionnaire.²⁰ Such findings further support the notion that the safety behaviors of carpenters in the study and control groups may have been similar because of the lack of implementation of the program after it was adopted. Additional investigation into the degree to which the program was implemented among the study group contractors is certainly warranted. And if indeed the program was essentially unworkable, additional research into what obstacles to implementation existed and how a plan could be made workable ought to be undertaken.

Although the safety plan itself did not appear to be particularly effective in changing carpenters' safe work practices across all the contractors in the study group, the data gathered on the site inspections offered a number of important insights into other factors that appeared to influence the safety practices of carpenters. In the case of reducing the probability of falls, a particularly deadly hazard on construction sites, seasonality and the pace of economic activity emerged as particularly important factors. Perhaps policies that emphasize fall-safe practices

²⁰The union did not fare much better than upper management with regard to safety (see Appendix C, Table C7).

could be especially implemented during periods of tight labor markets and during the Winter months when it appears as if workers are less likely to practice appropriate fall-safe procedures.

Hard hat usage did not appear to increase based on membership in the control group itself; however, a variable that measured how conscientiously the contractor followed the safety plan's guidelines was positively correlated with the use of hard hats when they were required. In addition, the results indicated that emphasizing the OSHA training of carpenter foremen may be a particularly effective way to increase the use of eye protection equipment, a practice that seems to be particularly neglected by carpenters. Similar to results on fall protection, eye protection appears to be particularly neglected as labor markets tighten, suggesting that during such periods special emphasis on its importance could be a useful strategy to increase safety.

Widely varying results among contractors is another persistent theme running through the results for all the dimensions of safe work practices observed by the inspectors. Managements' attitudes toward safety appeared to exert a significant impact in how safely carpenters worked. Such findings suggest that direct work with individual contractors that do not emphasize safe work practices may be of particular importance if construction sites are to be made safer for carpenters.

Finally, although evidence from statistical tests suggests that the sample is likely a relatively random draw from the population of small contractors who hire carpenters, it is not entirely clear that the results were not somewhat tainted by sample selection bias. Such bias may have been introduced into the sample by companies that were experiencing problems with safety and health in the first place to more readily volunteer for participation as members of the study group. If another opportunity arises to conduct a similar study, the methodological issue of

sample selection should be carefully addressed. In particular, care should be taken to ensure that contractors are randomly assigned to the study group. If feasible, it may also be useful to assemble a group of contractors as a control group in the same way the study group was assembled in the present study, so that the construction sites of both groups can be inspected at regular intervals in an identical manner.

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Appendix A: Health and Safety from the Perspectives of Economists

Economists have extensively studied health and safety in the work place, but not surprisingly, views on the subject vary significantly among members of the economics profession. I want to point out that the present review is not to meant to offer a comprehensive evaluation of the existing economics literature on the production of safety in the workplace -- a literature that has been competently and thoroughly reviewed elsewhere -- but to compare and contrast the various perspectives of job safety within the economics discipline, and to direct the interested reader to influential studies that have been conducted on the topic.²¹

While there is no absolute "received theory" among economists, there does appear to be a "text-book" consensus that any given level of job safety is determined in a labor market setting where the "going" level of safety depends on the interaction of supply and demand for it on the part of workers. The shadow price of safety is the amount in wages a worker will demand in order to assume an additional increment of risk of death, illness, and/or injury. In such a theoretical labor market employers offer a compensation package, which includes wages, fringe benefits, job safety, among other items to attract the desired quality and quantity of labor. Workers accept employment at firms that offer the appropriate complement of wages and other amenities (including job safety) that maximizes their well-being. An important underlying

²¹For examples of work in this vein see Smith (1979) and Viscusi (1992), both of which have detailed reviews and bibliographies of research on the theory and empirical testing of compensating wage theory. For the most thorough critique of the mainstream approach and a theoretical alternative to the mainstream approach among economists see Dorman (1996), whose ideas are used in the present analysis. Empirical studies by Dorman and Hagstrom (1998) and Leigh (1991) also cast doubt on elements of mainstream theory and the empirical work that supports it.

assumption is that safer working conditions are expensive to produce, so that, other things equal, workers must purchase job safety through lower wages.

In the stylized view of the neoclassical economist's model, there are many firms and many workers all with different preferences for various job characteristics, including safety, in their compensation packages and preferences for avoiding risk of death or injury. Workers making fully informed decisions based on relatively full information about risks of death, injury, and/or illness on the job, and, of course, who face costless mobility between workplaces choose a bundle of wages and job characteristics that suits their preferences. The many firms offer an array of combinations of wages and job characteristics, which are consistent with their own profit maximizing behaviors. The labor market process then matches workers with low risk tolerance to jobs with relatively low risk (and correspondingly lower pay) and less risk averse workers to riskier jobs (and correspondingly higher pay), all else equal.

For the model to maintain its logical coherence, it also requires that the labor market clears; that there is no involuntary unemployment. If involuntary unemployment exists, then the costs of quitting an unsafe job may rise to the point that at least some workers would not be willing to leave a workplace that is too unsafe according to their preferences. For to leave the job could lead to other severe consequences associated with unemployment that may outweigh the cost associated with the dangerous work. The fact that some workers may not leave jobs that are too unsafe according to their preferences suggests that they may not be fully compensated for the risk they are assuming.

Of course the model does not suggest that workers in riskier jobs will be paid more, only that once other characteristics that may affect wages are accounted for, there will be a positive

relationship between money wages and the risk of death or injury. Thus according to the mainstream economic perspective, safety is produced by the interaction of employers and workers as they consciously and freely trade money wages and the risk of illness, injury and death for labor. When the labor market clears, firms and workers maximize profits and utility, respectively. In the highly abstract theoretical treatment of the production of job safety, little theoretical space is left for any institutional intervention, such as interventions by government or trade unions to advocate for safer work places. Such intervention according to the pure logic of the model tends to prevent less risk averse workers from maximizing their utility by forcing safer work places on them, thus depriving them of the higher wages that would give them a higher level of well-being.

In the more realistic world of the labor market, many economists holding to the mainstream view, admit that the labor market produces less information on risks than would be required for optimal results to obtain, which may leave some room for governmental institutions to serve as a clearinghouse for information on workplace hazards so that workers can make the appropriate trade-offs between risk and wages. However, additional studies purport to demonstrate that even such limited intervention may be unnecessary. Viscusi and Moore (1991) for example suggest that if workers find themselves in a more dangerous situation than they bargained for when first employed, then additional information about the relationship between risk and the wage will surely come to light with increased tenure on the job. Thus less tenured workers will be more likely to quit than their higher tenured counterparts based on this new knowledge of unsafe conditions. Along with a number of other tests, Viscusi and Moore (1991) found that respondents in the PSID data from 1981 and 1982 behaved according to their

hypotheses. The findings suggest that even if information is imperfect during early stages of a workers' tenure, later -- after three years -- a more precise estimate of risk of illness, injury or death on the job is made and accounted for by workers. Furthermore, the inclusion of wage replacement after an injury from workers compensation insurance was found to decrease quits and cause workers to accept a lower wage. The results leave the fundamental model of compensating differentials in tact. Although the study's applicability to construction labor markets, which are characterized by short tenure with any one firm by most workers, leaves the study's findings of questionable value for understanding construction labor markets.

An intriguing response in opposition to the received wisdom of compensating differentials and its supporting body of empirical verification recently has been extended by Dorman and Hagstrom (1998). Their critique begins with a dissection of the measure of risk that has become commonly associated with much of the mainstream literature. They argue correctly that one of the unsolved mysteries of labor economics research is the unexplained existence and persistence of interindustry wage differentials. If industry risk data is used, as it most generally is, then the risk variable may be acting as a proxy for these persistent, yet unexplained, interindustry differentials. Under strictly competitive markets such interindustry differentials could not persist. Dorman and Hagstrom (1998) in their empirical study replicate Viscusi and Moore (1998), but attempt to include noncompetitive behaviors (such as collective bargaining, monopoly power, etc.) that may underlie interindustry differentials. When such factors are included, the empirical findings of wage compensation for risk, so commonly accepted as evidence supporting compensating wage differentials in the mainstream literature, are reduced to insignificance.

In some cases the results turn the argument of compensating differentials on its head, so that some lesser skilled nonunion workers appear to actually pay a premium to work in highly risky jobs. A result which makes no sense in the context of the textbook version of the competitive labor market, but which is easily explainable in a world of pervasive segmented labor markets with chronically limited information and mobility, and in a setting where workers do not make wage-risk trade-offs according to the utility maximizing calculus of mainstream theory.²²

²²Leigh (1991) has also pointed out that when unexplained interindustry wage differentials are accounted for the compensating differential for risk on the job is reduced, eliminated or turned on its head.

Appendix B: Results of the Survey of Carpenter Foremen

A survey of 60 foremen working at various construction sites in the tri-state New England area was administered by CPWR officials as they inspected construction sites for the incidence of safe work practices. The questionnaires were completed from October, 1997 to January, 2000. Carpenter foremen from 20 of the 21 contractors in the study group were represented in the sample.

During a site inspection, an inspector would locate the foreman and ask him to fill out a short questionnaire, which would take 5 to 10 minutes to complete.²³ The foremen who became part of the sample were all employed by contractors who had agreed to participate in the NIOSH/CPWR safety plan. Thus the target population may be considered more narrowly as all foremen in the study group, or more widely as carpenter foremen in the states of Connecticut, Massachusetts, and Rhode Island (given that no statistically significant differences in safety behaviors of the study and control groups were found in the study and control groups (see results of main study above).

No identifiable random selection mechanism governed the process that determined which carpenter foremen would complete a survey form, thus the sample must be treated as a convenience sample. A convenience sample should be used very cautiously to make inferences about underlying population parameters because it is more likely to be biased, or an inaccurate reflection of the target population. According to an interview with one inspector, most foremen who were asked to complete the form readily agreed. Some foremen, however, requested a survey form to complete later, agreeing to send it to the CPWR office by mail. No information is

²³The questionnaire is located at the end of this appendix.

available on the response rate from this group, or which subjects included in the sample completed the questionnaire in this manner.

Some claim to randomness is necessary to reasonably make inferences about the target population from sample statistics computed using the data.²⁴ If bias has somehow tainted the sample, then sample statistics may yield unreliable inferences about population characteristics. For example, suppose that respondents in the sample differ from the population because individuals more willing to complete the form have stronger opinions about the importance of safety than those who declined. The responses from such a sample may yield results more critical of prevailing safety conditions than responses from a sample of foremen that was randomly drawn from the population.

Another source of bias may have entered through the sample selection mechanism based on the inspectors' choices of which foremen were to be surveyed. From the sample size ($n=60$) and dates on the completed questionnaires, it is obvious that not all site inspections were accompanied by a survey of a foreman.²⁵ Perhaps foremen who appeared more interested in safety and the safety program were more likely to be offered a survey form than others who did not display the same level of interest. Without additional information on the selection process and on characteristics of the respondents, it is difficult to comment further on how well the

²⁴The main study contains a discussion of randomness with respect to how firms were selected into the study group. Some evidence supports the hypothesis that firms in the study group can tentatively be considered a random draw from the target population (see the main study above).

²⁵I do not mean to suggest that surveying a foreman on every site visit is a superior methodology for gathering data. In fact, it may have lead to instances of multiple responses from some individuals, which itself may have added bias.

sample reflects the underlying population.²⁶ Under such circumstances it is incumbent on the researcher to simply note the potential for bias and urge caution to readers if the sample statistics are used to make inferences about the target population.

Assuming enough randomness in the sample to make reasonable inferences about the population, one also encounters a relatively small sample size. A small sample size leads to rather imprecise estimates of population parameters, especially when the parameters are proportions. As will become apparent, however, many of the statistics computed from this particular sample could still offer meaningful and statistically valid results in spite of its small size.

Unlike the primary data on work site inspections, the data gathered from the survey of foremen originates only from respondents employed by contractors *in the study group*. Given that the objective was to gain perspective on the safe work practices and safety behaviors of those participating in the safety program, gathering data on perceptions of just foremen employed by participating contractors is reasonable. The analysis may have benefited, however, from analogous data on foremen in the control group.

Results of the Survey

A total of 60 carpenter foremen filled out questionnaires containing questions about their experience with safety policies, safety meetings on job sites, and their perceptions of upper

²⁶In some cases, post-stratification procedures in which known population information is compared to information in the sample can be used to test for how well the sample represents the underlying population. Not enough information was gathered in the foremen's survey to employ such a technique, however.

managements' attitudes toward safety on the job. The following summarizes the information obtained.

Written Safety Policies and Who is Responsible for Safety

A vast majority, 92 percent, of the foremen reported that their companies have written health and safety policies (see Figure B1). Although most foremen are aware of written policies, the question did not specifically address if the safety policies were derived from the NIOSH/CPWR program or some other source. When asked who at the company is responsible for safety, the answers varied widely as an inspection of Figure B2 demonstrates. A majority of the foremen mentioned specific names, presumably safety officers, superintendents, or other management officials (the information is not available in the sample). Eighteen percent reported that foremen are in charge of safety at the company level. The next most common responses indicated either a lack of knowledge (12 percent) of who is in charge of safety or that everybody is responsible (7 percent). Nearly one-fifth of the foremen sampled could not identify who is in charge of safety at the company level.

[Figure B1 about here]

[Figure B2 about here]

Foremen also answered a question about who is responsible for safety at the job site. For a summary of their answers see Figure B3. The respondents mentioned particular names in 30 percent of the cases, again presumably names of safety officers or other management officials. Forty percent of the respondents reported that foremen are in charge of safety on the job site and ten percent indicated that superintendents hold responsibility for safety. Combinations of

foreman and superintendents and foremen and union stewards accounted for another eight percent of the responses. Not surprisingly, foremen appear more knowledgeable about who is in charge of safety at the level of the job site than at the company level.

[Figure B3 about here]

Information on Safety Policy for New Hires

The foremen were queried about the practice of informing newly hired workers of their companies' safety policies. As Figure B4 demonstrates the practice is nearly universal, as 97 percent of the respondents answered in the affirmative. Contrast the 97 percent from the foremen's survey to responses from the worker questionnaire, which asked if they had been informed of the company's safety policies when they were hired. Only 65 percent of workers reported that they were informed of such policies when hired (see Appendix C). Perhaps workers who were not informed of companies' safety policies had been hired before the NIOSH/CPWR program had been adopted.

[Figure B4 about here]

Occurrence of Regular Safety Meetings

Safety meetings are a vital element of the NIOSH/CPWR program, which calls for "Weekly Toolbox Safety and Health Meetings." The meetings are meant to raise consciousness about safety, to act as venues for discussion of safety policies and safe work practices, and to offer management officials, foremen, and workers an opportunity to identify and eliminate potential hazards on job sites. Ninety-three percent of respondents reported that safety meetings

are held at their present job sites (see Figure B5). When foremen were asked, “How often are they given?”, seven percent reported “never.” Furthermore, eighty percent of the respondents reported that there is no set meeting schedule for safety meetings. Only three percent reported *weekly* safety meetings and seven percent reported that they are held semi-monthly.

[Figure B5 about here]

A surprisingly large majority of foremen indicated that safety meetings are held only sporadically. The virtual absence of regularly scheduled safety meetings, indicates a disturbing lack of compliance with one of the fundamental procedures of the NIOSH/CPWR safety program. The results from the sample of workers partially corroborate findings from the Foremen’s Survey (see Figure C5 in Appendix C)).

When safety meetings are held, foremen reported that in 68 percent of the cases they are conducted by foremen, in 35 percent of the cases by superintendents, and in 7 percent of the cases by fellow workers. No meetings were reported by 10 percent of the sample (see Figure B6).²⁷ It is also quite clear from the workers’ survey that such meetings generally do not include front-line workers, but most often include only management officials and foremen. When workers were asked if they attended safety meetings (see Figure C5a in Appendix C), 86 percent reported that either no meetings were held (21 percent) or that they never attended them (65 percent).

[Figure B6 about here]

²⁷Compare the 10 percent figure reported by the foremen with 21 percent in the survey of workers.

Topics of Discussion in Safety Meetings

When foremen were asked about the topics discussed in health and safety meetings, if they are held, 89 percent reported that safety hazards are discussed and 84 percent indicated that safe work practices are topics of discussion (see Figure B7). Sixty-three percent of respondents mentioned that OSHA regulations are discussed during safety meetings. The findings from the foremen's survey closely match findings in the survey of workers (see Table C5b in Appendix C).

[Figure B7 about here]

Attitudes of Top Management Toward OSHA Regulations and Safety

The carpenter foremen perceived a commitment by top management to adhere to OSHA health and safety guidelines. The results in Figure B8 indicate that when foremen were asked, "As far as compliance with OSHA requirements is concerned, is top management of this company insisting on health and safety standards that are 'sometimes less than OSHA standards,' 'meeting the minimum OSHA standards only,' 'meeting all the OSHA requirements,' or 'a safety program that exceeds OSHA guidelines,'" a large majority (89 percent) indicated that top management insists on 'meeting all' (52 percent) or 'exceed[ing] OSHA guidelines' (37 percent).

[Figure B8 about here]

Foremen also responded, however, that top management regularly permit cutting corners on safety when cost or time pressures are high. In a question that asked, "When the pressure is on, will top management permit minor trade-offs between safety and cost or safety and schedule

requirements?” the vast majority (92 percent) of the foremen responded that such trade-offs are made on a regular basis (see Figure B9). It appears that foremen receive mixed messages on the importance of safety from upper management. On the one hand, they identify commitment from their managers to meet or exceed OSHA safety standards, but on the other hand, they perceive top managers to regularly tolerate cutting corners on safety when time or cost pressures dictate.

[Figure B9 about here]

Summary and Conclusions

The survey of carpenter foremen employed by contractors in the study group reveals important information about the NIOSH/CPWR safety program. On a positive note, foremen reported knowledge of written safety policies, that such policies are communicated to new hires, that health and safety meetings are held during which safe work practices and potential hazards are generally discussed, and that upper management is committed to work performed according to OSHA's guidelines. On a negative note, however, the foremen reported nearly universally that upper management is willing to trade off safety for faster work or reduced cost when such pressures exist. Also troubling is what appears to be a high degree of noncompliance with procedures outlined in the NIOSH/CPWR safety program among participating contractors. For example, safety meetings, which are to be held weekly according to the NIOSH/CPWR safety program, are held only sporadically according to 80 percent of the foremen in the sample. Similar results calling into question the implementation of the program are found in the workers' survey.

The foremen's survey provides important insights into the results of the main study that assesses the effectiveness of the NIOSH/CPWR safety program. Specifically, a major element of the program, the weekly safety meetings, appear not to be held consistently by a large majority of the participating contractors. Without such meetings, management's commitment to safe work practices is less likely to be communicated to foremen and workers, information on potential hazards is less likely to be promulgated, and discussions among workers, foremen, and management officials about safe work practices and OSHA regulations are less likely to occur. Given the lack of compliance with such an important procedure in the program, perhaps it is not surprising that carpenters employed by contractors in the study group and those employed by contractors in the control group appeared quite similar with respect to safe work practices.

An obvious follow-up study suggested by the survey of carpenter foremen would be to gather and analyze more detailed information from workers, foremen, supervisors, and upper-level managers to determine what obstacles may have prevented compliance to the program's procedures. Armed with such information, one might be able to determine whether such obstacles could plausibly be removed, and if so, whether such modifications could possibly enhance the program's effectiveness.

Survey Instrument Administered to Foremen

Center to Protect Workers' Rights
NIOSH/CPWR Programs Project
Foreman Questionnaire

INTERVIEW QUESTIONNAIRE FOR FOREMEN

Date of Interview: _____

Site Location: _____

Contractor Name: _____

Person Completing
Questionnaire: _____

1. Does the company have a written policy on safety?

yes ____ no ____ don't know ____

2. Who is responsible for safety in the company?

_____ don't know ____

3. To whom is safety responsibility delegated at the job site?

_____ don't know ____

4. Does the company give instructions to new workers on the company
safety policy and requirements?

yes ____ no ____

5. Are there job safety meetings held at this job site?

yes ____ no ____

6. IF YES:

a. How often are they given?

weekly____
two times a month____
monthly____
no set meeting____
other (SPECIFY)_____

b. Who handles the meetings?

foreman____
superintendent____
union personnel____
fellow worker____
outside speaker____
other (SPECIFY)_____

c. What are the topics discussed?

safety hazards at the jobsite____
safe work practices____
OSHA regulations____
other (SPECIFY)_____

7. As far as compliance with OSHA requirements is concerned, is top management of this company insisting on:

sometimes less than meeting OSHA standards____
meeting the minimum OSHA requirements only____
meeting all the OSHA requirements____
a safety program which exceeds OSHA standards____

8. When the pressure is on, will top management permit minor trade-offs between safety and cost or safety and schedule requirements?

never____
almost never____
sometimes____
regularly____

Appendix C: Results of the Survey of Carpenters

A sample of 95 carpenters working at various construction sites in the tri-state New England area was constructed by inspectors as they inspected construction sites for the incidence of safe work practices. The questionnaires were completed from August, 1997 to January, 2000. Carpenters from 20 of the 21 contractors in the study group were represented in the sample, and generally more than one questionnaire was completed per site.

During a site inspection, an inspector would seek out the supervisor or foreman and ask permission to administer a questionnaire to carpenters on the site. The short questionnaire required between 5 and 10 minutes to complete.²⁸ Generally, the inspector was free to choose which of the workers would complete a questionnaire, but on occasion was directed to a specific worker or workers. The carpenters who became part of the sample were all employed by contractors who had agreed to participate in the CPWR/NIOSH safety plan. Thus the target population may be considered more narrowly as all carpenters in the study group, or more widely as carpenters employed in the states of Connecticut, Massachusetts, and Rhode Island (given that no statistically significant differences in safety behaviors were found between workers in the study and control groups (see results of the main study above).

No identifiable random selection mechanism governed the process that determined which carpenters would complete a survey form, thus the sample must be treated as a convenience sample. A convenience sample must be used very cautiously to make inferences about the underlying population parameters because it is more likely to be biased, or an inaccurate reflection of the target population. According to an interview with one inspector, most

²⁸The questionnaire is located at the end of this appendix.

carpenters who were asked to complete the form readily agreed. Some workers, however, requested a survey form to complete later, agreeing to send it to the CPWR office by mail. No information is available on the response rate from this group, or which workers included in the sample completed the questionnaire in this manner.

Some claim to randomness is necessary to reasonably make inferences about the target population from sample statistics computed from the data.²⁹ If bias has somehow tainted the sample, then computations of sample statistics often yield unreliable inferences about the population. For example, suppose that respondents in the sample differ from the population because those more willing to complete the form have stronger opinions about the importance of safety than those who declined. The responses from such a sample may yield results more critical of prevailing safety conditions than responses from a sample of workers that was randomly drawn from the population.

Another source of bias may have entered through the sample selection mechanism based on the inspectors' choices of which particular carpenter, or group of carpenters, were to be surveyed. From the sample size (n=95) and dates on the completed questionnaires, it is obvious that not all site inspections were accompanied by a survey of carpenters.³⁰ Perhaps workers that appeared more interested in safety and the safety program were more likely to be offered a survey form than others who did not display the same level of interest. Without additional

²⁹The main study contains a discussion of randomness with respect to how firms were selected into the study group. Some evidence supports the hypothesis that firms in the study group can tentatively be considered a random draw from the target population.

³⁰I do not mean to suggest that surveying carpenters on every site visit is a superior methodology for gathering data. In fact, it may have lead to instances of multiple responses from some workers, which itself may have added bias.

information on the selection process and on characteristics of the respondents, it is difficult to comment further on how well the sample reflects the underlying population.³¹ Under such circumstances it is incumbent on the researcher to simply note the potential for bias and urge caution to readers if the sample statistics are used to make inferences about the target population.

Assuming enough randomness in the sample to make reasonable inferences about the population, one also encounters a relatively small sample. A small sample size leads to rather imprecise estimates of population parameters, especially when the parameters are proportions. As will become apparent, however, many of the statistics computed from this particular sample could still offer meaningful and statistically valid results in spite of its small size.

Unlike the primary data on work site inspections, the data gathered from the survey of carpenters originates only from workers employed by contractors *in the study group*. Given that the objective was to gain perspective on the safe work practices and safety behaviors of those participating in the safety program, gathering data on perceptions of just carpenters employed by participating contractors is reasonable. The analysis may have benefited, however, from analogous data on carpenters in the control group for purposes of comparison.

Summary Statistics from the Sample of Carpenters

A total of 95 carpenters filled out a questionnaire answering questions about the sources and content of their safety and occupational training. The questionnaire also queried the

³¹In some cases, post-stratification procedures in which known population information is compared to information in the sample can be used to test for how well the sample represents the underlying population. Not enough information was gathered in the workers' survey to employ such a technique, however.

respondents about safety meetings on job sites and their perceptions of attitudes toward safety held by foremen, supervisors, unions, and upper management officials. The following summarizes the information obtained.

Access to Formal Training

Workers were asked, “Were you given any formal safety training?” Seventy-two percent reported receiving some kind of formal safety training (Figure C1). Of those who had received formal safety training, 29 percent indicated that it had been obtained through an apprenticeship program (Figure C1a), 62 percent reported such training had been obtained from an employer, 52 percent reported that training had been received through their union, and 6 percent cited other sources. Obviously, carpenters in the sample acquired formal training in safety from multiple sources.

[Figure C1 about here]

[Figure C1a about here]

When asked about the nature of the formal safety training, 56 percent of the sample indicated that they learned about commonly encountered safety hazards on construction sites during their training. Fifty-four percent reported training on safe work practices. A slightly higher proportion of workers (56 percent) reported training on OSHA regulations (Figure C1b).

[Figure C1b about here]

Other Sources of Training on Safety and Safe Work Practices

Although a majority of workers in the sample had received safety training from formal sources, most also reported learning safe work practices through informal channels. As with formal safety training, the results demonstrated that carpenters relied on multiple sources for informal safety training. Sixty-four percent reported that their foreman had provided on-the-job training about safe work practices. Similarly, more experienced workers trained respondents in 66 percent of the cases. An even larger proportion (80 percent) cited their own experience as a source of safety training. Only 9 percent indicated ‘other’ sources of training (See Figure C2).

[Figure C2 about here]

How Construction Workers Learned their Current Occupation

Carpenters in the sample learned their occupational skills from multiple sources. Figure C3 demonstrates that a vast majority (82 percent) learned their occupational skills while on the job. Fewer reported apprenticeship programs (35 percent) and trade schools (27 percent) as sources of their work skills. High schools and vocational schools also provided training to carpenters in the sample (20 percent), while the military trained only 3 percent of respondents. Because on-the-job training emerged as such an important source of skills training, perhaps more emphasis could be placed on safety training in on-the-job settings as well.

[Figure C3 about here]

Instructions on Companies' Safety Policies and Requirements

Sixty-five percent of the sample reported that they were instructed of the firms safety policies and requirements upon being hired (see Figure C4), which appears somewhat low considering that all respondents were employed in the study group and that 97 percent of carpenter foremen reported that newly hired workers are informed of companies' safety policies (see Appendix B). Perhaps those not informed of companies' safety policies were hired before the NIOSH/CPWR program was in place.

[Figure C4 about here]

The Occurrence of Regular Safety Meetings

Safety meetings are a vital element of the NIOSH/CPWR program, which calls for "Weekly Toolbox Safety and Health Meetings." The meetings are meant to raise workers' consciousness about safety, to act as venues for discussion of safety policies and safe work practices, and to offer supervisors, foremen, and workers an opportunity to identify and eliminate potential hazards. Seventy-five percent of respondents reported that such meetings were *regularly* held at their present job sites (Figure C5). In a differently worded question in the survey of carpenter foremen, 93 percent of the foremen indicated that safety meetings were held on their job sites (see Appendix B).³² Workers were then asked if they attended such meetings (see Figure C5a), 86 percent reported that either no meetings were held (21 percent) or that they never attended them (65 percent). Only 2 percent reported that they always attended safety

³²The question in the Foremen Questionnaire left out the word "regularly," but foremen reported that most safety meetings were held on an "as needed" basis.

meetings, the rest indicated occasional attendance (7 percent), or that they attended 'often' (4 percent).

[Figure C5 about here]

[Figure C5a about here]

One obtains a contrasting picture of the nature and regularity of safety meetings when comparing responses of foremen and front-line workers. Twenty-one percent of workers report no meetings compared to 12 percent of foremen who report no meetings (although the small sample suggests the proportions are likely not statistically significant). Furthermore, the almost universal lack of attendance by workers at safety meetings when they were held -- and they were held quite sporadically according to foremen (see Figure B4 in Appendix B) -- suggests at least questionable compliance with one of the central procedures of the safety plan. Results in Table C5a may be suggestive of why insignificant differences in safety behaviors were detected between the study and control groups in the main study.

Workers who report that safety meetings were held indicated that the discussions centered on topics such as, safety hazards on the site, safe work practices, and, less often, OSHA regulations (see Figure C5b). The fact that most workers responded to the question may suggest that even if safety meetings generally were not attended by workers, the contents of the meetings were nevertheless communicated to them in some manner.

[Figure C5b about here]

Workers Perceptions of Managements' and the Union's Attitude Toward Safety

Workers were asked about their perceptions of how important safe work practices are to their managers. A vast majority perceived that management cared very little about such practices. The results in Figure C6 indicate that 75 percent of workers believed that safe work practices were not at all important to top management and 20 percent indicated that management cared only slightly. Not a single respondent believed that safe work practices were 'very important' to management.

[Figure C6 about here]

The union did not fare much better among workers. In a differently worded question the workers were queried about how much *emphasis* the union places on safety. Sixty-six percent of workers answered 'none', while 31 percent reported 'very little', and 3 percent answered 'above average.' Again, not a single worker indicated that the union placed 'a great deal' of emphasis on safety practices (see Figure C7).

[Figure C7 about here]

Carpenters in the sample also were asked about how much supervisors and top management seem to care about their safety. The question elicited a large proportion of nonresponses as is evident in Figure C8. Thirty-one percent of the sample did not answer the question, while 41 percent indicated that managers were more interested in getting the 'job done as quickly and cheaply as possible.' Six percent indicated that management and supervisors 'do as much as possible to make the work place safe,' and 17 percent believed that managers 'care about safety, but could do more to increase it.'

[Figure C8 about here]

A similar pattern of responses is observed when workers were asked about the emphasis their foremen place on safety. Again, a large proportion of workers did not respond to the question (33 percent). Fifty-four percent of the sample indicated that their foremen 'never' or 'seldom' mention dangers or safety practices, while 8 percent reported that their foremen 'occasionally' address such items. Only four percent of the sample indicated that their foremen regularly praise and encourage safe work and warn of hazards (see Figure C9). Overall the results in Tables 6-9 suggest that workers do not perceive their managers, supervisors, foremen, or unions to be very concerned about safety or safe work practices.

[Figure C9 about here]

Summary and Conclusions

Carpenters in the sample reported multiple sources from which they had acquired their occupational skills and knowledge of safe work practices. Thus most of the respondents were aware of work practices that increased safety on the job. It does not appear, however, that communication of commitment to safety -- if it exists -- on the part of managers, foremen, and unions was effective. As was revealed in the sample of foremen, results from the sample of workers also suggest that safety meetings, a vital element in the NIOSH/CPWR program, did not appear to be occur weekly. And when they did occur, front-line workers rarely attended. Furthermore, the results indicate that a vast majority of workers perceive that safety on the job is not a concern of top management officials, their supervisors, foremen, or union.

Workers' widely held perception that their managers and union do not hold on-the-job safety as a serious concern is particularly disturbing in this particular case, because the employers

from which the sample of carpenters was drawn had all voluntarily committed to participate in a government/union sponsored safety program; a program that contains formal mechanisms by which managers and workers could regularly communicate with each other about safety issues, that establishes well-defined procedures to identify and eliminate unsafe working conditions, and that outlines plans of action to be followed if an accident were to occur. One would expect that among employees of such contractors, a larger percentage would perceive management and union officials to be concerned about safety on the job, although admittedly the lack of data on carpenters employed by nonparticipating contractors does not allow comparisons to a control group. Perhaps a clue to workers' perceptions lies in the degree of noncompliance with some of the fundamentals of the program -- in particular, weekly held safety meetings. Furthermore, given the level of noncompliance, perhaps the results of the main study, which detected no statistically significant difference in safe work behaviors between contractors who participated in the program and those who did not, are also not so surprising.

A much needed follow-up study ought to investigate if indeed there was a high rate of noncompliance with the fundamentals of the safety program. And if so, the nature of obstacles to compliance ought to be explored and suggestions formulated about how the program could be altered to increase its effectiveness.

Survey Instrument Administered to Carpenters

Center to Protect Workers' Rights
NIOSH/CPWR Programs Project

Worker Questionnaire

Date of Interview: _____

Site Location: _____

1. Current Employer _____

2. Were you given any formal safety training? yes___ no___ (SKIP to 3)

IF YES:

a. Were you given any of the following types of safety training?

Formal safety training through the apprenticeship program _____

Safety training sponsored by your employer _____

Safety training sponsored by the union _____

Other (PLEASE STATE) _____

b. Did the safety training include the following:

Information on safety hazards in the construction industry _____

Instruction on specific safe work practices _____

Information on OSHA safety regulations _____

Other (PLEASE STATE) _____

3. Did you ever learn safe work practices from:

The foreman _____

More experienced workers _____

Your own experience on the job _____

Other (PLEASE STATE) _____

4. How did you learn your current occupation?

Trade school _____
Apprenticeship program _____
On-the-job experience _____
Military _____
High school vocational training _____

5. When you were hired by your present employer, were you given instructions on the safety policy and safety requirements of the company? yes _____ no _____

6. Are there regular job safety meetings at your present job site?

yes _____ no _____ (SKIP TO 7)

IF YES:

a. How frequently do you attend them?

Always _____
Often _____
Occasionally _____
Never _____

b. What are the issues addressed?

Safety hazards at the job site _____
Safe work practices _____
OSHA regulations _____
Other (PLEASE STATE) _____

7. How important do you think safety practices are to the management of your company? PLEASE CHECK ONE ANSWER.

Very important _____
Relatively important _____
Slightly important _____
Not at all important _____

8. How much emphasis does the union place on worker safety practices?
PLEASE CHECK ONE ANSWER.

- A great deal _____
- About average _____
- Very little _____
- None _____

9. How much do supervisors and other top management seem to care about your safety? PLEASE CHECK ONE ANSWER.

They do as much as possible to make the job safe _____

They are concerned about safety but they could do more than they are doing to make the job safe. _____

They are really only interested in getting the job done as fast as and as cheaply as possible. _____

10. How much emphasis does the foreman place on safety practices on the job? PLEASE CHECK ONE ANSWER.

He regularly and frequently makes us aware of dangerous work practices and conditions, and praises us for safe conduct. _____

He regularly and frequently makes us aware of dangerous work practices and conditions. _____

He occasionally points out the most dangerous work practices and conditions. _____

He seldom mentions dangers or safety practices. _____

He never mentions danger or safety practices. _____

Table 1

Summary Statistics on Characteristics of New England Construction Sites:
By Study and Control Groups

Variable	Study Group		Control Group	
	Mean/Prop.	Std. Dev.	Mean/Prop.	Std. Dev.
<i>Dependent Variables</i>				
Fall Protection Compliance	0.811	0.392	0.906	0.292
Need for Fall Protection	0.544	0.499	0.434	0.497
Hard Hat Compliance	0.681	0.467	0.740	0.439
Need for Hard Hats	0.967	0.178	0.928	0.260
Eye Protection Compliance	0.427	0.495	0.455	0.499
Need for Eye Protection	0.893	0.310	0.864	0.344
Housekeeping Compliance	0.766	0.424	0.817	0.388
Ground Fault (GF) Compliance	0.886	0.318	0.919	0.273
Hearing Protection Compliance	0.824	0.381	0.868	0.339
<i>Independent Variables</i>				
Forman has Received OSHA 10 Training	0.437	0.497	0.421	0.495
Time Trend	24.205	12.568	28.443	8.177
Number of Carpenters on Site	7.629	7.858	9.932	18.191
Number of Other Workers on Site	44.313	68.388	58.315	74.111
Finish Work	0.117	0.322	0.089	0.286
Form Work	0.287	0.453	0.192	0.394
Interior Work	0.391	0.489	0.575	0.496
Wood Framing Work	0.127	0.334	0.021	0.145
Heavy and Highway Work	0.062	0.241	0.060	0.237
Other Construction Work	0.016	0.127	0.043	0.202
CPWR/NIOSH Program/A Program on Site	0.524	0.500	0.119	0.325
Quarter 1 (January-March)	0.199	0.400	0.157	0.365
Quarter 2 (April-June)	0.277	0.448	0.255	0.437
Quarter 3 (July-September)	0.336	0.473	0.345	0.476
Quarter 4 (October-December)	0.189	0.392	0.243	0.430
Construction site in Massachusetts	0.316	0.466	0.417	0.494
Construction Site in Rhode Island	0.417	0.494	0.289	0.454
Construction Site In Connecticut	0.267	0.443	0.294	0.456
Monthly Unemployment Rate in State	4.818	0.743	4.677	0.766
<i>Company Specific Control Variables.</i>				
Company A	0.049	0.216	---	---
Company B	0.029	0.169	---	---
Company C	0.059	0.235	---	---
Company D	0.065	0.247	---	---
Company E	---	---	0.077	0.267
Company F	0.101	0.302	---	---
Company G	0.033	0.178	---	---
Company H.	0.055	0.229	---	---
Company I	0.042	0.202	---	---
Company J	0.062	0.241	---	---
Company K	0.065	0.247	---	---
Company L	0.036	0.186	---	---

Table 1 cont.

Summary Statistics on Characteristics of New England Construction Sites:
By Study and Control Groups

Variable	Study Group		Control Group	
	Mean/Prop.	Std. Dev.	Mean/Prop.	Std. Dev.
Company M	0.062	0.241	---	---
Company N	0.029	0.169	---	---
Company O	0.033	0.178	---	---
Company P	0.055	0.229	---	---
Company Q	0.033	0.178	---	---
Company R	0.033	0.178	---	---
Company S	0.039	0.194	---	---
Company T	---	---	0.064	0.245
Company U	0.046	0.209	---	---
Company V	0.036	0.186	---	---
Company W	0.039	0.194	---	---
Number in Sample	307		235	

Source: Data on inspections of construction sites in New England.

Table 2

Probability of Fall Compliance Among Carpenters Working on New England Construction Sites (Probit Models)

Variable	Conditional Study Control		Fall-Safe Company Controls		Fall-Safe Study Group Control	
	Coefficients ^a	Standard Error	Coefficients ^b	Standard Error	Coefficients	Standard Error
Constant ^c	<u>-6.300</u>	1.973	-2.282	1.405	<u>-2.312</u>	1.316
Foreman has Received OSHA 10 Training	0.161	0.191	0.007	0.167	0.058	0.150
Time Trend	<u>0.127</u>	0.043	<u>0.057</u>	0.028	<u>0.069</u>	0.027
Time Squared	<u>-0.002</u>	0.001	-0.001	0.001	-0.001	0.001
Number of Carpenters on Site	0.003	0.009	-0.001	0.006	-0.004	0.006
Number of Workers from other Trades on Site	<u>0.005</u>	0.002	0.004	0.002	0.003	0.002
Form Work (Reference group is Finish Work)	<u>0.694</u>	0.418	0.148	0.383	0.115	0.264
Interior Work	<u>0.763</u>	0.390	0.164	0.372	-0.022	0.239
Wood Framing	<u>1.257</u>	0.462	-0.377	0.557	-0.013	0.320
Heavy and Highway Work	<u>1.096</u>	0.535	0.153	0.530	0.072	0.365
Other Construction Work	-0.208	0.765	-0.116	0.533	-0.130	0.463
CPWR/NIOSH Safety Program/A Safety Program on Site	-0.066	0.273	-0.150	0.223	-0.345	0.215
Quarter 2 (April - June)	<u>0.716</u>	0.422	0.409	0.313	0.438	0.305
Quarter 3 (July - September)	<u>0.819</u>	0.441	<u>0.574</u>	0.347	<u>0.584</u>	0.334
Quarter 4 (October - December)	<u>1.296</u>	0.565	<u>0.832</u>	0.417	<u>0.879</u>	0.405
Construction Site in Rhode Island	-0.801	0.509	-0.354	0.396	-0.428	0.362
Construction Site in Connecticut	-0.435	0.458	-0.282	0.365	-0.177	0.320
Average Monthly Unemployment Rate	<u>0.733</u>	0.365	<u>0.448</u>	0.269	0.404	0.258
Membership in Study Group	-0.086	0.266	---	---	-0.005	0.198
<i>Company Effects (missing estimates are because of lack of variability across sites)^v</i>						
Company A	---	---	-0.116	0.509	---	---
Company B	---	---	0.022	0.612	---	---
Company C	---	---	<u>-0.722</u>	0.413	---	---
Company D	---	---	-0.381	0.450	---	---
Company E*	---	---	<u>-0.854</u>	0.437	---	---
Company F	---	---	<u>-0.904</u>	0.344	---	---
Company G	---	---	-0.408	0.528	---	---
Company H	---	---	0.615	0.673	---	---
Company I	---	---	-0.486	0.484	---	---
Company J	---	---	-0.549	0.426	---	---
Company K	---	---	-0.052	0.464	---	---
Company L	---	---	0.152	0.607	---	---

Table 2

Probability of Fall Compliance Among Carpenters Working on New England Construction Sites (Probit Models)

Variable	Conditional Study Control		Fall-Safe Company Controls		Fall-Safe Study Group Control	
	Coefficients ^a	Standard Error	Coefficients ^b	Standard Error	Coefficients	Standard Error
Company M	---	---	-0.031	0.607	---	---
Company N	---	---	-0.395	0.516	---	---
Company O	---	---	---	---	---	---
Company P	---	---	0.334	0.613	---	---
Company Q	---	---	-0.762	0.599	---	---
Company R	---	---	-0.417	0.550	---	---
Company S	---	---	---	---	---	---
Company T*	---	---	0.033	0.544	---	---
Company U	---	---	-0.299	0.546	---	---
Company V	---	---	---	---	---	---
Company W	---	---	0.045	0.646	---	---
Number in Sample	269		542		542	
Log-Likelihood	-120.623		-191.337		-200.913	
Chi-Square	81.285		71.007		51.856	

^aOnly included inspections where fall protection was judged necessary by the inspectors.

^bSpecification controls for company specific effects and estimates the probability that workers are in a fall-safe environment.

^cBold and Italicized print signifies statistical significance at the .10 level or less.

^dAll but two of the companies in the table are located in the study group. There were only two instances in which companies in the control group had enough observations to be included as control variables (see Table 1).

Table 2a

Projected Change in the Probability of Proper Fall Protection Procedures
as a Result of Changes in Selected Explanatory Variables

Variables	Probability* Conditional	Probability** Comp. Controls	Probability*** Study Control
Averages	0.752	0.887	0.877
OSHA 10 (no)	0.728	0.886	0.872
OSHA 10 (yes)	0.779	0.887	0.884
Time (12th month)	0.446	0.781	0.749
Time (36th month)	0.874	0.933	0.931
Number of Carpenters			
Number = 20	0.761	0.884	0.868
Number = 40	0.782	0.880	0.852
Number from Other Crafts			
Number = 100	0.814	0.918	0.904
Number = 150	0.869	0.942	0.927
Finish Work	0.463	0.869	0.873
Form Work	0.726	0.898	0.896
Interior Work	0.748	0.900	0.869
Wood Framing	0.878	0.771	0.871
Heavy and Highway	0.842	0.898	0.888
Other Work	0.382	0.842	0.844
Plan Located on the Site (no)	0.761	0.896	0.900
Plan Located on the Site (yes)	0.740	0.867	0.825
Quarter 1	0.477	0.767	0.745
Quarter 2	0.745	0.872	0.863
Quarter 3	0.777	0.903	0.893
Quarter 4	0.892	0.941	0.938
Massachusetts	0.856	0.921	0.914
Rhode Island	0.603	0.856	0.825
Connecticut	0.735	0.872	0.882
Unemployment Rate (UR)			
UR = 4.2	0.617	0.831	0.825
UR = 4.4	0.671	0.853	0.845
UR = 4.6	0.723	0.873	0.864
UR = 5.0	0.812	0.906	0.896
UR = 5.2	0.849	0.920	0.910
Member of Study Group (no)	0.768	---	0.877
Member of Study Group (yes)	0.741	---	0.877

*Conditional: the probability of observing appropriate fall protection procedures given that they were necessary at the time of the inspection (study control included).

**Company Controls: The probability of working in a fall-safe environment with company specific effects controlled for (fall-safe implies correct procedures used or the procedures were not needed at the time of the inspection).

***Study Control: The probability of working in a fall-safe environment with a control for membership in the study group (no company specific controls).

Table 3

Probability of Hard Hat Usage Compliance Among Carpenters Working on New England Construction Sites (Probit Models)

Variable	Conditional Study Control		Hard Hat Usage Company Controls		Hard Hat Usage Study Group Control	
	Coefficients ^a	Standard Error	Coefficients ^b	Standard Error	Coefficients	Standard Error
Constant	-0.321	1.174	0.316	1.203	-0.107	1.139
Foreman has Received OSHA 10 Training	0.103	0.133	0.098	0.141	0.071	0.129
Time Trend ^c	<u>-0.086</u>	0.026	<u>-0.093</u>	0.027	<u>-0.087</u>	0.026
Time Squared	<u>0.002</u>	0.001	<u>0.002</u>	0.001	<u>0.002</u>	0.001
Number of Carpenters on Site	<u>0.024</u>	0.010	<u>0.019</u>	0.009	<u>0.023</u>	0.010
Number of Workers from other Trades on Site	<u>0.006</u>	0.002	<u>0.005</u>	0.002	<u>0.006</u>	0.002
Form Work (Reference group is Finish Work)	<u>1.305</u>	0.249	<u>1.150</u>	0.292	<u>1.189</u>	0.229
Interior Work	<u>0.631</u>	0.216	0.397	0.263	<u>0.476</u>	0.193
Wood Framing	<u>0.789</u>	0.298	0.561	0.478	<u>0.661</u>	0.283
Heavy and Highway Work	<u>1.373</u>	0.347	<u>1.561</u>	0.466	<u>1.229</u>	0.330
Other Construction Work	<u>1.291</u>	0.444	<u>1.421</u>	0.502	<u>1.143</u>	0.434
CPWR/NIOSH Safety Program/A Safety Program on Site	<u>0.434</u>	0.187	<u>0.426</u>	0.195	<u>0.404</u>	0.182
Quarter 2 (April - June)	-0.107	0.285	-0.197	0.286	-0.136	0.279
Quarter 3 (July - September)	-0.052	0.308	-0.124	0.310	-0.064	0.301
Quarter 4 (October - December)	0.211	0.365	0.121	0.366	0.181	0.355
Construction Site in Rhode Island	-0.441	0.323	-0.387	0.344	-0.423	0.315
Construction Site in Connecticut	-0.084	0.289	-0.002	0.323	-0.120	0.280
Average Montly Unemployment Rate	0.143	0.226	0.099	0.230	0.138	0.220
Membership in Study Group	<u>-0.411</u>	0.173	---	---	<u>-0.447</u>	0.167
<i>Company Effects (missing estimates are because of lack of variability across sites)~</i>						
Company A	---	---	-0.614	0.395	---	---
Company B	---	---	-0.866	0.527	---	---
Company C	---	---	<u>-0.904</u>	0.375	---	---
Company D	---	---	-0.735	0.419	---	---
Company E*	---	---	-0.342	0.402	---	---
Company F	---	---	-0.344	0.320	---	---
Company G	---	---	<u>-0.921</u>	0.440	---	---
Company H	---	---	-0.455	0.579	---	---
Company I	---	---	-0.440	0.397	---	---
Company J	---	---	-0.044	0.449	---	---
Company K	---	---	<u>-1.098</u>	0.375	---	---
Company L	---	---	-0.057	0.519	---	---
Company M	---	---	-0.266	0.556	---	---

Table 3

Probability of Hard Hat Usage Compliance Among Carpenters Working on New England Construction Sites (Probit Models)

Variable	Conditional Study Control		Hard Hat Usage Company Controls		Hard Hat Usage Study Group Control	
	Coefficients ^a	Standard Error	Coefficients ^b	Standard Error	Coefficients	Standard Error
Company N	---	---	0.204	0.580	---	---
Company O	---	---	-0.138	0.490	---	---
Company P	---	---	---	---	---	---
Company Q	---	---	-0.679	0.526	---	---
Company R	---	---	<u>-1.257</u>	0.529	---	---
Company S	---	---	---	---	---	---
Company T*	---	---	-0.087	0.404	---	---
Company U	---	---	<u>-1.130</u>	0.489	---	---
Company V	---	---	<u>-1.384</u>	0.473	---	---
Company W	---	---	-0.085	0.549	---	---
Number in Sample	515		542		542	
Log-Likelihood	-267.336		-270.759		-284.818	
Chi-Square	81.183		114.445		86.326	

*Only included inspections where hard hat usage was judged necessary by inspectors.

^aSpecification controls for company specific effects and estimates the probability that workers are using hard hats when they are required.^bBold and Italicized print signifies statistical significance at the .10 level or less.^dAll but two of the companies in the table are located in the study group. There were only two instances in which companies in the control group had enough observations to be included as control variables (see Table 1).

Table 3a

Projected Change in the Probability of Proper Hard Hat Usage as a Result of
Changes in Selected Explanatory Variables

Variables	Probability* Conditional	Probability** Comp. Controls	Probability*** Study Control
Averages	0.761	0.760	0.753
OSHA 10 (no)	0.747	0.747	0.743
OSHA 10 (yes)	0.779	0.777	0.765
Time (12th month)	0.760	0.761	0.747
Time (36th month)	0.776	0.777	0.773
Number of Carpenters			
Number = 20	0.835	0.823	0.827
Number = 40	0.926	0.906	0.919
Number from other Crafts			
Number = 100	0.841	0.833	0.836
Number = 150	0.902	0.890	0.899
Finish Work	0.455	0.523	0.503
Form Work	0.884	0.886	0.884
Interior Work	0.698	0.675	0.685
Wood Framing	0.751	0.732	0.748
Heavy and Highway	0.896	0.947	0.892
Other Work	0.881	0.930	0.875
Plan Located on the Site (no)	0.711	0.712	0.706
Plan Located on the Site (yes)	0.839	0.837	0.828
Quarter 1	0.762	0.781	0.759
Quarter 2	0.728	0.718	0.714
Quarter 3	0.746	0.743	0.738
Quarter 4	0.822	0.815	0.811
Massachusetts	0.813	0.801	0.808
Rhode Island	0.673	0.677	0.672
Connecticut	0.790	0.801	0.773
Unemployment Rate (UR)			
UR = 4.2	0.736	0.743	0.728
UR = 4.4	0.745	0.749	0.737
UR = 4.6	0.754	0.755	0.746
UR = 5.0	0.772	0.767	0.763
UR = 5.2	0.780	0.773	0.771
Member of Study Group (no)	0.828	---	0.825
Member of Study Group (yes)	0.704	---	0.687

*Conditional: the probability of observing appropriate hard hat usage given that it was necessary at the time of the inspection (study control included).

**Company Controls: The probability of observing proper hard hat usage or inspecting a site where hard hats are not necessary (company controls included).

***Study Control: The probability of observing proper hard hat usage or inspecting a site where hard hats are not necessary.

Table 3

Probability of Hard Hat Usage Compliance Among Carpenters Working on New England Construction Sites (Probit Models)

Variable	Conditional Study Control		Hard Hat Usage Company Controls		Hard Hat Usage Study Group Control	
	Coefficients ^a	Standard Error	Coefficients ^b	Standard Error	Coefficients	Standard Error
Constant	-0.321	1.174	0.316	1.203	-0.107	1.139
Foreman has Received OSHA 10 Training	0.103	0.133	0.098	0.141	0.071	0.129
Time Trend ^c	<u>-0.086</u>	0.026	<u>-0.093</u>	0.027	<u>-0.087</u>	0.026
Time Squared	<u>0.002</u>	0.001	<u>0.002</u>	0.001	<u>0.002</u>	0.001
Number of Carpenters on Site	<u>0.024</u>	0.010	<u>0.019</u>	0.009	<u>0.023</u>	0.010
Number of Workers from other Trades on Site	<u>0.006</u>	0.002	<u>0.005</u>	0.002	<u>0.006</u>	0.002
Form Work (Reference group is Finish Work)	<u>1.305</u>	0.249	<u>1.150</u>	0.292	<u>1.189</u>	0.229
Interior Work	<u>0.631</u>	0.216	0.397	0.263	<u>0.476</u>	0.193
Wood Framing	<u>0.789</u>	0.298	0.561	0.478	<u>0.661</u>	0.283
Heavy and Highway Work	<u>1.373</u>	0.347	<u>1.561</u>	0.466	<u>1.229</u>	0.330
Other Construction Work	<u>1.291</u>	0.444	<u>1.421</u>	0.502	<u>1.143</u>	0.434
CPWR/NIOSH Safety Program/A Safety Program on Site	<u>0.434</u>	0.187	<u>0.426</u>	0.195	<u>0.404</u>	0.182
Quarter 2 (April - June)	-0.107	0.285	-0.197	0.286	-0.136	0.279
Quarter 3 (July - September)	-0.052	0.308	-0.124	0.310	-0.064	0.301
Quarter 4 (October - December)	0.211	0.365	0.121	0.366	0.181	0.355
Construction Site in Rhode Island	-0.441	0.323	-0.387	0.344	-0.423	0.315
Construction Site in Connecticut	-0.084	0.289	-0.002	0.323	-0.120	0.280
Average Montly Unemployment Rate	0.143	0.226	0.099	0.230	0.138	0.220
Membership in Study Group	<u>-0.411</u>	0.173	---	---	<u>-0.447</u>	0.167
<i>Company Effects (missing estimates are because of lack of variability across sites) ~</i>						
Company A	---	---	-0.614	0.395	---	---
Company B	---	---	-0.866	0.527	---	---
Company C	---	---	<u>-0.904</u>	0.375	---	---
Company D	---	---	-0.735	0.419	---	---
Company E*	---	---	-0.342	0.402	---	---
Company F	---	---	-0.344	0.320	---	---
Company G	---	---	<u>-0.921</u>	0.440	---	---
Company H	---	---	-0.455	0.579	---	---
Company I	---	---	-0.440	0.397	---	---
Company J	---	---	-0.044	0.449	---	---
Company K	---	---	<u>-1.098</u>	0.375	---	---
Company L	---	---	-0.057	0.519	---	---
Company M	---	---	-0.266	0.556	---	---

Table 3

Probability of Hard Hat Usage Compliance Among Carpenters Working on New England Construction Sites (Probit Models)

Variable	Conditional Study Control		Hard Hat Usage Company Controls		Hard Hat Usage Study Group Control	
	Coefficients ^a	Standard Error	Coefficients ^b	Standard Error	Coefficients	Standard Error
Company N	---	---	0.204	0.580	---	---
Company O	---	---	-0.138	0.490	---	---
Company P	---	---	---	---	---	---
Company Q	---	---	-0.679	0.526	---	---
Company R	---	---	<u>-1.257</u>	0.529	---	---
Company S	---	---	---	---	---	---
Company T*	---	---	-0.087	0.404	---	---
Company U	---	---	<u>-1.130</u>	0.489	---	---
Company V	---	---	<u>-1.384</u>	0.473	---	---
Company W	---	---	-0.085	0.549	---	---
Number in Sample	515		542		542	
Log-Likelihood	-267.336		-270.759		-284.818	
Chi-Square	81.183		114.445		86.326	

^aOnly included inspections where hard hat usage was judged necessary by inspectors.^bSpecification controls for company specific effects and estimates the probability that workers are using hard hats when they are required.^cBold and Italicized print signifies statistical significance at the .10 level or less.^dAll but two of the companies in the table are located in the study group. There were only two instances in which companies in the control group had enough observations to be included as control variables (see Table 1).

Table 3a

Projected Change in the Probability of Proper Hard Hat Usage as a Result of
Changes in Selected Explanatory Variables

Variables	Probability* Conditional	Probability** Comp. Controls	Probability*** Study Control
Averages	0.761	0.760	0.753
OSHA 10 (no)	0.747	0.747	0.743
OSHA 10 (yes)	0.779	0.777	0.765
Time (12th month)	0.760	0.761	0.747
Time (36th month)	0.776	0.777	0.773
Number of Carpenters			
Number = 20	0.835	0.823	0.827
Number = 40	0.926	0.906	0.919
Number from other Crafts			
Number = 100	0.841	0.833	0.836
Number = 150	0.902	0.890	0.899
Finish Work	0.455	0.523	0.503
Form Work	0.884	0.886	0.884
Interior Work	0.698	0.675	0.685
Wood Framing	0.751	0.732	0.748
Heavy and Highway	0.896	0.947	0.892
Other Work	0.881	0.930	0.875
Plan Located on the Site (no)	0.711	0.712	0.706
Plan Located on the Site (yes)	0.839	0.837	0.828
Quarter 1	0.762	0.781	0.759
Quarter 2	0.728	0.718	0.714
Quarter 3	0.746	0.743	0.738
Quarter 4	0.822	0.815	0.811
Massachusetts	0.813	0.801	0.808
Rhode Island	0.673	0.677	0.672
Connecticut	0.790	0.801	0.773
Unemployment Rate (UR)			
UR = 4.2	0.736	0.743	0.728
UR = 4.4	0.745	0.749	0.737
UR = 4.6	0.754	0.755	0.746
UR = 5.0	0.772	0.767	0.763
UR = 5.2	0.780	0.773	0.771
Member of Study Group (no)	0.828	---	0.825
Member of Study Group (yes)	0.704	---	0.687

*Conditional: the probability of observing appropriate hard hat usage given that it was necessary at the time of the inspection (study control included).

**Company Controls: The probability of observing proper hard hat usage or inspecting a site where hard hats are not necessary (company controls included).

***Study Control: The probability of observing proper hard hat usage or inspecting a site where hard hats are not necessary.

Table 4

Probability of Eye Protection Usage Among Carpenters Working on New England Construction Sites (Probit Models)

Variable	Conditional Prob. Company Controls		Eye-Safe Company Controls		Eye-Safe Study Group Control	
	Coefficient ^a	Standard Error	Coefficient ^b	Standard Error	Coefficient	Standard Error
Company M	---	---	-0.629	0.516	---	---
Company N	---	---	-0.014	0.466	---	---
Company O	---	---	-0.161	0.451	---	---
Company P	---	---	0.615	0.400	---	---
Company Q	---	---	-0.166	0.523	---	---
Company R	---	---	0.616	0.519	---	---
Company S	---	---	0.138	0.454	---	---
Company T*	---	---	-0.643	0.443	---	---
Company U	---	---	<i>-0.780</i>	0.471	---	---
Company V	---	---	0.453	0.462	---	---
Company W	---	---	-0.363	0.475	---	---
Number in Sample	477		542		542	
Log-Likelihood	-319.423		-311.646		-331.325	
Chi-Square	91.961		120.023		80.666	

^aOnly included inspections where eye protection was judged necessary by the inspectors.

^bSpecification controls for company specific effects and estimates the probability that workers are in an eye-safe environment.

^cBold and Italicized print signifies statistical significance at the .10 level or less.

^dAll but two of the companies in the table are located in the study group. There were only two instances in which companies in the control group had enough observations to be included as control variables (see Table 1).

Table 4a

Projected Change in the Probability of Proper Eye Protection Procedures
as a Result of Changes in Selected Explanatory Variables

Variables	Probability* Conditional	Probability** Comp. Controls	Probability*** Study Control
Averages	0.379	0.431	0.434
OSHA 10 (no)	0.295	0.353	0.369
OSHA 10 (yes)	0.498	0.539	0.522
Time (12th month)	0.397	0.468	0.473
Time (36th month)	0.381	0.425	0.422
Number of Carpenters			
Number = 20	0.389	0.441	0.456
Number = 40	0.407	0.457	0.496
Number from other Crafts			
Number = 100	0.417	0.456	0.459
Number = 150	0.458	0.481	0.484
Finish Work	0.233	0.372	0.381
Form Work	0.505	0.487	0.544
Interior Work	0.286	0.373	0.339
Wood Framing	0.543	0.504	0.567
Heavy and Highway	0.558	0.596	0.584
Other Work	0.628	0.625	0.649
Plan Located on the Site (no)	0.362	0.421	0.424
Plan Located on the Site (yes)	0.409	0.450	0.454
Quarter 1	0.184	0.172	0.185
Quarter 2	0.353	0.393	0.393
Quarter 3	0.429	0.509	0.504
Quarter 4	0.554	0.617	0.620
Massachusetts	0.571	0.635	0.655
Rhode Island	0.156	0.208	0.192
Connecticut	0.474	0.495	0.506
Unemployment rate (UR)			
UR = 4.2	0.247	0.278	0.283
UR = 4.4	0.291	0.330	0.335
UR = 4.6	0.337	0.386	0.389
UR = 5.0	0.437	0.503	0.505
UR = 5.2	0.490	0.562	0.562
Member of Study Group (no)	0.407	---	0.481
Member of Study Group (yes)	0.358	---	0.399

*Conditional: the probability of observing appropriate eye protection procedures given that they are necessary at the time of the inspection (study control included).

**Company Controls: The probability of working according to eye-safe procedures. Company specific effects are controlled for. (Eye-safe implies correct procedures used or the procedures were not needed at the time of the inspection).

***Study Control: The probability of working according to eye-safe procedures with a control for membership in the study group (no company specific controls).

Table 5

Probability of Proper Housekeeping Procedures Among Carpenters Working on New England
Construction Sites (Probit Models)^a

Variable	Proper Housekeeping Company Controls		Proper Housekeeping Study Group Control	
	Coefficient	Standard Error	Coefficient	Standard Error
Constant	0.545	1.255	-0.018	1.192
Foreman has Received OSHA 10 Training ^u	0.230	0.147	<u>0.290</u>	0.135
Time Trend	0.031	0.026	0.025	0.025
Time Squared	0.000	0.001	0.000	0.000
Number of Carpenters on Site	-0.004	0.006	-0.002	0.005
Number of Workers from other Trades on Site	0.000	0.001	0.000	0.001
Form Work (Reference group is Finish Work)	<u>0.549</u>	0.293	<u>0.404</u>	0.227
Interior Work	0.147	0.269	0.147	0.202
Wood Framing	-0.237	0.459	-0.167	0.274
Heavy and Highway Work	0.631	0.412	<u>0.608</u>	0.346
Other Construction Work	0.081	0.444	0.090	0.413
CPWR/NIOSH Safety Program/A Safety Program on Site	-0.078	0.189	-0.125	0.187
Quarter 2 (April - June)	-0.239	0.295	-0.165	0.283
Quarter 3 (July - September)	-0.505	0.313	-0.354	0.301
Quarter 4 (October - December)	-0.172	0.387	-0.004	0.371
Construction Site in Rhode Island	0.197	0.356	0.227	0.325
Construction Site in Connecticut	0.461	0.333	0.298	0.291
Average Monthly Unemployment Rate	-0.026	0.244	0.057	0.233
Membership in Study Group	---	---	-0.096	0.173
<i>Company Effects (missing estimates are because of lack of variability across sites)</i>				
Company A	-0.295	0.439	---	---
Company B	-0.432	0.505	---	---
Company C	<u>-0.778</u>	0.378	---	---
Company D	<u>-1.146</u>	0.385	---	---
Company E*	0.185	0.452	---	---
Company F	0.204	0.353	---	---
Company G	<u>-0.837</u>	0.462	---	---
Company H	0.011	0.540	---	---
Company I	<u>-0.840</u>	0.406	---	---
Company J	-0.170	0.378	---	---
Company K	-0.190	0.404	---	---

Table 5 cont.

Probability of Proper Housekeeping Procedures Among Carpenters Working on New England
Construction Sites (Probit Models)^a

Variable	Proper Housekeeping Company Controls		Proper Housekeeping Study Group Control	
	Coefficient	Standard Error	Coefficient	Standard Error
Company L	---	---	---	---
Company M	-0.135	0.531	---	---
Company N	-0.304	0.491	---	---
Company O	0.433	0.622	---	---
Company P	0.341	0.562	---	---
Company Q	-0.230	0.508	---	---
Company R	-0.566	0.490	---	---
Company S	---	---	---	---
Company T*	<u>-0.693</u>	0.381	---	---
Company U	---	---	---	---
Company V	-0.272	0.481	---	---
Company W	---	---	---	---
Number in Sample	542		542	
Log-Likelihood	-249.035		262.891	
Chi-Square	62.171		34.459	

^aThe dependent variable was coded "1" when proper housekeeping was observed on the site among carpenters.

^bBold and Italicized print signifies statistical significance at the .10 level or less.

^cAll but two of the companies in the table are located in the study group. There were only two instances in which companies in the control group had enough observations to be included as control variables (see Table 1).

Table 5a

Projected Changes in the Probability of Proper Housekeeping on a Site
as a Result of Changes in Selected Explanatory Variables

Variables	Probability* Comp. Controls	Probability** Study Control
Averages	0.815	0.802
OSHA 10 (yes)	0.788	0.766
OSHA 10 (no)	0.848	0.845
Time (12th month)	0.777	0.763
Time (36th month)	0.836	0.826
Number of Carpenters		
Number = 20	0.804	0.795
Number = 40	0.782	0.781
Number from other Crafts		
Number = 100	0.813	0.806
Number = 150	0.810	0.809
Finish Work	0.749	0.744
Form Work	0.889	0.856
Interior Work	0.794	0.789
Wood Framing	0.668	0.688
Heavy and Highway	0.904	0.897
Other Work	0.774	0.772
Plan Located on the Site (no)	0.822	0.814
Plan Located on the Site (yes)	0.801	0.779
Quarter 1	0.879	0.845
Quarter 2	0.824	0.803
Quarter 3	0.747	0.746
Quarter 4	0.841	0.844
Massachusetts	0.757	0.753
Rhode Island	0.814	0.819
Connecticut	0.877	0.837
Unemployment rate (UR)		
UR = 4.2	0.819	0.794
UR = 4.4	0.818	0.797
UR = 4.6	0.816	0.800
UR = 5.0	0.814	0.972
UR = 5.2	0.812	0.809
Member of Study Group (no)	---	0.817
Member of Study Group (yes)	---	0.791

*Specification controls for company specific effects.

**Specification controls for membership in the study group.

Table 6

Probability of Proper Ground Fault (GF) Procedures Among Carpenters Working on New
England Construction Sites (Probit Models)^a

Variable	GF-Safe Company Controls		GF-Safe Study Group Control	
	Coefficient	Standard Error	Coefficient	Standard Error
Constant	-0.091	1.474	-0.972	1.398
Foreman has Received OSHA 10 Training	<u>-0.387</u>	0.182	-0.335	0.171
Time Trend ^u	0.028	0.030	<u>0.049</u>	0.029
Time Squared	0.000	0.001	-0.001	0.001
Number of Carpenters on Site	0.002	0.008	0.003	0.008
Number of Workers from other Trades on Site	0.001	0.002	0.001	0.001
Form Work (Reference group is Finish Work)	-0.305	0.351	-0.123	0.272
Interior Work	-0.100	0.332	-0.059	0.251
Wood Framing	0.501	0.870	-0.008	0.373
Heavy and Highway Work	-0.097	0.513	-0.147	0.377
Other Construction Work	---	---	---	---
CPWR/NIOSH Safety Program/A Safety Program on Site	<u>0.619</u>	0.255	0.387	0.251
Quarter 2 (April - June)	0.171	0.345	0.254	0.334
Quarter 3 (July - September)	0.275	0.387	0.351	0.372
Quarter 4 (October - December)	0.663	0.478	<u>0.787</u>	0.459
Construction Site in Rhode Island	-0.371	0.413	-0.560	0.386
Construction Site in Connecticut	-0.362	0.391	<u>-0.770</u>	0.340
Average Monthly Unemployment Rate	0.233	0.288	0.354	0.275
Membership in Study Group	---	---	-0.098	0.215
<i>Company Effects (missing estimates are because of lack of variability across sites)^v</i>				
Company A	<u>-1.054</u>	0.430	---	---
Company B	-0.190	0.658	---	---
Company C	0.384	0.568	---	---
Company D	<u>-0.813</u>	0.434	---	---
Company E*	---	---	---	---
Company F	-0.408	0.405	---	---
Company G	<u>-1.043</u>	0.493	---	---
Company H	-0.798	0.996	---	---
Company I	---	---	---	---
Company J	---	---	---	---
Company K	0.158	0.598	---	---
Company L	---	---	---	---

Table 6 cont.

Probability of Proper Ground Fault (GF) Procedures Among Carpenters Working on New
England Construction Sites (Probit Models)^a

Variable	GF-Safe Company Controls		GF-Safe Study Group Control	
	Coefficient	Standard Error	Coefficient	Standard Error
Company M	-0.963	0.890	---	---
Company N	-0.445	0.597	---	---
Company O	---	---	---	---
Company P	---	---	---	---
Company Q	<u>-1.301</u>	0.594	---	---
Company R	---	---	---	---
Company S	---	---	---	---
Company T*	---	---	---	---
Company U	-0.572	0.523	---	---
Company V	---	---	---	---
Company W	---	---	---	---
Number	542		542	
Log-Likelihood	-148.076		-157.020	
Chi-Square	55.359		37.470	

^aThe dependent variable was coded "1" when proper ground fault (GF) procedures were observed on the site among carpenters.

*Bold and Italicized print signifies statistical significance at the .10 level or less.

*All but two of the companies in the table are located in the study group. There were only two instances in which companies in the control group had enough observations to be included as control variables (see Table 1).

Table 6a

Projected Changes in the Probability of Observing Proper Ground-Fault
Procedures as a Result of Changes in Selected Explanatory Variables

Variables	Probability* Comp. Controls	Probability** Study Control
Averages	0.932	0.922
OSHA 10 (no)	0.951	0.941
OSHA 10 (yes)	0.897	0.891
Time (12th month)	0.888	0.865
Time (36th month)	0.953	0.948
Number of Carpenters		
Number = 20	0.934	0.926
Number = 40	0.939	0.933
Number from other Crafts		
Number = 100	0.939	0.930
Number = 150	0.946	0.937
Finish Work	0.942	0.932
Form Work	0.898	0.914
Interior Work	0.930	0.924
Wood Framing	0.981	0.931
Heavy and Highway	0.930	0.910
Other Work	---	---
Plan Located on the Site (no)	0.898	0.901
Plan Located on the Site (yes)	0.971	0.953
Quarter 1	0.886	0.857
Quarter 2	0.916	0.907
Quarter 3	0.931	0.922
Quarter 4	0.969	0.968
Massachusetts	0.958	0.967
Rhode Island	0.912	0.899
Connecticut	0.913	0.857
Unemployment rate (UR)		
UR = 4.2	0.913	0.889
UR = 4.4	0.920	0.902
UR = 4.6	0.927	0.914
UR = 5.0	0.939	0.934
UR = 5.2	0.944	0.943
Member of Study Group (no)	---	0.930
Member of Study Group (yes)	---	0.916

*Specification controls for company specific effects.

**Specification controls for membership in the study group.

Table 7

Probability of Proper Hearing Protection Among Carpenters Working on New
England Construction Sites (Probit Models)^a

Variable	Hearing-Safe Company Controls		Hearing-Safe Study Group Control	
	Coefficient	Standard Error	Coefficient	Standard Error
Constant	-1.081	1.418	-1.782	1.314
Foreman has Received OSHA 10 Training	-0.114	0.166	-0.135	0.148
Time Trend	-0.023	0.029	-0.009	0.028
Time Squared	<u>0.001</u>	0.001	0.001	0.001
Number of Carpenters on Site ^u	<u>-0.020</u>	0.006	-0.013	0.005
Number of Workers from other Trades on Site	-0.001	0.001	-0.001	0.001
Form Work (Reference group is Finish Work)	-0.050	0.432	<u>0.493</u>	0.260
Interior Work	-0.536	0.394	0.147	0.224
Wood Framing	<u>-1.207</u>	0.570	0.175	0.310
Heavy and Highway Work	-0.443	0.468	0.040	0.331
Other Construction Work	-0.419	0.577	0.041	0.475
CPWR/NIOSH Safety Program/A Safety Program on Site	0.043	0.224	-0.122	0.209
Quarter 2 (April - June)	0.225	0.325	0.280	0.311
Quarter 3 (July - September)	0.575	0.365	<u>0.580</u>	0.348
Quarter 4 (October - December)	0.683	0.426	0.632	0.409
Construction Site in Rhode Island	<u>-0.884</u>	0.403	<u>-0.656</u>	0.362
Construction Site in Connecticut	-0.569	0.362	-0.495	0.313
Average Montly Unemployment Rate	0.560	0.273	<u>0.526</u>	0.261
Membership in Study Group	---	---	-0.127	0.186
<i>Company Effects (missing estimates are because of lack of variability across sites) ~</i>				
Company A	0.033	0.507	---	---
Company B	-0.792	0.594	---	---
Company C	-0.088	0.533	---	---
Company D	-0.516	0.482	---	---
Company E*	<u>1.274</u>	0.688	---	---
Company F	-0.041	0.363	---	---
Company G	0.325	0.620	---	---
Company H	0.646	0.626	---	---
Company I	-0.026	0.489	---	---
Company J	-0.331	0.405	---	---
Company K	-0.482	0.435	---	---

Table 7 cont.

Probability of Proper Hearing Protection Among Carpenters Working on New
England Construction Sites (Probit Models)^a

Variable	Hearing-Safe Company Controls		Hearing-Safe Study Group Control	
	Coefficient	Standard Error	Coefficient	Standard Error
Company L	-0.082	0.620	---	---
Company M	<i>1.604</i>	0.716	---	---
Company N	-0.579	0.525	---	---
Company O	-0.108	0.530	---	---
Company P	0.396	0.616	---	---
Company Q	<i>-1.400</i>	0.580	---	---
Company R	-0.377	0.553	---	---
Company S	-0.650	0.554	---	---
Company T*	0.640	0.572	---	---
Company U	---	---	---	---
Company V	0.316	0.638	---	---
Company W	<i>-1.141</i>	0.574	---	---
Number in Sample	542		542	
Log-Likelihood	-194.974		-208.916	
Chi-Square	80.910		53.025	

^aThe dependent variable was coded "1" when hearing protection was used or workers were in a hearing-safe environment at the time of the inspection.

^bBold and italicized print signifies statistical significance at the .10 level or less.

^cAll but two of the companies in the table are located in the study group. There were only two instances in which companies in the control group had enough observations to be included as control variables (see Table 1).

Table 7a

Projected Change in the Probability of Proper Hearing Protection
Procedures as a Result of Changes in Selected Explanatory Variables

Variables	Probability* Comp. Controls	Probability** Study Control
Averages	0.890	0.874
OSHA 10 (no)	0.899	0.886
OSHA 10 (yes)	0.878	0.858
Time (12th month)	0.779	0.746
Time (36th month)	0.944	0.935
Number of Carpenters		
Number = 20	0.841	0.841
Number = 40	0.723	0.771
Number from other Crafts		
Number = 100	0.885	0.865
Number = 150	0.880	0.856
Finish Work	0.948	0.826
Form Work	0.943	0.924
Interior Work	0.863	0.861
Wood Framing	0.664	0.867
Heavy and Highway	0.882	0.836
Other Work	0.887	0.836
Plan Located on the Site (no)	0.888	0.883
Plan Located on the Site (yes)	0.896	0.857
Quarter 1	0.796	0.770
Quarter 2	0.854	0.846
Quarter 3	0.920	0.907
Quarter 4	0.935	0.915
Massachusetts	0.956	0.936
Rhode Island	0.795	0.807
Connecticut	0.872	0.847
Unemployment Rate (UR)		
UR = 4.2	0.820	0.803
UR = 4.4	0.848	0.831
UR = 4.6	0.873	0.856
UR = 5.0	0.914	0.899
UR = 5.2	0.930	0.916
Member of Study Group (no)	---	0.888
Member of Study Group (yes)	---	0.862

*Specification controls for company specific effects.

**Specification controls for membership in the study group.

Table 8

Summary of Companies' Strengths and Lapses in Compliance with Various Safe Work Practices

Company Name	Type of Hazard						Negative (x)	Positive (o)
	Fall Protection	Hard Hats	Eye Protection	House Keeping	GF Compliance	Hearing Protection		
Company A					x		1	0
Company B							0	0
Company C	x	x		x			3	0
Company D				x	x		2	0
Company E*	x				o		1	1
Company F	x		x			o	2	1
Company G		x		x	x		3	0
Company H			o				0	1
Company I			o	x	o		1	2
Company J					o		0	1
Company K		x	x				2	0
Company L				o			0	1
Company M							1	0
Company N						x	1	0
Company O	o				o		0	2
Company P		o					1	0
Company Q					x	x	2	0
Company R		x			o		1	1
Company S	o	o		o	o		0	4
Company T*				x	o		1	1
Company U		x		o		o	1	2
Company V	o	x	x		o		2	2
Company W				o	o		0	2
Ratio: Negative/Positive	3/3	6/2	3/2	5/4	4/9	2/2		

Note: Companies with a negative and statistically significant parameter estimate in the relevant probit model see (Tables 2-7) are marked with an "x" in the appropriate cell. In cases where the relevant parameter estimate could not be estimated in the probit equation, the information is taken from Appendix Table 1.

*Company in the Control Group.

Appendix Table 1

Likelihood Ratio Tests to Determine if Study and Control Groups are
Drawn from the Same Statistical Populations

Independent Variables	Full Using All Data	Model Using Study Group	Model Using Control Group	Difference	Chi-Square
Fall Protection	-202.206	-126.514	-68.778	6.913	13.827
Hard Hat Usage	-303.687	-176.023	-124.813	2.851	5.702
Eye Protection	-339.663	-184.493	-148.296	6.874	13.747
Housekeeping	-268.071	-157.531	-105.249	5.291	10.582
Ground Fault (GF)	-158.567	-95.100	-58.399	5.068	10.136
Hearing Protection	-212.062	-125.342	-78.372	8.349	16.697

Note: the log-likelihoods were generated from probit estimates of the probability of observing, for example, a fall-safe work site as a function of a vector of 12 explanatory variables. In all cases the likelihood ratio tests yielded chi-square statistics that indicate acceptance of the null hypothesis. Acceptance of the null hypothesis suggests that the data from the Study and Control groups were drawn from the same statistical populations.

Appendix Table 2

Proportion of Study Group Contractors' Sites that were Observed to be either Compliant
with the Listed Safe Work Practices or Sites where the Practices were not Applicable

Dependent variable	Companies							
	Company A	Company B	Company C	Company D	Company E	Company F	Company G	Company H
Fall Protection	0.867	0.778	0.667	0.800	0.833	0.645	0.800	0.882
Hard Hat Usage	0.600	0.333	0.667	0.800	0.722	0.677	0.400	0.765
Eye Protection	0.400	0.444	0.278	0.600	0.556	0.161	0.400	0.824
House Keeping	0.800	0.556	0.667	0.650	0.889	0.839	0.600	0.647
Ground Fault (GF)	0.733	0.889	0.944	0.750	1.000	0.903	0.700	0.941
Hearing Protection	0.867	0.667	0.889	0.850	0.889	0.806	0.900	0.824

Dependent variable	Companies							
	Company I	Company J	Company K	Company L	Company M	Company N	Company O	Company P
Fall Protection	0.846	0.789	0.850	0.909	0.778	0.778	1.000	0.941
Hard Hat Usage	0.462	0.895	0.400	0.818	0.889	0.889	0.700	1.000
Eye Protection	0.000	0.316	0.250	0.636	0.444	0.444	0.400	0.706
House Keeping	0.538	0.684	0.800	1.000	0.667	0.667	0.900	0.941
Ground Fault (GF)	0.923	1.000	0.950	0.909	0.889	0.889	0.900	0.882
Hearing Protection	0.846	0.737	0.700	0.909	0.667	0.667	0.800	0.941

Dependent variable	Companies							
	Company Q	Company R	Company S	Company T	Company U	Company V	Company W	Average*
Fall Protection	0.700	0.700	1.000	0.933	0.714	1.000	0.917	0.825
Hard Hat Usage	0.500	0.600	1.000	0.733	0.643	0.364	0.833	0.651
Eye Protection	0.400	0.700	0.750	0.133	0.286	0.727	0.500	0.450
House Keeping	0.700	0.700	0.917	0.533	1.000	0.818	1.000	0.747
Ground Fault (GF)	0.700	1.000	1.000	1.000	0.714	1.000	1.000	0.890
Hearing Protection	0.600	0.800	0.833	0.933	1.000	0.909	0.667	0.806

Source: proportions calculated from site inspection data.

**Figure 1: Unemployment Rates in the
Tri-State New England Region (Not
Seasonally Adjusted)**

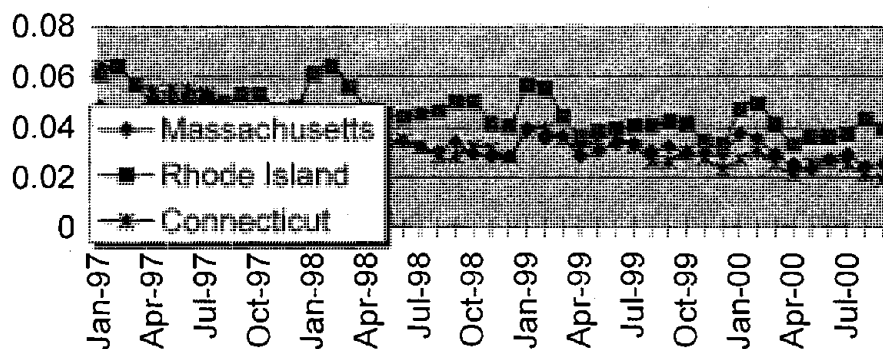


Figure B1: Percent of Foremen who Reported that their Employer has a Written Safety Policy

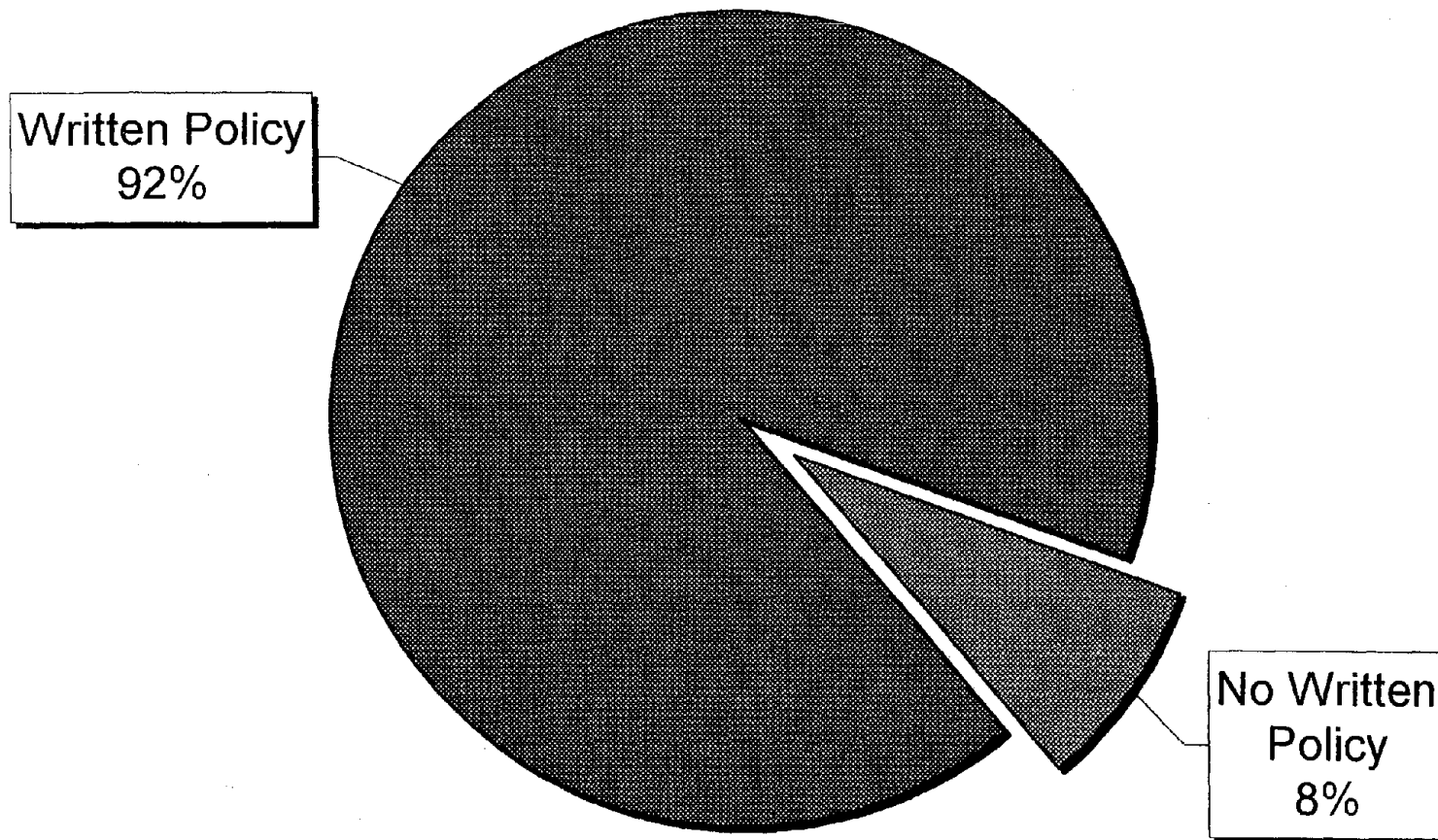


Figure B2: Who is in Charge of Safety at the Company Level? As Reported by Foremen

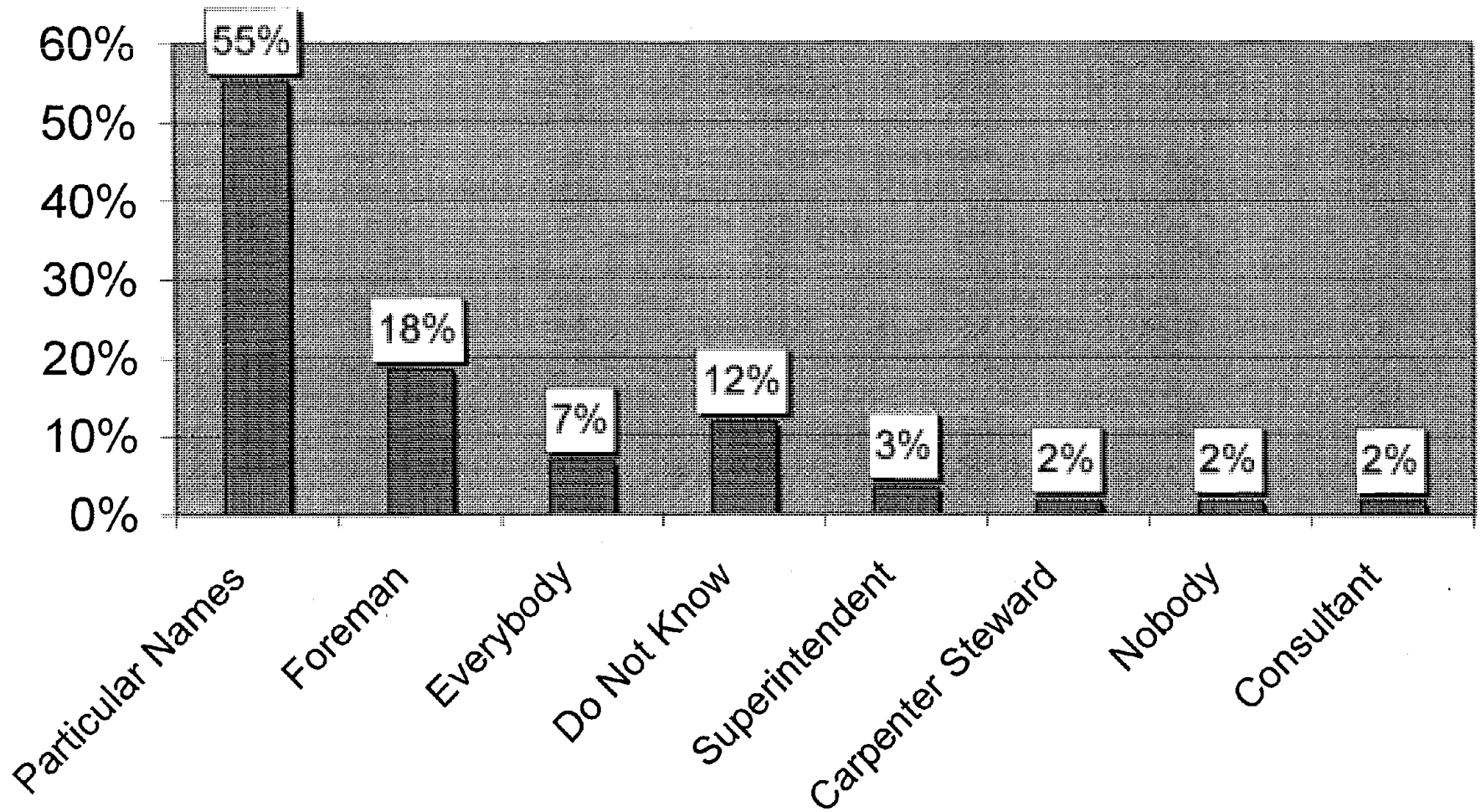


Figure B3: Who is in Charge of Safety at the Job Site? As Reported by Foremen

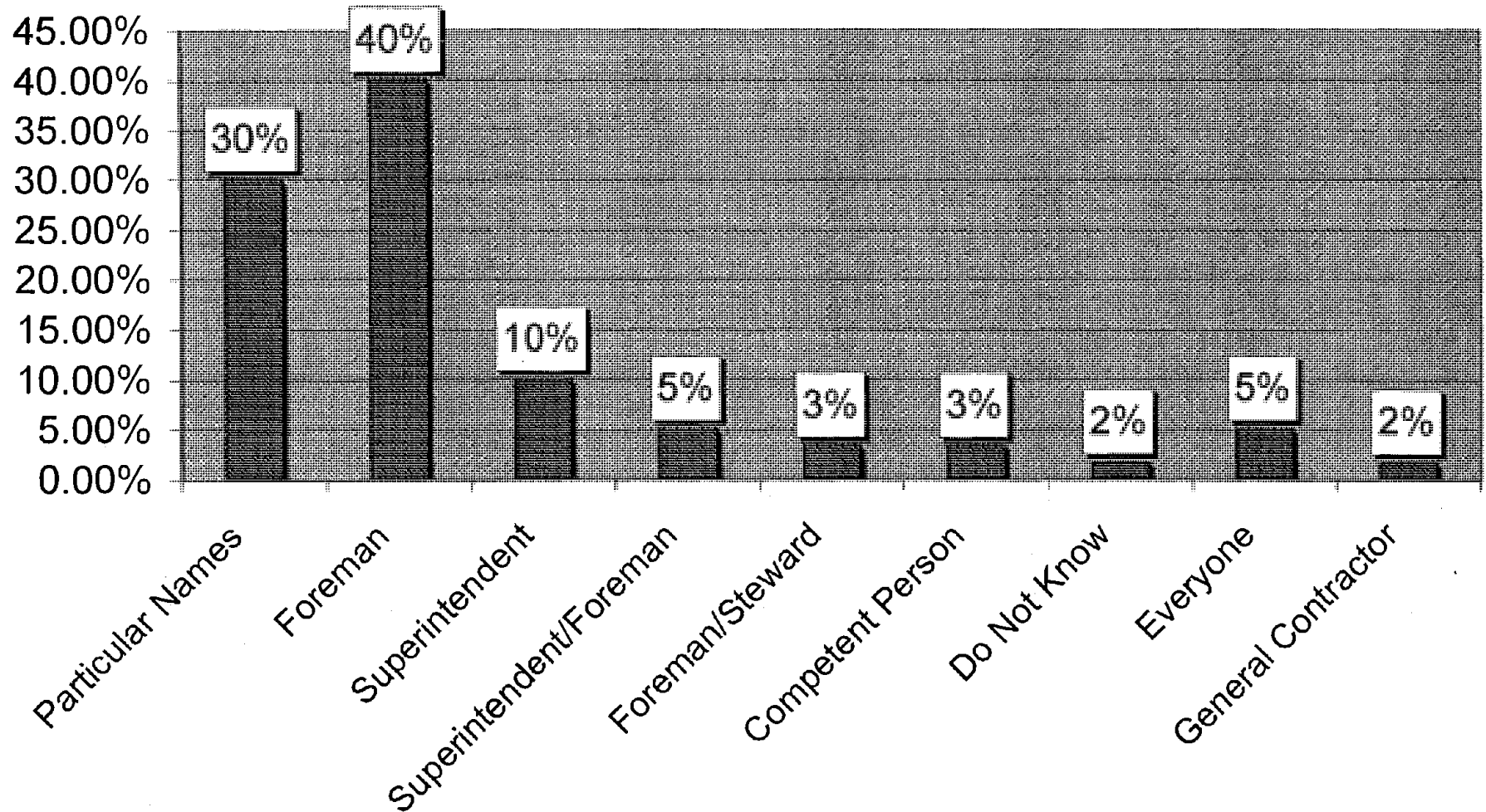


Figure B4: Percent of Foremen who Reported that New Hires are Informed of Safety Policies

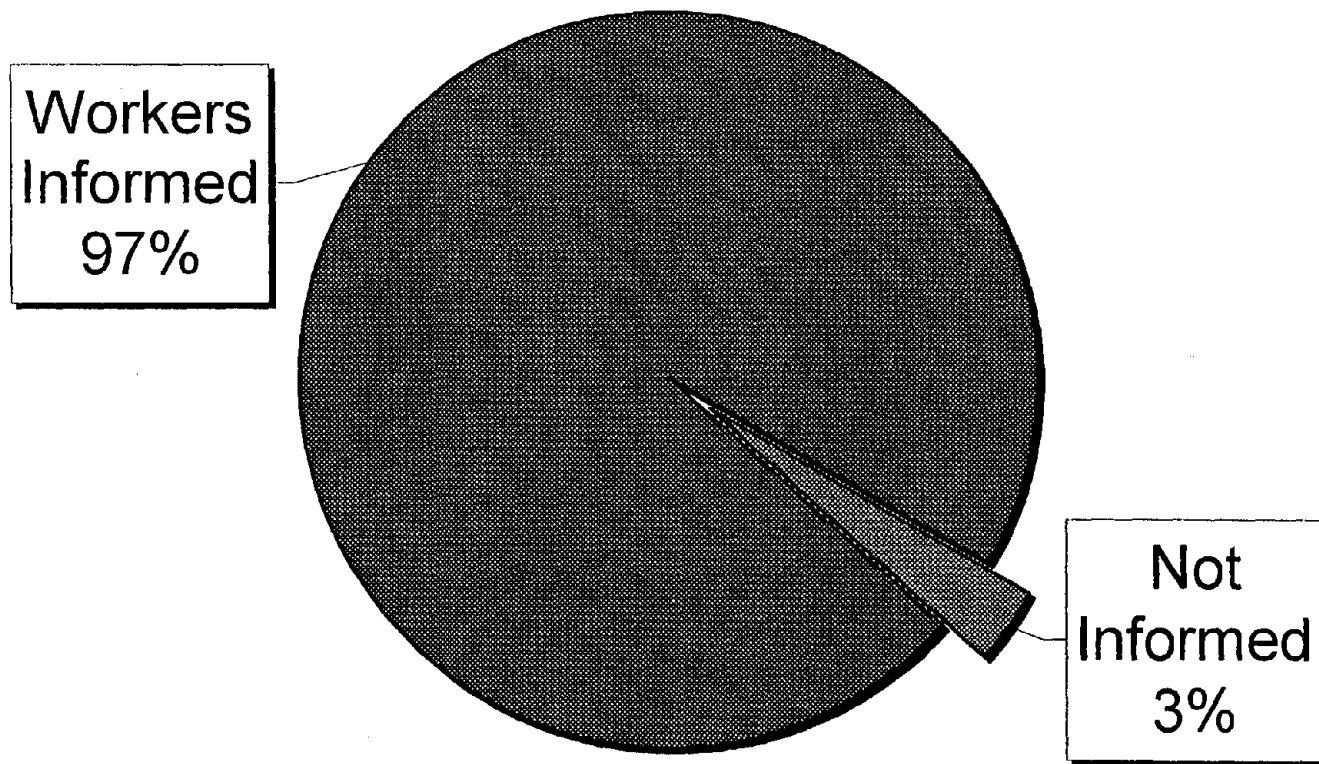


Figure B5: How Often Safety Meetings are Held: As Reported by Foremen

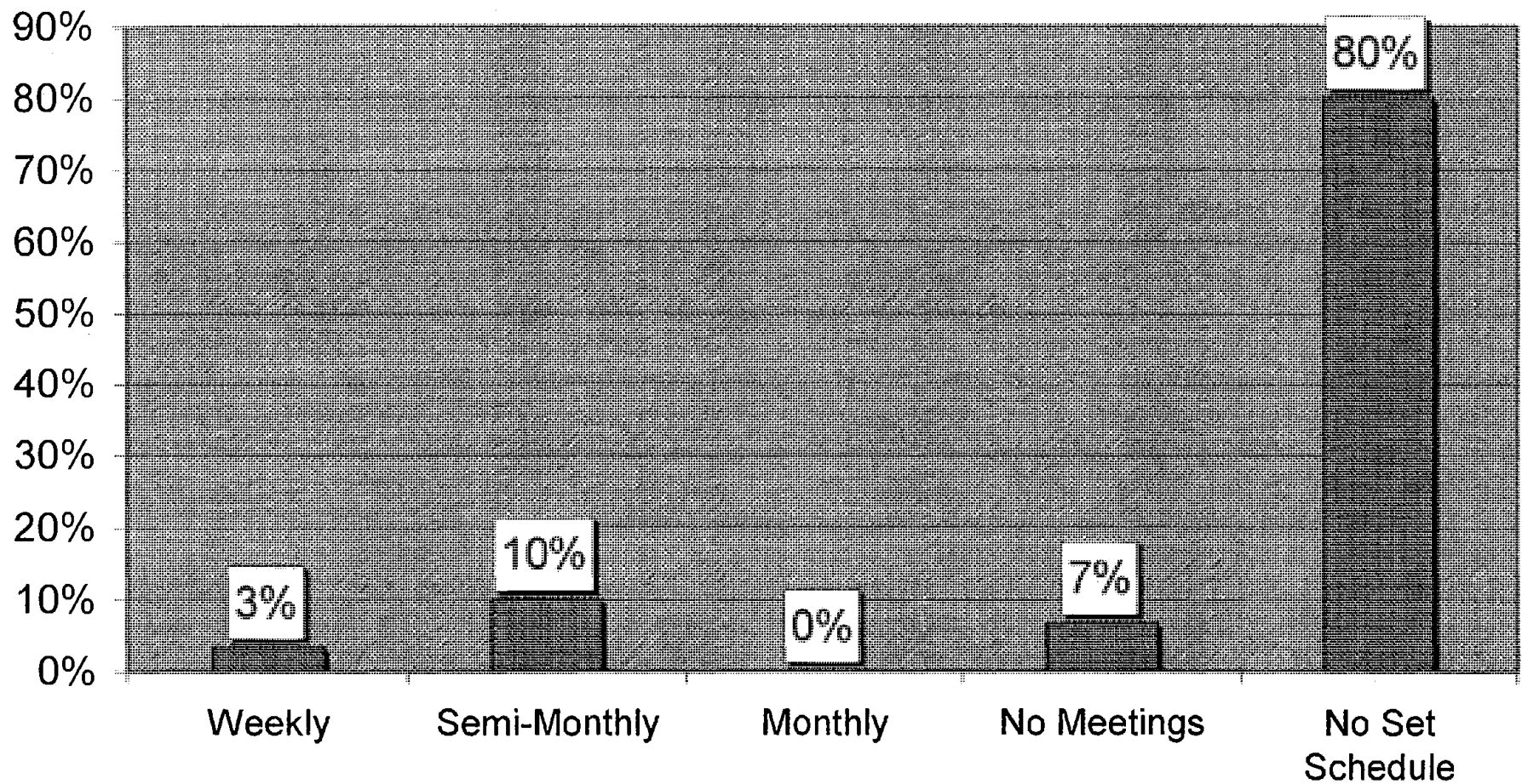


Figure B6: Who Handles the Safety Meetings?
(Multiple Answers)

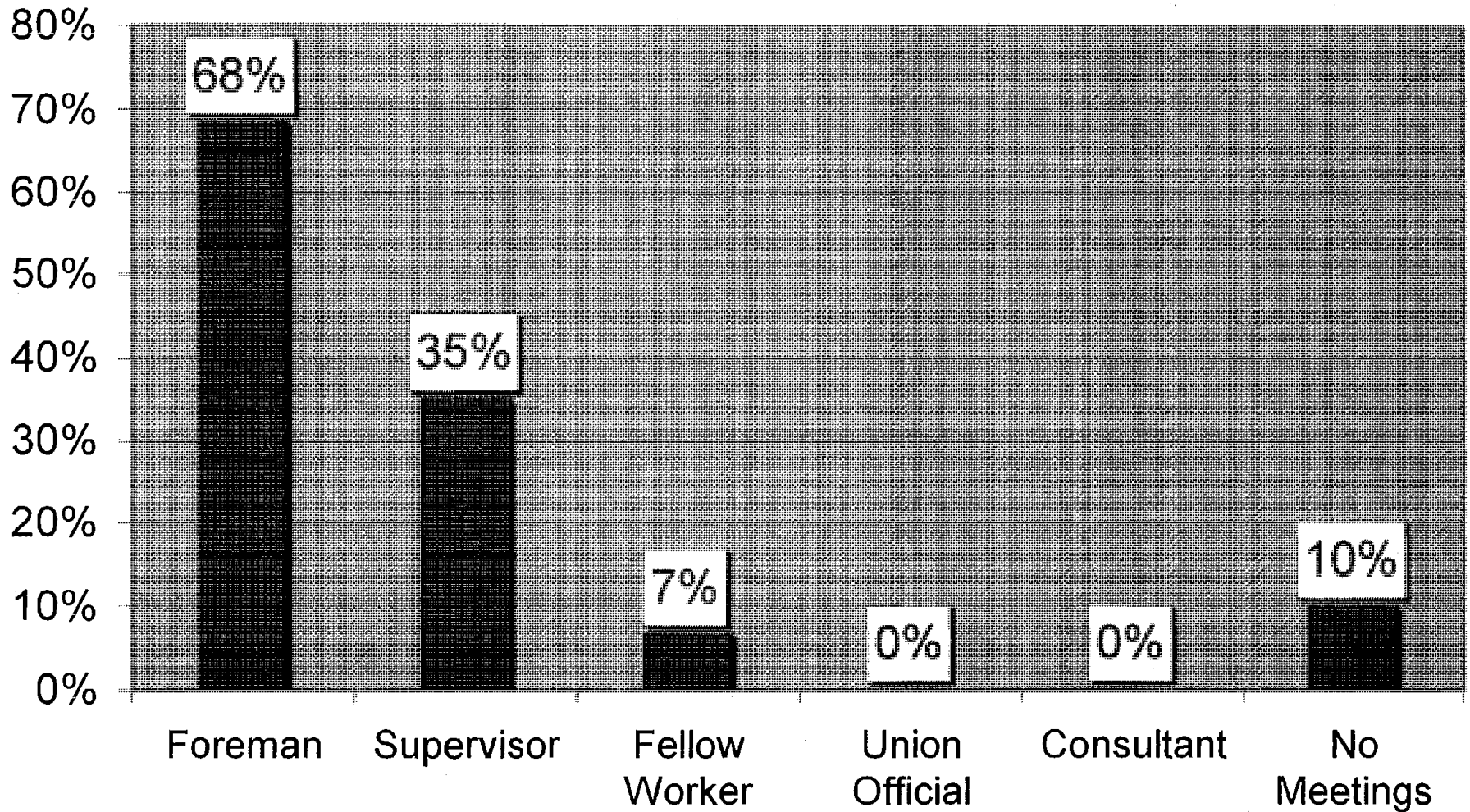


Figure B7: Topics Discussed at Safety Meetings
(Multiple Answers)

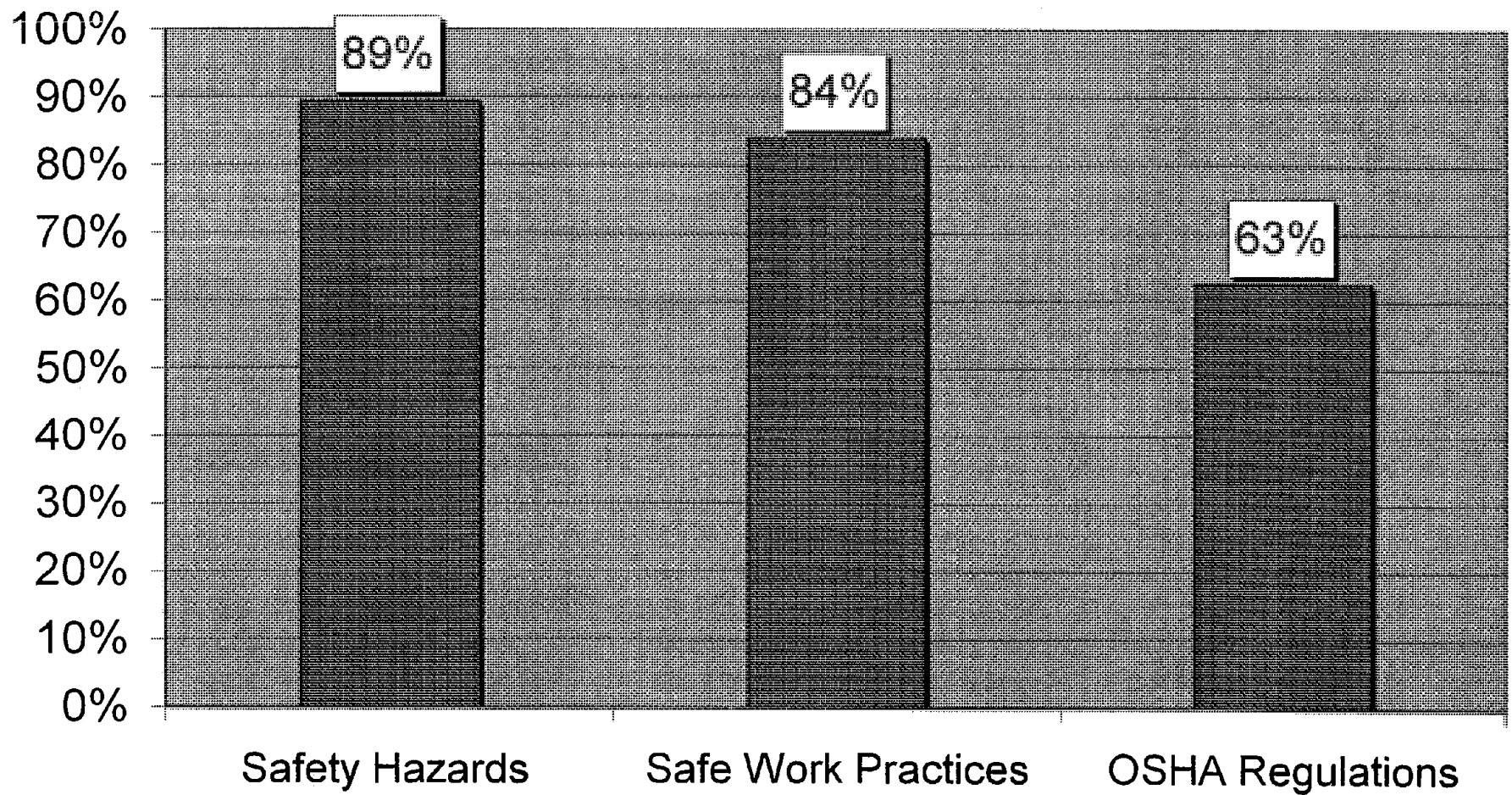


Figure B8: The Degree to which Top Management Insists on Meeting OSHA Standards: As Reported by Foremen

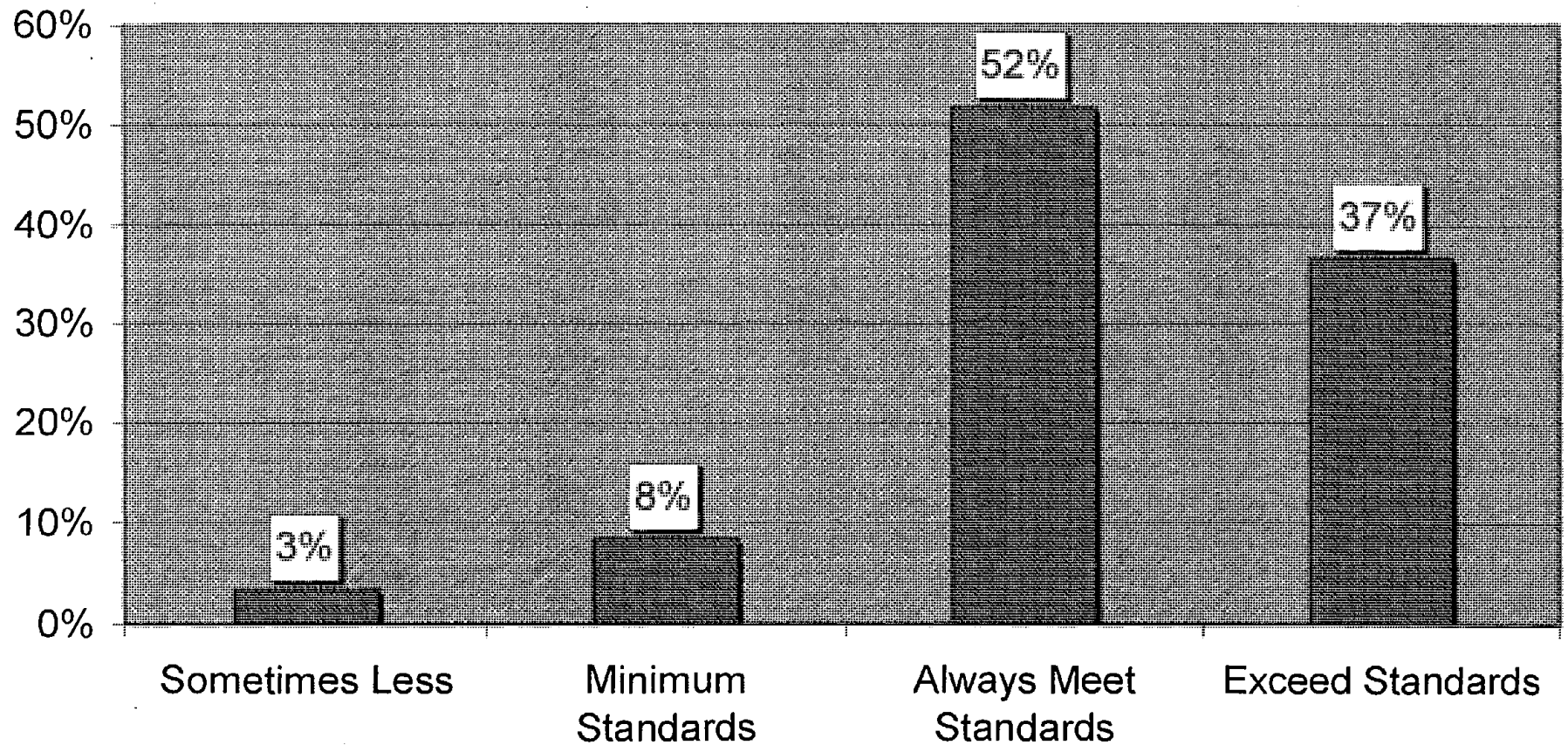
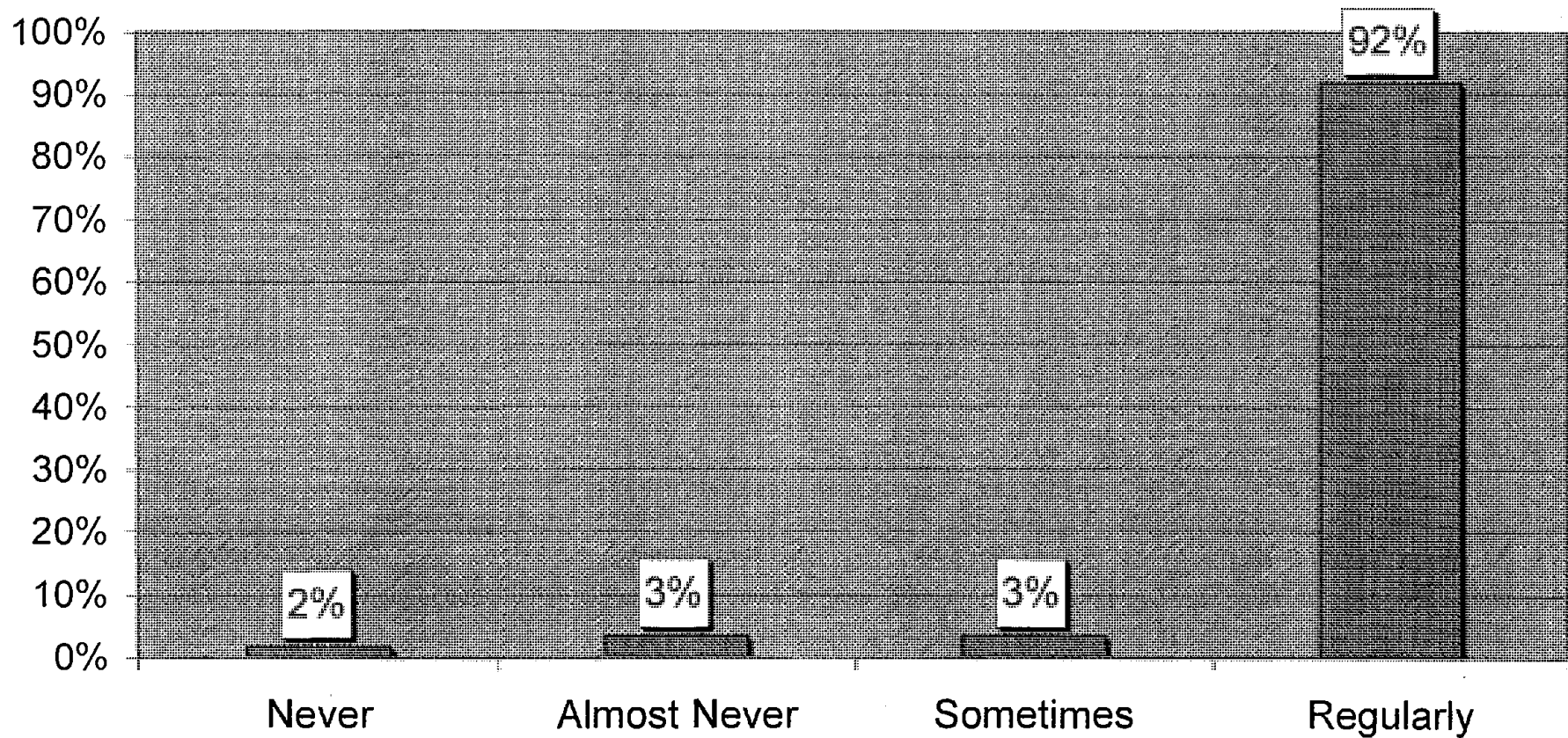


Figure B9: How Often Top Management Will Permit Minor Tradeoffs between Cost and Safety: As Reported by Foremen



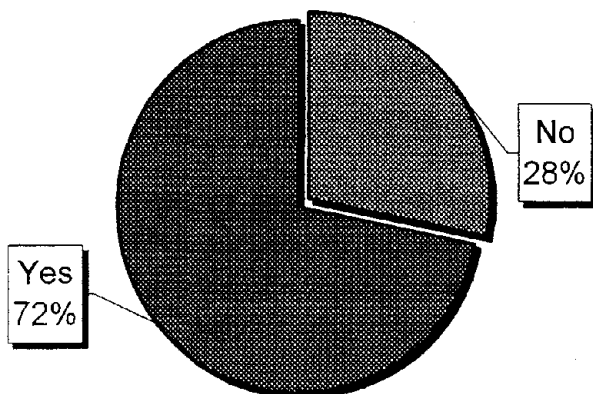
FORMAL

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	27 28.4210526	28.42105263	28.42105263
	1	68 71.5789474	71.57894737	100
Total		95	100	100
Total		95	100	

Notes: 68 reported formal safety training, 20 reported training from apprenticeship

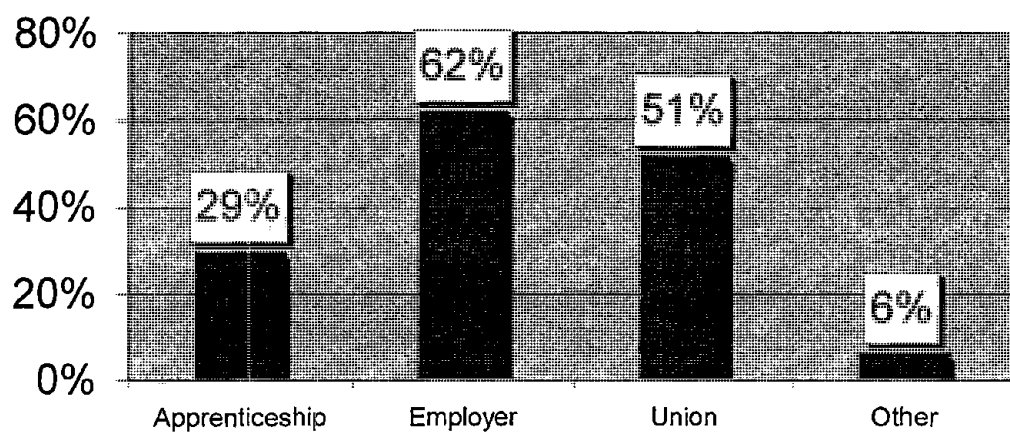
No 0.284211
Yes 0.715789

Figure C1: Percent of Carpenters Reporting Formal Safety Training



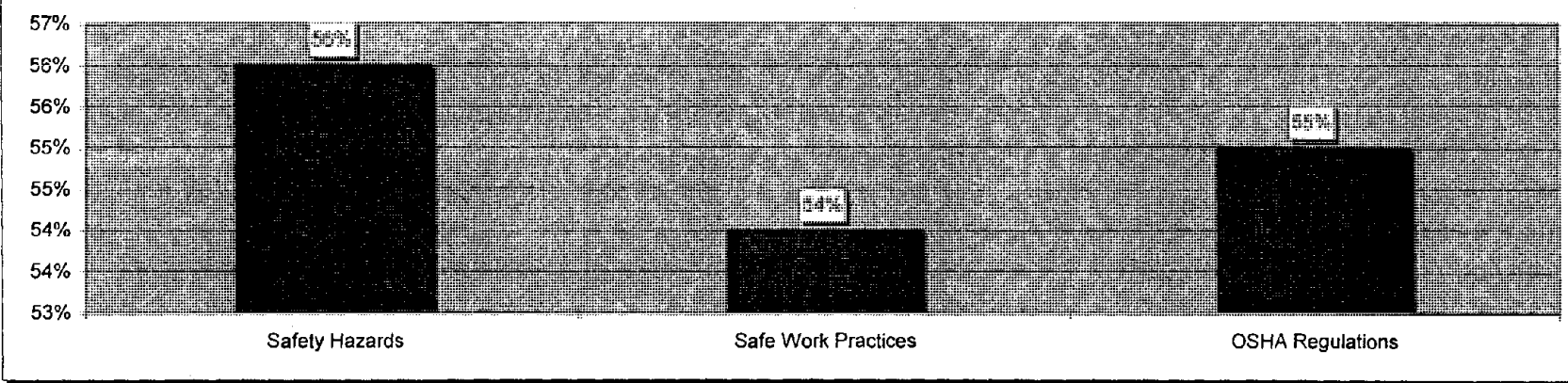
Apprenticeship	0.294117647	20
Employer	0.617647059	42
Union	0.514705882	35
Other	0.058823529	4

Figure C1a: Sources of Formal Safety Training (Multiple Sources)



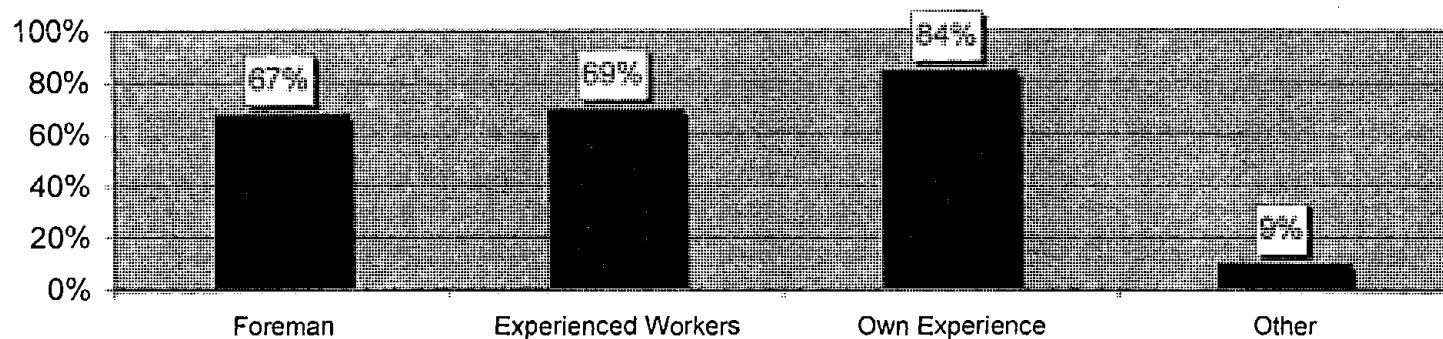
Safety Hazards	0.56
Safe Work Practices	0.54
OSHA Regulations	0.55

Figure C1b: Content of Formal Safety Training for Workers who Reported Training (Multiple Answers)



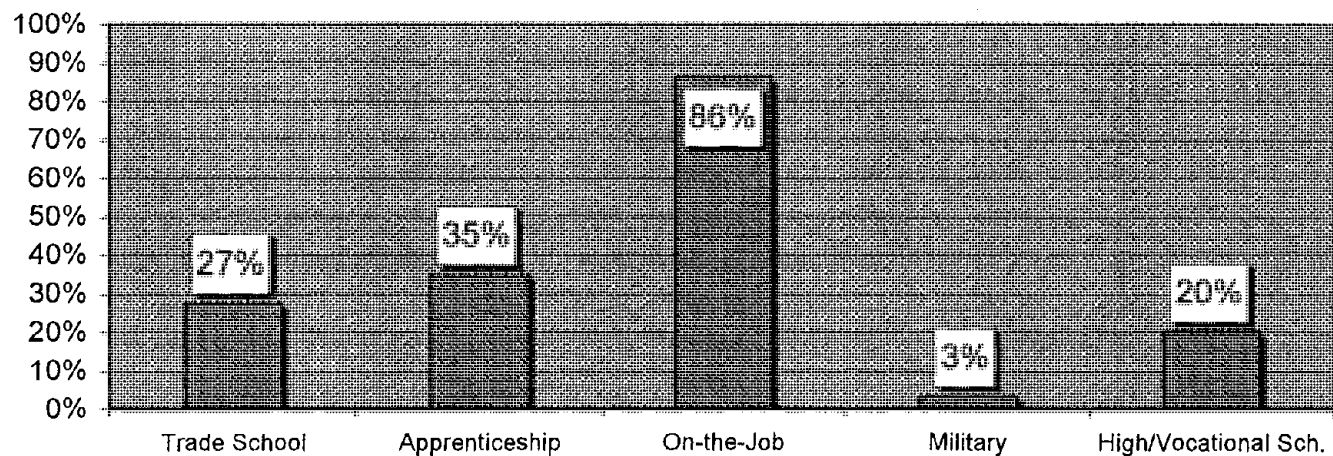
Foreman	0.673684	64
Experienced Workers	0.694737	66
Own Experience	0.842105	80
Other		

Figure C2: Sources from which Carpenters Learned Safe Work Practices (Multiple Answers)



Trade School	0.273684	26
Apprenticeship	0.347368	33
On-the-Job	0.863158	82
Military	0.031579	3
High/Vocational Sch.	0.2	19

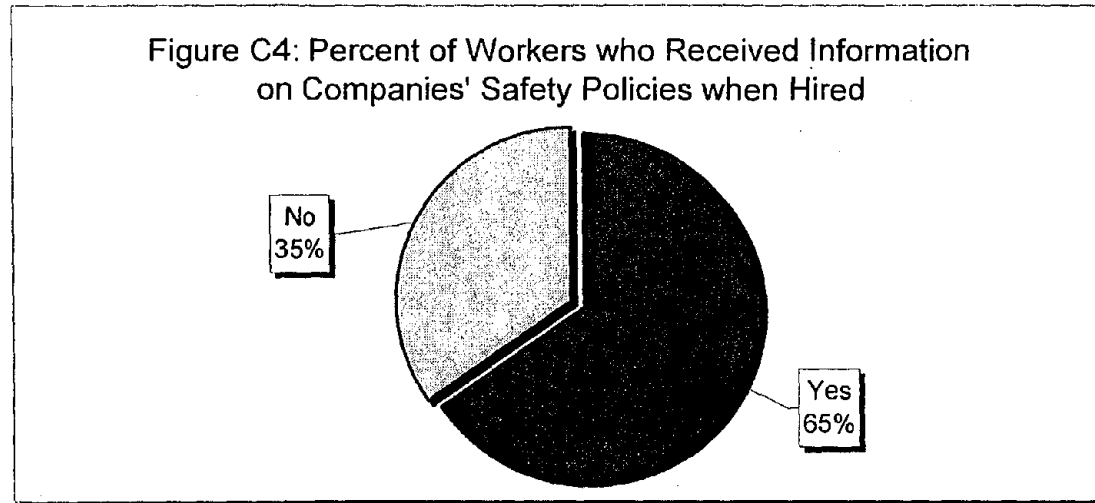
Figure C3: Sources from which Carpenters Learned Current Occupation (Multiple Answers)



SAFEPOLI

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	33	34.73684211	34.73684211	34.73684211
	1	62	65.26315789	65.26315789	100
Total		95	100	100	
Total		95	100		

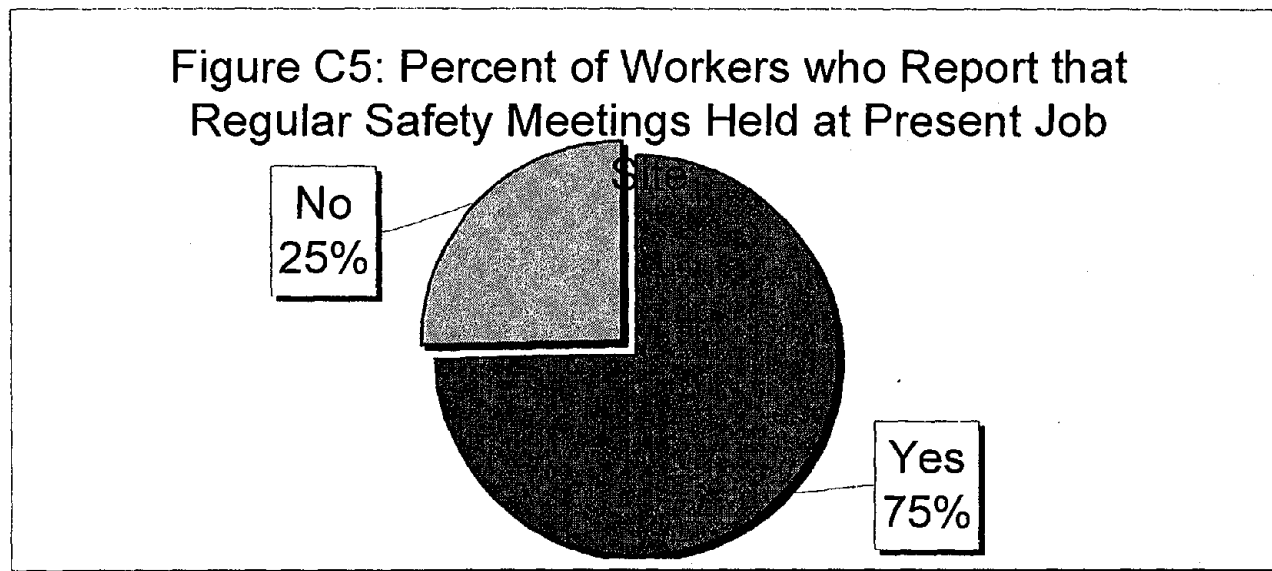
Yes 0.652631579
No 0.347368421



REGMTG

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	24	25.26315789	25.26315789
	1	71	74.73684211	74.73684211
Total		95	100	100
Total		95	100	100

Yes 0.747368421
No 0.252631579



Appendix 4 - Analysis of Steward Interviews

by Cora Roelofs and Eduardo Siqueira

Final Report for the UMASS Lowell Contract with The Center to Protect Workers Rights' Project "Safety and Health Interventions in the Construction Industry"

1) METHODS

A total of 30 interviews were conducted by project staff with stewards from eleven of the twenty Massachusetts United Brotherhood of Carpenters (UBC) Locals. Appendix 1 is a summary table that partially displays the four different steward interview forms used to conduct the interviews. These interview forms had slightly different questions aimed at separating carpenter stewards in four distinct groups: a) stewards who had worked for any of the 21 participating or intervention contractors since 1997 and were familiar with the health and safety program given to the intervention contractors, the so-called "Red Binder" program; b) stewards who had worked for any of the 21 intervention contractors since 1997 but were not familiar with the "Red Binder" program; c) stewards who had not worked for any of the intervention contractors since 1997, but were familiar with the "Red Binder" program; and d) stewards who had not worked for any of the intervention contractors since 1997, nor were familiar with the "Red Binder" program.

Of the thirty carpenter stewards interviewed, twelve stewards recognized the health and safety program ("Red Binder" or Carpenter union) and have worked for intervention contractors, twelve recognized the program but did not work for any participating contractor, three recognized the program but did not work for any participating contractor, and three have neither recognized the program nor worked for a participating contractor. Carpenter steward interviewees were mainly identified by the Business Agents (BAs) of their Locals. The interviewer (Sara Driscoll) contacted the BAs for each of the Carpenter locals in Boston Metropolitan area. The Boston Metropolitan area was generously defined as those areas within easy reach of the Interstate Route 495 beltway.

Generally, the BAs were informed of the project and the interviewer faxed a letter of introduction from Ken Halperin to the local union offices describing briefly the project and the role of the interviewer. The BA's were requested to provide the names and telephone numbers of stewards who had, in the past three years, worked for, or were currently working for any of the participating contractors. Some BA's gave names directly; others contacted the stewards first to ask for their permission to be contacted by Sara. In the case of Local 40 in Cambridge, the BA was contacted and informed of the project prior to a stewards' meeting in early June. The BA presented the project to the attending stewards and invited to them to sign on for the interview process. Seven carpenters agreed to be interviewed at that meeting.

Additional help was received from Elizabeth Skidmore, Organizer/Contractor Relations for the New England Regional Council of Carpenters. The interviewer and Ms. Skidmore had both previously served on the Board of the Boston Tradeswomen's Network. Ms. Skidmore provided advice on gaining access to BA's busy schedules and how to approach carpenter

stewards about the project. She also sent lists and maps of the locations of the Locals in the New England Regional Council Area.

For each steward, the interviewer usually made two to four phone calls to initiate and schedule an interview. The calls were often made the very early morning or in the evening. Nineteen of the interviews were conducted in person and ten by phone. Phone interviews were conducted usually very early in the morning (5:30 or 6:00 am) or in the late evening (7:00 or 7:30 am). In person interviews were conducted during working hours with the foreman's permission, during break times during the working day, or after work. Most of the in-person interviews were conducted on or near worksites.

The average number of interviews from each Local was two, excluding Local 40, from which ten interviews were conducted. Table 1 summarizes the distribution of interviews by Local.

Table 1- Distribution of Interviews by Carpenter Locals

Local Number	Location	Number of Interviews
26	Randolph	1
40	Cambridge	10
67	Boston	2
107	Worcester	3
111	Methuen	1
218	Medford	5
424	Randolph	1
475	Ashland	1
535	Randolph	3
624	Randolph	3
723	Boston	2

Mark Erlich of the New England Regional Council estimated that there are 300 carpenter stewards in the Boston Metro area and 1,000 in New England as a whole. Thus our Massachusetts sample represents approximately 10% of new England stewards. All but one of

the Carpenters interviewed were male and all but one were white (one was Afro-Caribbean). The average age of the interviewees was 45 and the range was 30 to 60 years old. (Appendix 1). The interviewees are believed to be demographically (gender, age, ethnicity) representative of the universe of New England Carpenter Stewards.

Sample Representativeness

The study sample seems to be representative of the different types of carpentry work and the kinds of construction sites where small construction contractors do business in Massachusetts. Stewards interviewed have a broad range of work experiences in the different types of carpentry work - finish, framing/drywall, form work, furniture, concrete - and have worked in a wide variety of construction projects such as high schools in Malden, Medford, or Worcester, a shopping mall, power plants in Everett and Sandwich, a college arena, the new Foxboro Stadium, etc.

Study Reliability, Validity, and Biases

Each individual interview was prefaced by a standard statement that:

a) identified the interviewer and the Construction Occupational Health Project (COHP) of the University of Massachusetts Lowell as the institution conducting the research, and b) described the objective and the length of the interview and asked for the interviewee's consent to have it taped.

The most important type of bias potentially introduced into this study is the self-reporting bias, which relates mainly to the fact that stewards' perspectives could not be confirmed or triangulated with other information sources such as non-steward carpenters, written materials, union officials, managers, etc. Four factors may have biased steward's responses: 1) relationship with the contractors, 2) relationship with the local union, 3) a biased or self-interested perception of the steward's positive role in safety issues, and 4) an interest in appealing to the perceived interests of the interviewer, i.e., an exaggeration of the steward commitment to site safety. All four of these factors may have influenced the stewards interviewed to emphasize progress in safety conditions on site and their positive influence in health and safety promotion and to minimize the negative aspects of site safety and their lack of activity in site safety.

Another bias that probably occurred is the recall bias, since some questions depended on the steward's memory about past jobs and experiences that may have occurred several years ago. An additional potential bias in the direction of increasing short-term safety concerns or awareness by the stewards was the well publicized death of an ironworker during the period of the interviews.

The interviewer tried not to deviate much from the standard interview forms. However,

as she became more comfortable with the interview process she began pressing or prompting for in-depth answers or would repeat questions for which initial responses seemed off- track or incomplete. This procedure may have also created a slight interview or test bias in the latest interviews.

2) RESULTS

Experience with Intervention Contractors

Appendix 1 provides a summary report of the thirty interviews conducted in a format that describes as well as quantifies most of the answers provided by the stewards. While some of the interview questions are closed-ended and can be quantified, the majority of the questions can be only reported qualitatively as literal quotes or themes derived from stewards' perspectives on construction safety issues. The most important preliminary findings of the qualitative study of factors that affect or determine safety and health conditions of a sample of small contractor construction sites in Massachusetts are discussed below. We will describe the findings and themes identified by the initial analysis of the answers provided by the participants, following the order of the questions in the interview forms. In this report we will for the most part discuss the interviews with the stewards who worked for participating contractors, since those were the majority of the interviews and the most relevant for the objectives and hypotheses of the study.

Most stewards interviewed (24 out of 30 or 80%) worked for a contractor who agreed to implement the intervention -intervention contractor- since 1997 or before 1997. Some stewards had worked for contractors participating in the study before the intervention study started in 1997. However, some of the remaining six who did not work for any of the intervention contractors (the stewards who worked for the here called "control" contractors) have worked long enough in the construction industry in Massachusetts to have a general sense of the safety trends in construction sites. Fifteen of the stewards interviewed (12 have worked for intervention contractors and 3 have not) reported that they are not familiar with the health and safety program proposed in the intervention study. Of the fifteen who claimed to recognize the program (12 have worked for intervention contractors and 3 have not), most actually referred to the UBC health and safety program, not the "Red Binder." We thus conclude that a significant number of stewards conflated the regular UBC health and safety program with the actual health and safety intervention program. For example, one steward said:

"I heard about them through the Carpenters Training Center in Millbury. I believe I've seen some videos that were put out by them when I've taken some of the courses up there.... I believe I saw some of those, I think one of them was on

fall protection. I'm trying to think of what the other ones were on. I think they were on hazmat."

The health and safety program mentioned above is clearly not the one given to the intervention contractors. Therefore the content validity of this question is low because many stewards confused the UBC program with the actual health and safety program given to the participating contractors. However, the two safety programs address several common topics such as fall protection and personal protective equipment (eye protection, hard hats, etc). Another subgroup within those who claimed to recognize the program stated that they know it because they either drove the project director (Ken Halperin) while he was in the Boston area visiting sites or talked to him on-site. Two of those stated:

"...Actually, they [Ken and another unidentified visitor] showed up on my last job at the Salemwood School in Malden....I met a few of the guys. I cannot remember their names or any of that...."

"I did bring someone from Washington, D.C. around to a few jobs."

A pattern that appears from most answers of this subgroup is that the researcher visit to the sites to observe and count safety and health practices became the perceived site intervention, i.e., carpenter stewards associated the visits to the sites to a not always well-defined health and safety intervention sponsored by the UBC International. An example of this lack of precision regarding the purpose of the visits by the observer is shown in these steward words:

"They were more or less like a survey, too. They were on like hard hats and safety glasses and safety..."

"As far as I know, what I understand is they [union and contractors] were basically targeting certain areas and certain contractors, they agreed to go on their jobs and check out the safety on the jobs, basically, and see how it was run."

Changes Resulting from the Adoption of the "Red Binder" Program by Intervention Contractors

Most stewards reported that they know the carpenters' health and safety program after having attended health and safety training offered by the carpenters union and do not have good knowledge of the "Red Binder" program. Their views on site safety changes should thus reflect the overall impact of the union health and safety program as well as their increased awareness and knowledge on site safety. It is also possible that the answers regarding site safety improvements in intervention contractor sites may reflect the latter's adoption and implementation of the Red Binder program. In only a few cases could we ascertain that the changes reported by the stewards have clearly resulted from the contractors' adoption of the "Red

Binder" program.

According to the majority of stewards who worked for intervention contractors, the overall trend within those contractors is that the safety program, however defined, changed site safety conditions. For example:

"People are more aware of it [safety] when they go to do things, like when you are using a chop saw. You have to have a face shield, and not just safety glasses. You know what I mean? And now, companies know that they should have face shields where before, they thought just eyeglasses were sufficient."

"A lot of changes. Number one, they are always looking for slip and fall protection, working in the harnesses, glasses and hard hats. That's just an everyday common thing."

"I've seen quite a few changes, actually, since I've started. I mean, there was no back rails, no nothing on anything and no harnesses and now, with the program and the contractors working together with it, it seems to have worked out. It's better for us."

"I think nowadays people are realizing that that's a, the job site is definitely required to have a hard hat and safety glasses. Sometimes people take it for granted, if they're on the roof, well, there's nobody above me, I don't need my hard hat, or I'm not grinding, so I don't need glasses, but I think it's becoming second nature now, people realize that that's part of the job and that's part of the uniform, basically, to protect them".

"It seems to me that a lot of these companies now they take it upon themselves now to be more safety orientated then it seemed like in the past."

"They want the job site safe. I mean, that's most of the guy's main priority, is a safe work site, except for a few companies that I've dealt with. I don't know about other companies, but a few that I've dealt with on a number of jobs have changed over the years".

Other stewards could not tell whether the changes were related to the program or not:

"I see a lot of contractors being more safety conscious. Whether it's because of this program or not, again,, with insurance skyrocketing and the cost of workmen's comp. cases and all, financially..."

"To be honest with you, I can't pinpoint anything to the program itself. It could be partially due to the program that things seem to be getting better a little bit better, or it could just be the fact that the more knowledgeable we get about things

and the more we implement the better”.

Last, a small minority of stewards did not see any change whatsoever in the industry:

“As far as know, I don’t see no changes.”

“Nothing [changed].”

Site Safety Improvements

We asked stewards how the safety program improved health and safety conditions in construction sites. Many stewards gave us good examples of site safety improvements that they related to the safety program. One steward saw improvements in carpenter’s concern with safety:

“I think that I’ve seen probably more of a concern on the carpenter’s part. It shows me that they have concern about safety. But that’s about all that I can say that I’ve really seen.”

Another steward characterized improvements in contractors’ response to a lot of things such as :

“A lot of changes. Number one, they’re always looking for slip and fall protection, working in the harnesses, glasses and hard hats. That’s an everyday common thing.”

Or, in the view of this steward, major general changes occurred over the years:

“Just the overall condition of how things are being done now is altogether different from when it was first originated, when we first were working. It’s changed dramatically.”

Other stewards referred improvements in staging erection, more job-specific safety issues being discussed in safety meetings, and clearer Material Safety Data Sheets (MSDS).

Role of Carpenter Steward

The overwhelming majority of the carpenter stewards interviewed believe that the carpenter steward is the “steward of all trades” in small construction sites, where only the Laborers may have enough people on a given job to also have a steward. According to those informants, other construction trades tend to rely on the carpenter steward as the union safety representative for the whole site. In addition, many of the stewards believe that the carpenter steward is the “eyes and ears” of safety on small construction sites. When a steward can not see a safety hazard with his/her own eyes, a fellow worker may come to the steward and report it;

when the steward is not able to watch out for the safety conditions of a whole site, because either the site may be too large or the steward may have to do his own work as a carpenter, a fellow worker would often tell him/her about a safety problem in the site. Many carpenter stewards believe that they should enforce the contract language and are supposed to resolve specific health and safety problems that arise daily by talking to the foremen or supervisors. Examples of stewards' opinions on the issues above follow:

"My experience is it does seem like that the carpenter's steward o the job really does take the forefront of the safety on the job site, being involved with things specifically like guardrails and protection of open holes, and usually a lot of the materials that these things are built fall under the jurisdiction of carpenters, so it does seem like they do have a more active role."

"...For the most part, carpenter stewards' main role for quite a while is safety, especially at the beginning of the job, since, like you [the interviewer] said, we usually put the safety barriers up as long as they are made of wood."

"We're basically, we do everything for the other trades to work as far as safety rails and stuff. No one else can be in that area unless it's safety wise, which means iron workers, laborers. So, basically we've got all the control of the safety on the job."

"The other trades, if they see something, they are going to let me know. And I've had it on this job quite a few times."

"... And those issues [safety] always come up. You have to see those, take care of those. I mean like elevator shafts, they all have to be barricaded off. Railings and safety railings."

"The steward is the safety man for the union and if he sees something wrong he should tell the foreman."

When asked in what ways carpenter stewards are involved in safety and health issues , a significant number of stewards answered that "the safety of the men" is their utmost responsibility, and that it is an essential part of their jobs.

"I mean, once again, it is the responsibility for the steward to make sure his men are working safe."

"... that's where I come in effect as a steward, that is my job to make sure these men are working safe, and as long as we have a health and safety plan going on, which will help us."

"...it is our responsibility, yes, to make sure the safety is done."

"You are representing your men, your union. You are the safety officer for your men, you know."

Many respondents also stated that carpenter stewards get involved in health and safety by controlling or leading weekly safety meetings or as a result of being properly trained to identify, recognize, and control construction safety hazards, such as slips, trips, falls, head and eye injuries, exposure to chemicals, poor lighting, etc. The most important reason why carpenter stewards have a stronger role in site health and safety than stewards from other trades, is their control of wood for making safety rails, barriers to prevent fall protection, and erecting scaffolds.

Barriers Faced by Carpenter Stewards

The barriers to stewards being more involved in health and safety issues are numerous and express a wide variety of causes, ranging from structural economic and political conditions that pertain to the employers to turf battles amongst building trade unions, to rank-and-file attitudes regarding safety. The barriers mentioned by the interviewees are:

- a) Contractors' demand for "getting the job done," or "pressure to move on with the work," above and beyond safety considerations;
- b) Contractors' lack of will to spend money on safety ;
- c) Contractors' lack of concern with safety of workers;
- d) Lack of respect for the carpenter steward from the other building trades;
- e) Outsourcing of construction activities to subcontractors makes it unclear who is responsible for safety;
- f) Lack of full mobility on the site limits stewards' ability to do their job properly;
- g) Lack of support from rank-and-file may also be a problem in some situations when the members are fearful for their jobs or believe it takes too much time to make a job safe.

Carpenter Stewards' Actions on Health and Safety & Retaliation Against Carpenter Stewards

The last part of the interview form is composed of a series of questions addressing stewards' actions around health and safety and their concerns about retaliation resulting from those actions. A brief summary of the answers provided by the stewards who have worked for intervention contractors is given below.

None of the carpenter stewards interviewed have ever filed an OSHA complaint about a safety problem. Over 90 % have warned fellow workers about a safety problem or notified a job superintendent about a safety problem; about 80 % have not led a work stoppage related to a safety problem; over 70% have notified local union officials about a safety problem; and a little

over 60% have taken part in a work stoppage related to a safety problem (typically a very short term stoppage that lasted a few hours to a day at the most). None of the carpenter stewards are concerned about retaliation after reporting a safety violation to OSHA, neither are they concerned about retaliation after stopping work over a safety violation. All the stewards interviewed reported that there has never been a health and safety problem against which they decided not to take action. Last, about 80% of the stewards rate their local union as very active in health and safety, and about 20% rate it as somewhat active.

Appendix 1
Summary of the UBC Health and Safety Program Study

Question	program recognition and worked for participating contractor	No program recognition, but worked for participating contractor	program recognition, but did not work for participating contractor	No program recognition, and did not work for participating contractor
BACKGROUND				
n	12	12	3	3 (1 female)
Age (mean, range)	42, 30-53	44, 34-60	46, 42-51	49, 46-50
Years in Union (mean, range)	14, 2-22	13.5, 1-33	17, 12-22	9, 3-17
Holding other union office	11	??	1	None
Type of Work		finish (3); everything (5); framing/drywall (2); form work (2); casework installation (1)	Concrete to finish	Finish, forms, furniture, framing and safety work
PROGRAM EVALUATION (INTERVENTION RECOGNITION)				
Contractors	Archer Construction (4) Continental Construction (4) Drywall Limited (5) Whitehawk Construction (1) Hart Engineering (1) Avg 1 yr; range 3 mos. -2 yrs	Continental Construction (1) Drywall Limited (1) JW Drywall (1) Whitehawk Construction (1) Bacon Construction (2) Century Drywall (1) Housing Systems (2) JL Marshall (2) ?? times?	None	
How did you hear about the program?	Ken's visits (8) Union meetings and S.D. (2) Carpenters Training Center (2)		Drove Ken to sites Had Ken on his site Heard about it at a union meeting	

What can you tell me about the program?	Nothing (3); General education and safety awareness had increased (3); Weekly safety mtgs. now; Contractor showed fall protection video; The program was to protect the safety of the workers (3); Following a new protocol and part of another study (Big Dig?)		Not much (2) It's trying to provide a safer environment for workers	
What changes have you seen as a result of the program?	Couldn't really say (2); Safety is more of an issue now because workers comp. premiums are up; (4) Three years ago he had to fight for safety, now it's automatic; MSDS became clearer (2); Things were good when Ken was on-site but that you still have to push; Fall protection is much better; Staging erection is much better; He is personally more aware in general which leads to a greater awareness on-site.		Greater safety awareness including increased use of safety glasses, hard hats, face shields and ear plugs (2) Fall protection increased	

How has the program improved health and safety on site?	Contractor response is better (4); Safety meetings were more job specific rather than over-all safety issues being discussed (like specific fall protection, increased hard hat use, safety glasses for the specific site needs) (2); Greater role for stewards, fewer injuries, general education of issues better; In the union too short a time to be able to say.		Individuals now know more what's expected (2) It protects the membership: there's less fear about asking for safety equipment	
Do you think the improvements will last over time?	Yes (7); No answer; Not unless people internalize it; With the help of refresher courses in OSHA; You must stay on top of contractors; Yes, it saves money (2); You need good men on site; Yes, the most important thing is safety (2); Yes, if all trades continue to push for health and safety.		With practice, over time, it will be like putting on your shoes (2) Yes, safety is getting addressed more; it saves on workers' comp	

Do you think other contractors would implement the program? (why/not)	Yes, it would keep fines down (5); Yes, contractors want safe jobs and it would save money (3); The big contractors would be good but you have to stay on top of the smaller contractors; Those guys working for the contract manager may be more careless; It would be good to make it be that safety is a natural thing not just a one-shot deal; It's important to make sure the foremen are informed of the safety levels required on a job.		Some will and some won't; it's a question of time and money; the union pushes safety Money will be the issue It should be forced on contractors	

PROGRAM EVALUATION (NO INTERVENTION RECOGNITION)

What changes have you seen in these contractors' health and safety programs since 1997?	Not Applicable	Attention to safety concerns has increased (4); Haven't noticed any changes (3); More emphasis on eye, ear and fall protection (4); Things are not being overlooked and there are more safety officers; More attention to air quality; More compliance with rules.	Not Applicable	More awareness, contractors willing to attend to safety more (2) Some are better and some worse but there is more use of safety glasses and harnesses
What factors do you think helped these changes to come about?		Workers' compensation costs (3); The presence of other stewards; It is clearer that you can still get the work done while using safety equipment; OSHA plays a role; The increased education of workers to rules and regulations creates more awareness (2).		Workers' Comp premiums decrease with increased safety (2) Union pressure Contractor's excellent safety officer

In what ways do you think these changes have improved health and safety?		A safer environment makes for a more productive day (4); It allows guys to go home; Contractors will do things more correctly for fear of fines; There is an increase in general safety awareness (2); Workers need to get educated about exposure issues, being union and working safety into the contract; Good safety is a good example for the apprentices.		Fewer falls Much safer jobs overall
What do you think small contractors could do to improve health and safety on site?		It is not the job of small contractors to do safety of the general contractor; They need to comply with rules for hard hats, goggles, chains on lifts (3); There is a need for more safety inspections (2); There is a need for more education and a standard training course (2); There is a need to have Supers and foremen more on top of it -- often, they are union members, too; Allot more money to safety; Putting safety first would save money.		Hold safety meetings (2) Invest more in safety to bring down insurance premiums Foreman should be more insistent about safety equipment Have a suggestion box
STEWARD'S ROLE				

In what ways are Carpenter stewards involved in safety and health issues?	Carpenters control weekly safety meetings; Safety is the steward's job (6); They provide examples through safety training, such as safe scaffold erection; It's a process of one-on-one reminding; Support from the men is very important; They are getting more certifications than before in specialty safety; It's a requirement for stewards to have OSHA training; He felt like the only one out there.	They have OSHA classes and greater safety awareness (3); They support workers when they ask for safety equipment and are buffer to the foreman (2); Safety is built into the contract and that it is the stewards' role (3); They take it on as a personal responsibility and to set an example (2); It's on-the-job training.	Stewards lead weekly safety meetings; big role in fall protection; Stewards stay on top of workers and their equipment (hand rails, etc.) Lighting is an issue	The steward's job is safety Get trained, peer support at meetings Training is excellent, now can nudge carpenters on-site, set a good example and monitor site
How would you describe the role of the carpenters' steward when it comes to health and safety on construction sites?	They are the only trade with stewards regularly on site, and therefore have more responsibilities (6); Agreed that the safety rails, etc. do fall under carpenter jurisdiction if made of wood (3); He will not repair scaffolding he has not built; Stewards are the safety officer lots of times (2); Other trades will point out a safety problem to the carpenter steward; He will alleviate danger no matter who is in the area.	The other trades rely on the carpenters to clue them in to issues on site (6); They make suggestions for safety (2); He repairs barriers without asking; It is important for everyone to communicate; They play the role of mediator between contractors and the workers.	"We control all safety on the job." Stewards keep an eye on the contractors and are trained to install safety barriers, also responsible for checking on sexual harassment	Other trades "use" the carpenter steward as a safety person (2) The carpenters do the safety work and need the workers to bring safety to stewards' attention Stewards have a greater responsibility and can exercise it

What do you think are the barriers to Carpenter stewards being more involved in health and safety issues?	Contractor push for work was a barrier (5); Lack of respect from the other trades; Construction managers out-source everything to subs makes it unclear who is responsible for safety (2); Stewards need full mobility and they are given lip service by foremen; You can go as far as you want "Can't afford not to have it"; Guys are fearful for their jobs if it takes too much time; There are no barriers; It's impossible to be everywhere at once.	Contractors not caring was a barrier (2); Not wanting to spend the money was a barrier (3); Too much pressure to move on with the work (2); There are no barriers; Good companies don't bother stewards; Workers don't take enough responsibility and there aren't enough stewards from the other trades; Small contractors worry about money, and some are new to the union contract so they don't have the same take on safety.	Contractors using their own safety officers rather than stewards	None Contractor reluctance to provide materials Overcome barriers by being productive and positive with all foremen.

Other comments	He's just happy to be in the union; More health and safety input would be great; Carpenters were in the forefront of the health and safety struggle (2); Carpenters are safety conscious in general; Safety was getting better and that there are fewer injuries (2); It's better to be too safety conscious, Local 218 has safety as a high priority; Should offer refresher courses in OSHA; Bathrooms are supposed to be on every three floors but the contractors don't want to pay to keep a crane there to clean them weekly so they are non-existent or filthy and that the men are still peeing in the open building; Piecework with the framing and wallboard is dangerous and still goes on; Some contractors try to stir up jurisdictional struggle between the trades to divert attention from safety issues.	Contractors need to listen to stewards; It's a good thing to have safety be #; There needs to be more consistent education programs (3); Stewards have to be very persuasive to foreman and Supers to correct a problem and often it appears again; Companies need to take a more active role; Tying off on ladders can be a pain, especially when speed is pushed; Having witnessed an accident as a foreman makes him a better steward; Need more tool-box meetings; Need better lighting and housekeeping; Propane lifts were changed for electric due to too many fumes and they were able to do that with new safety emphasis; JL Marshall is excellent on safety with regard to glasses and fall protection.	Lack of bathrooms, inadequate lighting, speed; You can never be safe enough — "I want to go home at night Bathrooms; inadequate lighting; speed; can never be safe enough, "I want to go home at night."	It's important to keep on focusing on safety issues Small contractors are not following through As a change from non-union, this is a big improvement

Notes: Comments are unique unless indicated. Parentheses indicate how many responded similarly.

Appendix 5 - Analysis

by Matthew Bodah and Terry Thomason

Report of Findings
Interviews with United Brotherhood of Carpenters stewards
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February 2001

I. Introduction.

During the summer of 2000, the University of Rhode Island's Schmidt Labor Research Center conducted a series of interviews with union stewards of the United Brotherhood of Carpenters and Joiners of America, AFL-CIO. The URI team interviewed stewards in Southern Connecticut, Southeastern Massachusetts, and Rhode Island. (Efforts to coordinate interviews with stewards in Hartford were unsuccessful).

Interviewers used a structured interview format that was designed for three broad purposes: First, to get evaluation feedback from the stewards concerning the so-called "Red Binder" safety program that had been implemented through a set of small contractors by the Center to Protect Workers Rights (CPWR). Second, for those stewards unfamiliar with the Red Binder program or who did not work for a Red Binder program contractor, to get feedback on changes in health and safety climate among small contractors generally. And, third, to get information from both sets of respondents on stewards' role perceptions and behaviors regarding health and safety matters.

At the same time that the URI team was interviewing stewards in Southern New England, a research team from the University of Massachusetts-Lowell was implementing the same questionnaire primarily in the Greater Boston area.

All interviews were tape-recorded and transcripts produced from the tape recordings. The combined efforts of URI and UMass-Lowell produced 67 usable interviews and nearly one thousand pages of transcripts. Although the results of the

interviews do not provide answers to all our research questions, they do provide extremely useful insights and help address a number of our research questions when combined with the quantitative portions of the research.

II. Summary of findings.

A. Evaluation.

1. Changes in health and safety.

When asked: “What changes have you seen in contractors health and safety programs since 1997?” an overwhelming number of respondents, both those who had worked for Red Binder program contractors and those who had not, reported substantial improvements in construction site health and safety efforts since 1997. No respondents reported a decline. Several respondents stated that improvements depended on the contractor, with some having improved more than others. Several respondents reported no change, but this result was often accompanied by a statement such as “the company I work for has always been very safety conscious.”

Stepping back from the comments, it appears that changes can be sorted into four categories. First, these stewards see better hazard protection against injuries resulting from (particularly) falls and electrical shocks. Second, they perceive more attention being paid to equipment—both safety equipment and tools. This means increased emphasis on eye protection, hardhats, harnesses and lanyards, and hearing protection. It also means that contractors are becoming more vigilant about keeping construction tools and equipment in good working order. Contractors are more likely to adhere to maintenance schedules for equipment and unfixable and unsafe equipment is discarded. Third, stewards report better communications mechanisms such as regular safety

meetings and “toolbox talks.” Fourth, they report better attitudes toward safety by co-workers, union officials, and contractors. They mention that contractors are more willing these days to listen to their safety suggestions, and note the increased presence of specialized safety managers as evidence of growing contractor concern.

It is difficult to conclude from the comments of these stewards that the Red Binder program contractors have improved health and safety conditions more than non-program contractors. The responses of stewards who have worked with Red Binder firms and those who have not are quite similar—both groups have seen improvements. Although more analysis needs to be done, the same is true across areas. Stewards in Connecticut, Massachusetts, and Rhode Island all seem to have noticed improvements.

2. Reasons for changes.

In answering the question: “What factors do you think helped these changes come about?” most of the stewards interviewed believe that financial and costs issues, particularly workers compensation insurance premiums, are the main reasons for improvements in the health and safety climate. As evidence, they note the increased use of safety incentives and greater pressure to avoid lost-time injuries.

A minority of respondents note factors such as increased training, union pressure, and general societal attitudes about health as possible causes of health and safety improvements. But, again, most see the issue as related to cost pressures.

3. Effects of changes.

Responses to the question: “In what ways do you think these changes have improved health and safety?” were often unclear and many participants simply restated a belief that “things had gotten safer.” However, about one half of the respondents

indicated a belief that there were fewer injuries, particularly serious injuries. One respondent, for example, noted that he had worked on a very large project where one might have expected several fatalities, but, instead, there were no serious injuries.

4. What else could be done?

Although respondents seem generally pleased with improvements during the past several years many had suggestions for further improvements. While it is difficult to categorize the suggestions, they appear to involve more financial investment, enforcement, and better communications.

A number of respondents stated that small contractors should invest more money in worksite safety. Some complained that equipment (e.g. harnesses and safety glasses) was sometimes difficult to replace and that materials for railings and coverings (e.g. 2x4s and plywood) were sometimes in short supply.

A number of respondents also suggested that current rules and regulations were good, but unevenly enforced. This seems particularly to be a problem when deadlines are approaching and production speed becomes important.

Quite a few respondents also stated that contractors needed to listen to stewards and workers more. Several felt that toolbox talks were either too infrequent or too ineffective. (A couple even mentioned fraud with regard to attendance sheets). Others simply stated that superintendents and safety managers sometimes resisted the input of stewards or rank-and-file carpenters.

A few respondents had very specific suggestions, such as “contractors need to pay more attention to the issue of heat stress.” A number mentioned problems with housekeeping and sanitation on sites.

5. Specific questions concerning the Red Binder program.

Respondents were asked if they were familiar with the Red Binder program. If they were, they were then asked several specific questions concerning their thoughts on the program and its effectiveness. These responses were not very satisfying. Although 17 of 67 respondents said that they were familiar with program—some had met or seen Ken Halperin on site, some had heard about it at union meetings, a few were not sure how they had heard about it—none could describe the program in much detail. Several stated that they had heard of the program, but really could not tell us much about it; others gave general or vague answers about the program, i.e. that it was intended to improve health and safety, etc.

Because of the inadequacy of responses concerning knowledge about the program, answers to questions about the program's effectiveness need to be viewed with caution. Nonetheless a clear majority of respondents stated that they believe the program had improved health and safety on site, that these improvements should last over time, and that other contractors would implement the program.

B. The union's role.

Participants were asked a series of questions concerning role perceptions and behaviors related to health and safety.

1. Steward's role.

Participants were asked: "In what ways are carpenters' stewards involved in health and safety matters?" Responses to this question can be grouped in the several categories. First, nearly all respondents mention that they had a responsibility to monitor

the worksite and bring safety problems to the attention of co-workers, union officials, and/or superintendents.

Beyond that, some stressed that their primary job was to make sure that carpenters were working safely, and “getting after” co-workers who tried to take risks or shortcuts. Others stressed that their primary duty was to deal with contractors, particularly safety managers. These stewards told of disagreeing with management personnel over the safety of sites or procedures, bringing workers’ suggestions to safety meetings, or acting as a worker’s advocate in individual situations. Several respondents also mentioned a responsibility for injured workers. They indicated, for example, that the steward should make sure that injured workers received prompt and proper attention, take a worker to the hospital, or notify a worker’s family about an injury. These respondents also mentioned a responsibility for filling out a portion of the worksite accident report.

In sum, nearly all respondents mentioned at least one duty related to worksite safety. It is clear that these respondents believe that stewards are an integral part of the health and safety process.

2. Carpenters’ stewards’ special role.

Participants were asked if carpenters’ stewards have a special role in health and safety relative to the stewards from other trades. Roughly twenty percent saw no special role for carpenters, and another twenty percent gave only vague responses to how the carpenters’ role was special. Nonetheless, a majority of respondents did see a special role arising mainly from the carpenters’ jurisdiction over wood. Because of this jurisdiction, carpenters are responsible for making hand railings, covering holes, building ladders and

stairs, etc. On some large projects, a carpenter might be hired by the general contractor specifically to handle safety-related projects.

Beyond a responsibility for wood, several respondents mentioned that carpenters are often on sites longer and work in larger areas than more specialized trades and, therefore, have a broader view of safety problems.

A couple of respondents also mentioned that carpenters are one of the few trades that have on-site stewards and, therefore, carpenters stewards often assume *de facto* responsibility for representing the other trades as well.

3. Barriers to further involvement.

Participants were asked: “What do you think are the barriers to carpenter stewards being more involved in health and safety issues?” Responses tended to address barriers to health and safety more than barriers to greater steward participation. Nonetheless, responses do provide valuable information.

Responses to this question can be divided into several categories: barriers concerning the employer, barriers concerning co-workers, and barriers that are more contextual.

The principal barrier mentioned is money. This is, small contractors either lack the resources or are unwilling to commit these resources to further improve health and safety. Again, this may mean that worn safety equipment is difficult to replace or adequate material or equipment are not available on-site. One respondent wondered if all the money budgeted for safety in contract bids is actually spent on safety or instead accrues to profits.

A second employer-related barrier is resistance to the input of stewards. A number of respondents mentioned that superintendents and safety managers sometimes resisted the advice or opinions of stewards.

Not all respondents believed that employers presented the only barriers. Some complained of co-workers who did not listen to their advice or who took too many unnecessary risks. A few stewards complained about workers from other trades who made the carpenters' role in health and safety more difficult. For example, one respondent complained that other trades might remove a handrail to gain access to an area, but then not tell the carpenter that the railing needs to be reset.

A few responses related to contextual variables. One respondent spoke of communications' problems, including those relating to language differences, and suggested that stewards be taught some basic Spanish and Portuguese in order to be able to warn co-workers of dangers. A few said that the greatest barrier was an inability to monitor large worksites.

4. Training

Participants were asked what types of safety training they had taken, and whether they had taken any additional training as stewards. A majority of respondents mentioned receiving some form of OSHA training. Some said they had taken OSHA-10 training; others OSHA-30; and many were not specific as to whether they had taken the ten or thirty hour course.

Many other types of training were also mentioned. The most frequently mentioned were CPR, first aid, scaffolding, hazardous materials, and confined space.

Respondents from one local stated unequivocally that they were required to take OSHA training in order to be stewards. A total of 31 respondents indicated that they took additional safety training as stewards. Many, however, mentioned a general stewards training course. It is not clear the extent to which those courses covered health and safety matters. As well, a number mentioned taking additional training, but were unclear as to whether they were required to do so as stewards, or simply chose to do so.

Approximately ten respondents indicated that they had taken no safety training courses whatsoever, but were familiar with safety matters through experience.

5. Specific behaviors.

Respondents were asked what specific actions they had taken regarding health and safety. Table 1. displays the results of all respondents.

Table 1. Health and safety actions		
(Percentages in parentheses)		
	Yes	No
Have warned fellow workers about a safety problem.	66 (99)	1 (1)
Have notified local union officials about a safety problem.	39 (58)	28 (42)
Have notified the job superintendent about a safety problem.	59 (88)	8 (12)
Have filed an OSHA complaint about a safety problem.	9 (13)	58 (87)
Have taken part in a work stoppage related to a safety problem.	19 (28)	48 (72)
Have led a work stoppage related to a safety problem.	16 (24)	51 (76)

Table 2. displays health and safety actions by program contact—i.e. those who work (or have worked) for a program contractor since 1997 and those who have not. For the most part, the actions of both groups are similar. However, there are fairly substantial differences with regard to notifying union officials and filing OSHA complaints. Those

who had worked for a program contractor were more likely to have taken these actions than those who had not.

Table 2. Health and safety actions by program contact.				
(Percentages in parentheses)				
	Worked for program contractor		Did not work for program contractor	
	Yes	No	Yes	No
Have warned fellow workers about a safety problem.	45 (100)	0 (0)	21 (95)	1 (5)
Have notified local union officials about a safety problem.	29 (64)	16 (36)	10 (45)	12 (55)
Have notified the job superintendent about a safety problem.	42 (93)	3 (7)	17 (77)	5 (23)
Have filed and OSHA complaint about a safety problem.	7 (16)	38 (84)	2 (9)	20 (91)
Have taken part in a work stoppage related to a safety problem.	12 (27)	33 (73)	7 (32)	15 (68)
Have led a work stoppage related to a safety problem.	11 (24)	34 (76)	5 (23)	17 (77)

Table 3 displays health and safety actions by location. Again, there is general similarity across regions, but with Massachusetts respondents appearing less like to have notified union officials about safety problems and Connecticut respondents more like to have taken part in or led work stoppages.

Table 3. Health and safety actions by location.						
(Percentages in parentheses)	CT		MA		RI	
	Yes	No	Yes	No	Yes	No
Have warned fellow workers about a safety problem.	19 (100)	0 (0)	29 (97)	1 (3)	18 (100)	0 (0)
Have notified local union officials about a safety problem.	12 (63)	7 (37)	15 (50)	15 (50)	12 (67)	6 (33)
Have notified the job superintendent about a safety problem.	18 (95)	1 (5)	26 (87)	4 (13)	15 (83)	3 (17)
Have filed and OSHA complaint about a safety problem.	2 (11)	17 (89)	4 (13)	26 (87)	3 (17)	15 (83)
Have taken part in a work stoppage related to a safety problem.	7 (37)	12 (63)	7 (23)	23 (77)	5 (28)	13 (72)
Have led a work stoppage related to a safety problem.	6 (32)	13 (68)	6 (20)	24 (80)	4 (22)	14 (78)

6. *Concern with retaliation.*

Table 4 displays respondents' concerns with retaliation. The overwhelming number of respondents were "not concerned at all" with retaliation. It should be noted that participants were asked if they were "concerned" with retaliation, not if they believed retaliation would occur. When probed, several did say that the employers "might" or "probably" would retaliate, but that this did not concern them because the union would defend them, they could easily be sent to other jobs, or safety was simply too important to allow employment considerations to intervene. Since such a large majority of responses fall in a single category, no further breakdown of responses is provided. Regardless of program contact or area, most respondents are "not concerned at all" about retaliation.

Table 4. Concern with retaliation. (Percentages in parentheses).			
	Not concerned at all	Somewhat concerned	Very concerned
How concerned are you that reporting a safety violation to OSHA could lead to retaliation?	54 (81)	10 (15)	3 (4)
How concerned are you that stopping work over a safety violation could lead to retaliation?	57 (85)	8 (12)	2 (3)

Similarly, Table 5 shows that an overwhelming majority of stewards believe that their locals are “very active” in health and safety issues.

Table 5. Local union’s activity in health and safety.			
	Not active at all	Somewhat active	Very active
How active is your local in health and safety issues?	1 (1)	14 (21)	52 (78)

7. *Other comments.*

At the end of the interviews, participants were asked if they had any other comments. Some used the opportunity to offer specific recommendations; some offered general criticisms; and a few reiterated a belief that safety had improved.

Examples of specific comments include: workers need more training on rigging procedures; each trade should have its own safety person on site; unions should fight the growing practice of mandatory physical exams; sites frequently have poor lighting; toolbox talks do not occur often enough; and heat stress is not taken seriously enough. Several participants called for standardized joint safety training.

General criticisms included statements such as: small contractors “need to be more aware when they come on site;” small contractors “are not backing up safety talk

with action;” “there is always room for improvement;” or “accidents will always be part of the job.”

Many participants reiterated a belief that safety had improved. Some credited union officials, some contractors, and some both. As one respondent put it: “Last couple of years, I’m not even worried about safety on the job, because they’re so concerned about it. It’s nice to know that you’re going to work and are going to come home safe.”

III. Conclusions.

Several conclusions can be drawn from this research:

- Overwhelmingly, participants believe that health and safety has improved during the past three years.
- Most participants believe that financial concerns, particularly workers compensation insurance rates, have been the main reason for change.
- Most participants believe that there are fewer serious injuries because of changes
- Most participants believe that small contractors need to invest more in health and safety and improve enforcement and communications.
- While 45 of 67 participants had worked for Red Binder program contractors, only 17 had heard of the program.
- When pressed, participants who indicated knowledge of the Red Binder program, could give few details about it.
- Nonetheless, those who had heard of the Red Binder program believe that it has improved health and safety, that improvements will last, and that other contractors will adopt the program.
- Nearly all participants believe that stewards have an important role in health and safety. They are responsible for monitoring worksites, dealing with contractors, representing workers, and assisting injured workers.
- Most participants believe that carpenters’ stewards have a special role in health and safety. They are responsible for building handrails and covering openings. They are on site longer and cover more of the site than other trades, and frequently speak on behalf of other trades who lack stewards on site.
- Many participants see barriers to further safety involvement. These barriers are a lack of financial commitment to safety by some contractors, and resistance to the input of stewards. As well, co-workers present barriers by taking unnecessary risks and not heeding the advice of stewards. This can be a particular problem across trades or when non-union workers are present. Finally, contextual variables such as language differences and the size of worksites can cause barriers to safety.

- Nearly all participants have received several types of training. Many have had OSHA-10 or OSHA-30 training, as well as scaffolding, hazard materials, confined space, and various other kinds of training. Many indicate extra training as union stewards, but the requirement for and extent of the training is unclear.
- A number of participants reported having never taken a safety course.
- Nearly all respondents have warned fellow workers and job superintendents about safety problems; most have also reported safety violations to union officials; some have taken part in or have led work stoppages over safety issues; and a few have filed OSHA complaints.
- Only about one-fifth of respondents are concerned that filing an OSHA complaint or stopping work over a safety issue would lead to retaliation.
- Nearly eighty percent believe that their locals are very active in health and safety matters.
- For the most part, responses do not differ based on experience with a Red Binder program contractor or by location.

Taken together a message emerges from this information. Stewards are generally pleased with health and safety progress in construction and see themselves as an integral part of that progress. However, their lack of knowledge of the Red Binder program, along with some of the barriers to safety they mention, and the lack of uniformity in training, leads to the preliminary conclusion that stewards are not being used optimally in the safety process.

Remedies might include the establishment of joint, multi-craft, safety training. This would assure some baseline of understanding between stewards and contractors and across trades. As well, special attention should be paid to notifying stewards of new safety initiatives in which their unions are participating. It is clear that few were made aware of the details of the Red Binder program, which is unfortunate considering their role in the safety process.

IV. Shortcomings and limitations.

Sixty-seven interviews are quite a few for this type of research. As well, the responses are consistent enough that it is unlikely that more interviews would contribute significantly more to our knowledge base.

However, the number of cases limits our ability to make serious cross-local comparisons. This is particularly a problem in the Greater Boston area where there are many local unions. In three cases we have only one observation per local union. Some cross-location analysis is possible. But by combining the responses of individuals in different locals we cannot truly study cross-local differences.

Another limitation regards program contact. While respondents were asked if they had worked for a program contractor since 1997, it is very unlikely that their responses were limited to those experiences. One reason is that some respondents had worked for program contractors for very short durations during that time period—sometimes only a day or two and often only a few months. Therefore, it is more likely that their responses concerning safety improvements include perceptions beyond their experience with program contractors and very likely beyond the period of 1997 to the present.

In short, this study has provided us with a great deal of information on how stewards view health safety, perceptions of their roles in the health and safety process, and what actions they have taken regarding health and safety. It has been less useful for determining the efficacy of the Red Binder program or in determining cross-local differences. Nonetheless, the information can certainly be used to improve future interventions.

**Local Union Variation in Workplace Health and Safety Practices:
An Analysis of Work Site Inspection Data**

November 2000

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In this paper, we present an analysis of data on workplace health and safety practices and conditions obtained through on-site inspections of construction projects in Southern New England. As part of this analysis, we examine the effects of an intervention by the United Brotherhood of Carpenters (UBC) that was designed to improve workplace safety on selected project sites. We also examine the extent to which the efficacy of this intervention was influenced the local union as well as the extent of variation in safety and health practices and conditions among local unions more generally.

Background

As indicated, this study was initiated by the UBC with funding obtained from the National Institute of Occupational Safety and Health. Its purpose was to improve health and safety practices of small contractors in the construction industry. To this end the UBC obtained the cooperation of approximately two dozen small contractors in Southern New England, who agreed to participate in the study. Supervisory personnel for these contractors (called "study" contractors for the purpose of this report) were provided with training on a range of construction industry health and safety issues and procedures. This training was followed up with on-site visits to project sites where these contractors were employed. Site visits were conducted by personnel from UBC and/or the Center to Protect Workers' Rights (CPWR). Site visits were also made at projects sites where the UBC served as the collective bargaining agent for

carpenters but at which there were no participating contractors. For the purpose of this paper, contractors at these sites, who were not party to the UBC health and safety plan, will be designated as “control” contractors.

During these site visits, researchers evaluated several specific aspects of workplace health and safety. These included both the extent to which carpenters were in compliance with OSHA regulations with respect to wearing personal protective equipment (i.e., hard hats, eye protection, and ear protection) and the extent to which the sites were in compliance with OSHA fall protection and ground fault regulations. Researchers also rated housekeeping at the site and provided an overall evaluation of workplace health and safety conditions. Finally, researchers collected other data pertinent to the study, including the number of carpenters and other workers at the site, the type of carpentry work performed, the location of the site, whether or not the union steward and foreman at the site had received OSHA-10 or OSHA-30 training provided by the UBC.

A total of 558 site visits were conducted by UBC/CPWR researchers between March 11, 1997 and August 9, 2000. These visits involved over 172 contractors, 22 of which were study participants – contractors who had agreed to participate in the UBC health and safety program, while the remaining 150 contractors served as controls. These contractors worked at over 100 different sites in Massachusetts, Rhode Island, and Connecticut. Out of the 558 site visits, 309 involved evaluations of study contractors, while 249 involved controls, although in two site visits, the identity of the control contractor was not established.

In this report, we examine the influence of the local union on workplace health and safety using six measures of workplace health and safety: the percentage of carpenters wearing hard hats and eye protection, whether or not the site was in compliance with OSHA fall protection and ground fault regulations, and the inspectors’ evaluation of housekeeping and overall health and

safety conditions.¹ It is important to note that the inspectors' initial evaluation of housekeeping and overall health and safety conditions were narrative descriptions. These narratives were transformed into a rating scale that ranged from one ("very good") to five ("very poor") by the authors of this report.

As indicated, we are interested in the extent to which the local union may influence workplace health and safety. We expect that the extent of this influence may vary across local unions for a number of reasons. First, the underlying attitudes towards health and safety (and, consequently, local union policy) may vary among local union officials. Second, support for the UBC/CPWR health and safety project may also vary across local unions. Finally, there may be significant differences among locals with respect to the organizational infrastructure necessary to communicate both the objectives and methods of the health and safety project (or health and safety regulations more generally) to union stewards who are responsible for ensuring compliance on-site.

Due to the small number of site visits involving some of the locals that participated in the study, it was necessary to collapse the data across locals in order to obtain reliable estimates of health and safety performance. Thus, for the purpose of the analyses, we assign participating UBC locals to the following groups: (1) Connecticut locals, (2) Rhode Island (Local 94), (3) locals whose jurisdiction includes the city of Boston, and (4) other Massachusetts locals.² Based on anecdotal evidence, this grouping is sensible in that locals within these groups tend to share

¹ Eye and ear protection is not required in all situations, and in those instances in which eye or ear protection was not required, we treated these observations as missing. Similarly, ground fault and fall protection compliance were not at issue at a number of work sites. In these instances, we treated these variables as missing. Due to the small number of non-missing observations, we decided to not examine compliance with ear protection regulations.

² There is only one local in Rhode Island. The Boston locals did not include other locals whose jurisdictions include other cities within the Boston metropolitan area, such as Cambridge.

more relevant characteristics with each other than they do with locals in other groups. However, it is important to note that the anecdotal evidence forming the basis for these groupings is sketchy and that by aggregating our data in this way, we may be missing significant variation among locals and are therefore biasing our results in favor of the null hypothesis that there are no differences in health and safety practices among local unions.

Variation in Workplace Health and Safety Practices

Table 1 reports the mean, standard deviation, and sample size (number of site visits for which usable data is available) for these selected health and safety measures. We report these statistics for the total sample and disaggregated by local union group.

As indicated, data in the first two rows represent the proportion of carpenters who were in compliance with the personal protective equipment at the time of the site visit. In other words, these data indicate that 75.8 percent of carpenters at all sites visited by the UBC/CPWR researchers were in compliance with hard hat regulations, while 51.7 percent were in compliance with eye protection regulations. The lower figure for eye protection may reflect the fact that eye protection is not required at all times on these sites, while hard hats are. In other words, the eye protection standard requires some judgment on the part of the worker, the contractor, and the inspector as to whether and when eye protection is required.

The next two rows report the proportion of work sites that were in compliance with the ground fault and fall protection regulations. As can be seen, 87.9 percent of all work sites were in compliance with the ground fault regulation at the time of the site visit, while 70.8 percent of work sites were in compliance with the fall protection requirement. The last two rows are ratings of health and safety conditions at the work sites. As indicated, these ratings range from 1 (“very

good”) to 5 (“very poor”) so that higher numbers reflect a more hazardous workplace. The data reveal that when all site visits are considered, the average rating for both housekeeping and overall health and safety was between “good” (rating = 2) and “mediocre” (rating = 3).

The table suggests some interesting variation among UBC locals. The Boston and Connecticut locals are consistently above average (for the total sample) with respect to their compliance with OSHA regulations, while Local 94 (Rhode Island) and the other Massachusetts locals are rank consistently below average. Similarly, Boston and Connecticut locals have higher scores on both health and safety rating measures (housekeeping and general impression) than the Rhode Island and other Massachusetts locals. Simple one-way analyses of variance reveal that the differences among these local union groups with respect to eye (F = 10.35, p = 0.0000) and fall protection compliance (F = 3.01, p = 0.0306) and the housekeeping (F = 10.77, p = 0.0000) and general impression (F = 4.68, p = 0.0031) ratings are statistically significant at the 0.05 level. However, we failed to find statistically significant differences for ground fault (F = 1.41, p = 0.2402) and hard hat (F = 2.30, p = 0.0768), and eye protection compliance.

Thus, there appears to be some meaningful differences among local unions with respect to health and safety performance. As previously indicated, these differences may reflect local union support of the UBC health and safety plan, or they may be due to a more general difference in attitudes towards health and safety among local unions. To examine this issue further we must examine the effects of the UBC intervention.

Effects of the UBC Intervention on Workplace Health and Safety Practices

While the UBC health and safety plan was introduced to the study firms prior to the first site visit, it is believed that the impact of the plan on workplace practices is not immediate but

accumulates over time, so that site visits occurring late in the study period are more likely to measure plan effects than are site visits at the beginning of the study period. Accordingly, an appropriate measure of plan effects is a before-after comparison of “study” contractors with “control” contractors on the dependent measures (OSHA compliance and work site health and safety ratings), where “before” designates site visits that occurred at the beginning of the study period and “after” designates visits that occurred at the end of the period. Comparing changes in the dependent health and safety measures for “study” contractors with those for “control” contractors allows us to account for the effects of any other concurrent changes in factors that may workplace health and safety for both types of contractors, such as a change in workers’ compensation premiums.

Table 2 reports data on these before and after comparisons for the total sample and for each union group separately, where “before” includes site visits that occurred before July 7, 1999.³ Specifically, these data show the absolute and percentage “before-after” changes in OSHA compliance and worksite safety ratings for both “study” and “control” contractors. In other words, this table reports the extent to which these measures changed between the first and second halves of the study period. For example, the data for hard hat compliance for the total sample show that 7.6 percent of carpenters who worked for “control” contractors were more likely to be in compliance after July 7, 1999 than before that date, while the compliance rate of “study” carpenters increased by 20.7 percent. In relative terms, the hardhat compliance rate for control carpenters increased by 10.6 percent, while a 31.1 percent increase in hardhat compliance was observed for study carpenters. In addition, we have marked those changes that are

³ This date is median date for site visits, so that one half of the site visits occurred prior to this date and one-half occurred afterwards.

statistically significant at the 0.01, 0.05, and 0.10 levels according to two-tailed t-tests with one, two, and three asterisks, respectively.

For each dependent measure, Table 2 also reports differences in the “before-after” changes in the dependent variables between the control and study contractors. For example, for the total sample, there was a 0.131 difference ($= 0.207 - 0.076$) between study and control contractors with respect to their improvement in hardhat compliance. That is, while the hardhat compliance rate of both types of contractors improved over the study period, the improvement of study contractors exceeded that of control contractors by 13.1 percentage points in absolute terms. Once again, we have marked statistically significant differences in “before-after” changes between study and control contractors with one, two, or three asterisks, indicating the p-level as 0.01, 0.05, or 0.10, respectively.⁴

Overall, the data indicate that, with the exception of housekeeping, the UBC health and safety plan was effective in improving workplace health and safety. The data for the total sample indicates that study contractors improved on every dependent measure and that these improvements were statistically significant at the 0.01 or 0.05 levels. On the other hand, while control contractors similarly improved health and safety performance over the study period, these improvements were statistically significant for two dependent measures (fall protection and housekeeping). Furthermore, with the exception of housekeeping, the improvement of study contractors exceeded that of controls; statistical tests indicate that this difference in the extent of improvement was greater for study contractors than for controls on two of the dependent variables (hard hat compliance and fall protection).

⁴ Statistical significance was determined through examination of the interaction of the treatment (“before-after” comparison) with the study/control group in a two-way analysis of variance.

These data further suggest that the UBC health and safety plan was more effective in improving certain health and safety practices than others. Specifically, the intervention was most effective in increasing compliance with fall protection regulations; compliance at study sites increased by 35.7 percent in absolute terms and by 73.1 percent in relative terms (that is, the compliance rates increased in the second half of the study period were 73.1 percent higher than they were in the first half). This compares with an absolute 13.3 percent increase in ground fault compliance (or a 16.2 percent increase in relative terms).

Finally, the data suggest that there are differences among the local groups in the efficacy of the UBC intervention. In general, the intervention was apparently least effective for the Connecticut locals, but only because there was substantial improvement in the health and safety measures for both the control and study groups. For example, eye protection compliance rates for study contractors in Connecticut increased by 33.6 percent in absolute terms (or 69.8 percent in relative terms); however, compliance for control contractors in that state similarly increased by nearly as much: 28.4 percent in absolute terms (or 64.1 percent in relative terms). Consequently, there is no significant difference for the before-after comparisons between control and study contractors in Connecticut.

There are two possible explanations for the Connecticut results. Either the UBC plan had spillover effects from the study to the control contractors, perhaps due to a general heightened awareness of health and safety issues among Connecticut carpenters, or a change in some other factor affecting workplace health and safety, but unrelated to the UBC intervention, is responsible for the improvement. Of these two explanations, we are more inclined to believe that the improvements result from spillover effects, since the changes are so dramatic and since we

have no information of any other significant change that could affect workplace health and safety.

Of the remaining union local groups, Local 94 in Rhode Island showed the most significant improvement on a the entire range of health and safety measures for the study contractors, while the results for other Massachusetts locals were the most anemic overall.

Controlling for Other Variables Affecting Health and Safety

The previous analyses are potentially flawed in that they assume that other variables influencing the incidence of health and safety practices are constant across time, study and control contractors, and local union groups. If, however, there are differences between the study and control contractors or over time with respect to other variables affecting workplace health and safety that are unrelated to the UBC intervention, then our conclusions concerning the intervention's effects may be in error. For example, if Connecticut contractors were more likely in the second half of the study period to work on projects where compliance with OSHA regulations was easier, due to the nature of the work or the project owner, then this factor, and not the UBC intervention, would explain the general improvement in health and safety practice found for Connecticut contractors.

To explore this further, we estimated regression equations predicting the health and safety performance of contractors (using the six dependent variables described previously). Separate regression equations were estimated for study and control contractors. The duration (in days) between January 1, 1997 and the date of the site visit served as measure of the effect of the UBC intervention, based on the hypothesis that the intervention would have a delayed and cumulative effect on workplace health and safety practices. Control variables include the number

of workers on the site, the number of workers squared, a dummy variable indicating whether the carpenter foreman had received OSHA-10 training,⁵ four dummies indicating the nature of the work being performed by the contractor,⁶ and a dummy indicating whether the project owner was a public sector entity. Finally, some regressions included three dummies indicating the local union group.⁷ Table 3 reports the means and standard deviations of these variables.

If the UBC intervention is effective, then we expect to find that the time variable will be positively associated with OSHA compliance and with the researchers evaluations of health and safety conditions at the work sites for the study contractors, but not necessarily for the controls. If there has been a general improvement in workplace health and safety for all contractors over the study period, then we would expect to see improvement for both study and control contractors, but if the UBC safety plan was effective, then extent of improvement, as measured by the time variable should be greater for the study participants than for the controls. That is, the magnitude of the time variable coefficient should be significantly larger (more positive) for study observations than for controls.

We also hypothesize that, consistent with prior research, there will be an U-shaped relationship between the project size, as measured by the number of workers on the site, and the

⁵ We were missing information on foreman OSHA10 training for 112 of the 558 observations. Accordingly, we used a hotdeck procedure that utilized information on the type of contractor (residential, heavy and highway, or commercial) to impute values for these missing observations.

⁶ UBC/CPWR researchers identified eight different types of work: (1) finish, (2) flooring, (3) interior, (4) formwork, (5) heavy & highway, (6) piles, (7) renovation, and (8) wood framing & roofing. Due to the small number of observations for the flooring, piles, and renovation categories, which reduced the number of observations in our regression analyses, we collapsed the flooring and interior categories, the piles and heavy & highway categories, and the renovation and wood framing & roofing categories. This resulted in the four categories utilized in our analyses and reported in Tables 3 – 5 as well as an omitted category of wood framing & roofing & renovation.

⁷ In these analyses, other Massachusetts locals comprise the omitted category.

incidence of workplace health and safety practices, so that the coefficient on the number of employees variable should be positively signed, while the coefficient on the number of employees squared should be negatively signed. We also hypothesize that sites where the foreman has had OSHA-10 training are more likely to be in compliance with OSHA regulations than sites where the foreman has not had this training. In addition, given the differences in the underlying risks of injury, we would expect that contractors may be less stringent in complying with OSHA regulations when they are engaged in finish and interior work than in other types of work, and more stringent in their compliance when engaged in formwork or heavy & highway construction. Finally, we expect that since the lack of a profit motive should attenuate cost concerns, sites where the project owner is a public-sector entity are likely to be more attentive to safety issues than sites where the owner is in the private sector.

Estimation procedures appropriate to limited dependent variables were utilized. Specifically, hard hat and eye protection compliance were estimated using a double-truncated tobit, assuming that the dependent variable was censored at 0 and 1. Logit regressions were used to estimate ground fault and fall protection compliance, which are 1-0 variables. Finally, the general impression and housekeeping ratings were estimated with an ordered probit.

The results of these regression analyses are reported in Tables 4 and 5. Both tables report coefficient estimates and associated absolute t-statistics (in parentheses) for each regression equation. Asterisks designate coefficients that are statistically different from zero at the 0.10 (*), 0.05 (**), and 0.01 (***) probability levels (two-tailed tests).

An examination of the data in these two tables reveals that the time variable is significantly different from zero in all study contractor regression equations except eye protection compliance. On the other hand, the corresponding coefficients for the time variable in

the control contractor regressions is only significantly different from zero in the housekeeping rating equation. In addition, with the exception of the housekeeping rating, the magnitude of the time coefficient estimates are larger in the study contractor equations than in the control equations, although these differences are not statistically significant at conventional levels. However, taken together these data suggest that the UBC intervention was successful in improving workplace health and safety as measured by these dependent variables.

We obtained mixed results for other variables in the regression equations relative to our expectations. The dummy indicating that, consistent with expectations, the foreman had received OSHA10 training was positively related to the dependent variable in all equations, although this relationship was only statistically significant in four of these equations. There is also evidence that public-sector project owners were more likely to be in compliance with OSHA regulations than private-sector owners; all but two coefficients for the public-sector project dummy were positively signed, although only two of these were statistically significant. Similarly, there is relative strong evidence indicating that both housekeeping and overall safety and health conditions were better at publicly-owned than at privately-owned sites. We also find the expected relationships between type of work and OSHA compliance.

On the other hand, there is little evidence supporting our hypothesis of a u-shaped relationship between project size and health and safety conditions. The number of workers on site is positively and significantly related to hard hat compliance in two equations. Likewise the quadratic term is negatively related to eye protection compliance in the control contractors regression. In other regression equations, the coefficient for these two variables is not statistically different from zero.

To estimate whether, taken as a whole, variation among union locals accounts for a significant proportion of the variance in OSHA compliance or other health and safety conditions, we examined likelihood ratio tests comparing regression specifications that contain the three local union group dummy variables with a restricted specification that did not include these dummies. The chi-square ratios from these likelihood ratio tests are reported in Table 6.

As can be seen from that the data in that table, differences among local union groups accounted for a statistically significant portion of the variation in three of the eight OSHA compliance regressions, and in all four of the regressions predicting the inspectors rating of other health and safety conditions. We can conclude from these statistics that local unions significantly influence health and safety conditions at construction work sites.

Conclusions

The data in presented in this study provides evidence that the UBC health and safety plan increased both OSHA compliance as well as workplace health and safety conditions more generally. Furthermore, there is evidence that there is substantial variation among local unions with respect to the successful implementation of health and safety practices in the workplace.

Table 1
Means, Standard Deviations, and Observations, by Local, Selected Practices

Variable	Statistic	Total Sample	Boston	Rhode Island	Connecticut	Mass- achusetts
<i>Hard Hat Compliance</i>	Mean	0.758	0.828	0.705	0.778	0.749
	S.D.	0.391	0.331	0.413	0.395	0.391
	N	514	100	174	147	93
<i>Eye Protection Compliance</i>	Mean	0.517	0.564	0.434	0.651	0.398
	S.D.	0.413	0.406	0.390	0.399	0.427
	N	484	94	171	142	77
<i>Ground Fault Compliance</i>	Mean	0.879	0.944	0.846	0.877	0.873
	S.D.	0.327	0.231	0.363	0.330	0.336
	N	372	72	123	114	63
<i>Fall Protection Compliance</i>	Mean	0.708	0.817	0.663	0.760	0.588
	S.D.	0.455	0.390	0.475	0.430	0.497
	N	281	60	95	75	51
<i>General Impression</i>	Mean	3.853	3.931	3.688	4.116	3.727
	S.D.	1.006	0.887	1.035	0.908	1.131
	N	436	87	160	112	77
<i>Housekeeping</i>	Mean	3.688	3.655	3.337	4.185	3.489
	S.D.	1.051	0.807	1.192	0.868	1.040
	N	269	58	83	81	47

Table 2
Changes in Health and Safety Practices

Variable	Statistic	Total		Boston		Rhode Island		Connecticut		Other Mass.	
		Control I	Study II	Control I	Study II	Control I	Study II	Control I	Study II	Control I	Study II
<i>Hard Hat Compliance</i>	<i>Abs. Change</i>	0.076	0.207***	-0.007	0.317***	-0.108	0.134*	0.356***	0.361***	-0.072	0.052
	<i>% Change</i>	10.6%	31.1%	-0.8%	49.5%	-14.7%	20.1%	65.3%	61.9%	-9.8%	6.7%
	<i>Diff. (II-I)</i>	0.131*		0.503**		0.348*		-0.034		0.165	
<i>Eye Protection</i>	<i>Abs. Change</i>	0.011	0.101**	-0.167	0.017	-0.070	-0.044	0.284***	0.336***	-0.202	-0.027
	<i>% Change</i>	2.1%	21.1%	-28.0%	2.7%	-14.8%	-10.0%	64.1%	69.8%	-37.6%	-6.7%
	<i>Diff. (II-I)</i>	0.090		0.184		0.025		0.052		0.174	
<i>Ground Fault Compliance</i>	<i>Abs. Change</i>	0.103	0.133***	-0.031	0.053	0.089	0.162**	0.180**	0.171**	0.182	0.100
	<i>% Change</i>	12.3%	16.2%	-3.3%	5.6%	11.4%	20.2%	22.8%	22.3%	22.2%	12.0%
	<i>Diff. (II-I)</i>	0.031		0.084		0.073		-0.009		-0.082	
<i>Fall Protection Compliance</i>	<i>Abs. Change</i>	0.079*	0.357***	-0.060	0.390**	0.214	0.349***	0.175	0.264*	-0.125	0.401
	<i>% Change</i>	10.7%	73.1%	-6.5%	72.4%	30.0%	73.1%	28.0%	43.9%	-20.0%	103.0%
	<i>Diff. (II-I)</i>	0.278***		0.450**		0.135		0.089		0.526*	
<i>General Impression</i>	<i>Abs. Change</i>	0.096	0.364***	-0.057	0.220	-0.386	0.364*	0.625**	0.519**	-0.044	0.145
	<i>% Change</i>	4.4%	15.7%	-2.7%	10.6%	-17.2%	15.2%	27.9%	23.7%	-2.2%	5.8%
	<i>Diff. (II-I)</i>	0.268		0.278		0.751**		-0.107		0.189	
<i>Housekeeping</i>	<i>Abs. Change</i>	0.495**	0.412***	0.061	-0.192	-0.010	0.365	0.771**	0.7*	1.75**	0.565
	<i>% Change</i>	19.0%	15.5%	2.6%	-8.3%	-0.4%	12.8%	33.0%	28.0%	43.8%	18.8%
	<i>Diff. (II-I)</i>	-0.083		-0.253		0.375		-0.071		-1.185	

Table 3
Means & Standard Deviations, Independent Variables

Variables	Mean	Standard
<i>Time (in days)</i>	844.3949	336.9652
<i># of workers</i>	60.49183	84.51395
<i># of workers squared</i>	10788.91	60577.98
<i>Foreman -- OSHA 10</i>	0.507246	0.500401
<i>Finish</i>	0.107078	0.309493
<i>Formwork</i>	0.239564	0.427206
<i>Heavy & Highway</i>	0.475499	0.499853
<i>Interior</i>	0.067151	0.25051
<i>Wood Framing & Roofing</i>	0.110708	0.314055
<i>Boston</i>	0.188406	0.391391
<i>Rhode Island</i>	0.36413	0.481622
<i>Connecticut</i>	0.282609	0.450676
<i>Other Massachusetts</i>	0.164855	0.371386
<i>Public Project</i>	0.543478	0.498558

Table 4
Regression Equations Predicting Compliance with Health and Safety Regulations

	Hard Hats		Eye Protection		Fall		Ground Fault	
	Study	Control	Study	Control	Study	Control	Study	Control
Time	0.4131*** (3.68)	0.0095 (0.04)	-0.0117 (0.22)	-0.0478 (0.45)	0.7371*** (5.71)	0.3435 (1.38)	0.4888*** (3.79)	0.2605 (1.14)
# of workers	0.8866*** (2.64)	0.8095 (0.61)	0.0125 (0.07)	0.5531*** (2.97)	0.3248 (0.47)	-0.8739 (0.63)	0.2811 (0.34)	-0.0848 (0.14)
# of workers squared	-0.0542 (0.57)	0.3650 (0.42)	0.0267 (0.63)	-0.0628*** (2.57)	0.0952 (0.25)	0.8500 (0.85)	0.0530 (0.10)	0.0360 (0.12)
Foreman -- OSHA 10	0.2150 (1.08)	0.4935 (1.36)	0.3270*** (2.90)	0.2330 (1.58)	0.4082* (1.71)	-0.1569 (0.51)	-0.0628 (0.24)	0.4647 (1.45)
Finish	-0.9830** (2.41)	-2.423** (2.52)	-0.1127 (0.50)	-0.6500* (1.75)	-1.418*** (2.82)	0.4086 (0.35)	-0.3922 (0.77)	-5.729*** (6.28)
Formwork	0.8165** (2.42)	1.543* (1.94)	0.2245 (1.20)	0.5098* (1.72)	-0.6621 (1.62)	0.8792 (1.48)	0.1717 (0.38)	-6.313*** (7.38)
Interior	-0.3322 (1.12)	-0.1492 (0.23)	-0.3672** (2.14)	-0.0302 (0.11)	-0.6309* (1.82)	0.8841* (1.93)	0.0725 (0.18)	-5.436*** (6.68)
Heavy & Highway	0.5130 (1.14)	1.974* (1.79)	0.2102 (0.81)	0.7304* (1.94)	-0.7057 (1.27)	1.303* (1.75)	-0.5391 (0.97)	-5.813*** (6.11)
Boston	-0.0680 (0.19)	0.8735 (1.52)	0.5637*** (2.78)	0.2004 (0.83)	-0.0788 (0.31)	-0.1788 (0.58)	0.1102 (0.42)	-0.2858 (0.89)
Rhode Island	-0.3604 (1.28)	-0.2978 (0.54)	0.0372 (0.23)	0.1650 (0.69)	0.3356 (0.85)	0.7917 (1.59)	0.8835 (1.53)	0.1798 (0.31)
Connecticut	0.1119 (0.35)	0.7887 (1.43)	0.5448*** (2.96)	0.6440*** (2.72)	0.2877 (0.96)	0.4572 (0.96)	0.1486 (0.43)	-0.4287 (0.78)
Public	0.3628* (1.73)	0.2571 (0.71)	-0.0876 (0.76)	-0.1071 (0.72)	0.7416** (1.99)	0.1524 (0.33)	-0.0712 (0.19)	0.0925 (0.17)
Constant	-0.0370 (0.08)	0.4001 (0.36)	0.3203 (1.29)	-0.0641 (0.14)	-1.240** (2.41)	-1.0097 (1.11)	0.0386 (0.07)	6.271*** (6.56)

Table 5
Regression Equations Predicting Inspector Evaluations of
Worksite Health and Safety

	Housekeeping		General Impression	
	Study	Control	Study	Control
Time	0.2247** (1.96)	0.5842*** (2.85)	0.2669*** (3.57)	0.1944 (1.54)
# of workers	-0.4408 (1.50)	-0.3760 (0.62)	-0.4275 (1.28)	0.1762 (0.80)
# of workers squared	0.1100 (1.36)	0.1440 (0.48)	0.1490 (0.92)	-0.0134 (0.55)
Foreman -- OSHA 10	0.0933 (0.51)	0.3216 (1.39)	0.2788* (1.95)	0.3036* (1.77)
Finish	0.1551 (0.43)	-0.3513 (0.70)	-0.1864 (0.64)	-0.0033 (0.01)
Formwork	0.5494 (1.63)	0.3739 (0.93)	0.0278 (0.12)	0.8801** (2.51)
Interior	0.1758 (0.58)	-0.1100 (0.32)	-0.4372** (2.00)	0.4387 (1.38)
Heavy & Highway	0.4887 (1.10)	1.2097* (1.66)	-0.5574* (1.67)	1.127** (2.51)
Boston	-0.0264 (0.14)	0.1672 (0.76)	0.1433 (0.97)	-0.0960 (0.57)
Rhode Island	0.4693 (1.52)	0.1978 (0.55)	0.6443** (2.53)	-0.3206 (1.22)
Connecticut	-0.0323 (0.13)	-0.1559 (0.42)	0.1385 (0.69)	-0.4001 (1.56)
Public	0.6984** (2.50)	1.206*** (3.35)	0.5870** (2.56)	0.2413 (0.93)
Constant	-1.110** (2.08)	0.1622 (0.20)	-1.470*** (4.04)	-0.8858 (1.58)

Table 6
Chi-square Coefficients for Likelihood Ratio Tests Comparing Models
With and Without Local Union Dummy Variables
(Sample size in parentheses)

Variable	Study	Control
<i>Hard Hat Compliance</i>	4.04 (276)	8.33** (231)
<i>Eye Protection Compliance</i>	21.19*** (269)	10.92** (210)
<i>Fall Protection Compliance</i>	4.14 (167)	3.45 (112)
<i>Ground Fault Compliance</i>	3.73 (224)	2.53 (142)
<i>Housekeeping</i>	12.66*** (150)	24.35*** (115)
<i>General Impression</i>	12.44*** (245)	10.08** (186)



DEPARTMENT OF HEALTH AND HUMAN SERVICES

Public Health Service
Centers for Disease Control
and Prevention (CDC)

Memorandum

Date: May 9, 2001

From: Roy M. Fleming, Sc.D., Director, Research Grants Program RMF
Office of Extramural Programs, NIOSH, D30

Subject: Final Report Submitted for Entry into NTIS for Grant 5 R01 CC317873-03.

To: William D. Bennett
Data Systems Team, Information Resources Branch, EID, NIOSH, P03/C18

The attached final report has been received from the principal investigator on the subject NIOSH grant. If this document is forwarded to the National Technical Information Service, please let us know when a document number is known so that we can inform anyone who inquires about this final report.

Any publications that are included with this report are highlighted on the list below.

Attachment

cc: Sherri Diana, EID, P03/C13

List of Publications None



DEPARTMENT OF HEALTH AND HUMAN SERVICES

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Attachment

cc: Sherri Diana, EID, P03/C13 w/attachment

List of Publications *None*

Title: Demonstration: Health & Safety Programs in Construction
Investigator: Wilfrid Cameron
Affiliation: Center to Protect Workers' Rights
City & State: Washington, DC
Telephone: (206) 935-7748
Award Number: 5 R01 CC317873-03
Start & End Date: 9/30/1996–9/29/2000
Total Project Cost: \$593,902
Program Area: Intervention Effectiveness Research Methods
Key Words:

Abstract:

A safety program was introduced to 21 small contractors who employ union carpenters in the New England Area (Massachusetts, Rhode Island, and Connecticut). After the program was introduced, participating contractors' construction sites were inspected over a three-year period. During the same period, inspectors also observed construction sites of nonparticipating contractors who employed union carpenters. Data were gathered on the necessity and incidence of safe work practices such as fall protection, hard hat usage, eye protection, proper housekeeping procedures, proper ground fault procedures, and hearing protection, along with other characteristics, of 542 construction sites.

The aim of the study was to determine if the safety program affected the observed incidence of safe work practices among the carpenters employed by the participating contractors. The overall results revealed no statistically significant difference in safe work practices of carpenters employed by participating contractors compared to their counterparts employed by those not participating. Other notable findings suggested a trend of less compliance with fall protection guidelines in the winter months and a higher probability of compliance during periods of more unemployment in the regions. Hard hats were more likely to be worn if a formal safety plan was located on the site, perhaps a proxy of how conscientious the contractors followed the safety plan. Proper eye protection procedures were more likely to be observed when the carpenter foremen had received OSHA training and unemployment rates were higher than average. The analysis also discovered substantial heterogeneity between contractors with respect to the six safety practices, implying that managements' safety policies and/or attitudes toward safe work must be seriously addressed if safety improvements are to occur on construction sites. Finally, the ancillary surveys of foremen and carpenters cast doubt on the degree to which important elements of the safety plan were adopted by participating contractors. Such findings may explain the findings of similar safety behaviors between the study and the control groups.

Publications

No publications to date.