Preliminary OSHA Fatality Summary Analysis 1984-2014

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Introduction

Since 1984 there have been over 300 fatalities recorded in the telecommunications industry and the incidents do not appear to be diminishing. In fact, there has not been a statistically significant difference in the number of fatalities from 1984 through 1998 as compared to 1999 through 2013 (t=0.576). Often, this author has been told by technicians that fatalities during the "early years" of the industry were "not as high as they are today." It was upon this proclamation that this author decided to investigate OSHA summaries from 1984 to present. The OSHA database provides summary information in computerized form from 1984 to present day, thus the study is limited from the year 1984 until 2013. This current year, 2014, is not included in analysis as many of the fatality investigations by OSHA have not been completed.

All of the data for this article is ***preliminary***. The information contained herein is a direct result of reading, studying, and interpreting the information given in the OSHA investigation *summaries*. All summaries are readily available to the public as long as one has a summary number, inspection number, report, or accident identification number. These inspection numbers and data were provided by Dr. Michael S. Landa (2013). This author looked up and mined data from the publicly available data. Currently, this author is in the process of ordering copies of every OSHA report dated 1984 to the present. Once those are obtained, a more meticulous survey of the data will be performed; each case will be read and information extrapolated to refine the preliminary findings in this short analysis.

Procedure

Every summary of each fatality in the industry (as identified by the NAICS and SIC Codes from the Bureau of Labor Statistics (BLS)) was read and reviewed. Once collected, an experienced climber and industry professional of twenty years reviewed this author's database and reviewed the coding and interpretation of the summaries. Data was then coded and placed into SPSS, a statistical software analysis program.

Data Collection

Fatality and climber data was collected from the OSHA summaries. Data from the summaries included date of the fatality, reason for fatality (explained in more detail in the next section), whether or not it was possible that the worker was not 100% secured during the execution of his/her duties, if the climber or another crew member was not properly utilizing the equipment, if there was use of defective equipment, whether or not the fatality was riding the winch, headache ball, or load lines, or whether the climber was documented in the summary as "free climbing." Additionally, OSHA fines for each fatality, per the summary reports, were also recorded.

Based on climber deaths and the state of the industry's safety culture, it has often been speculated that technicians are likely to engage in risky behaviors and that they are sometimes their "own worst enemy." Often, those in the industry claim that many fatalities are a result of improper / non-use of their equipment, or misuse / non-use of equipment in the field by the climber and/or crews. While there is limited research into industry (Landa, 2014), it is theoretically reasonable to assume that given the advances in safety equipment and education provided by OSHA, NATE, TIA, and other advocates, and standards available to companies and technicians, there may be validity to this assumption. Data was collected for strictly descriptive analysis as a ***preliminary investigation***. This preliminary investigation will guide further inquires after full OSHA reports are obtained.

It should also be noted that there are other issues embedded within the safety culture of the telecommunications industry that may also play a part in the fatalities of telecom technicians that are not addressed fully within this paper. These include, but are not limited to: pressurized deadlines by carriers, substandard or no training for technicians, technicians with limited experience being asked to perform duties beyond the scope of their capabilities, or improper / poor equipment being provided by employers. The author expects to collect data on these other factors in subsequent investigations.

Coding Variables

Coding of variables extrapolated from the summaries corresponded to the nature of the data collected. Data for "reason for accident" were originally coded as 1 = Equipment

Malfunction, 2 = Free Climbing, 3 = Electrocution, 4 = Fall – Climber Error, 5 = Tower Collapse / Tower Fall, 6 = Riding the line, gin, or headache, 7 = External Causes, 8 = Improper Rigging, and 9 = Missing Data. Similarly, data for whether or not it was possible that the worker was not 100% secured during the execution of his/her duties, if the climber or another crew member was not properly utilizing the equipment, if there was use of defective equipment, whether or not the fatality was riding the winch, headache ball, or load lines, or whether the climber was documented in the summary as free climbing was coded as 1 = Yes, 2 = No, 3 = Unknown, 4 = Possible, 9 = Missing Data. The year of the accident was coded as 1-31, with 1984 being coded a 1, and subsequent years being coded in numerical order through 2013. OSHA fines were coded in blocked amounts from codes of 1-18 for varying amounts (see Table 3).

Dummy-Coding

Recoded data for "reason for accident" were subsequently dummy-coded as dichotomous in nature, and coded as a 0 or 1 for coding purposes: 0 = climber/crew at fault and 1 = climber/crew not at fault, respectively. The data for "reason for accident" was re-coded in this manner so that a logistic regression could be performed on the data. A binary logistic regression was performed to determine the predictive value of the variables listed below.

Results & Analysis

Almost all of the data analysis, given the limited nature of the data collected, is descriptive in nature; mainly frequencies and percentages. Of the original 304 fatality cases compiled from the researchers' database, 302 cases were viable for analysis; 2 cases were removed because they were deemed to be duplicates, recorded an injury and not a fatality, and/or were missing the "reason for accident data" on the OSHA summary. It is anticipated that more detailed information will be extrapolated from full OSHA reports once they are available.

"Reason for Accident"

Table one lists the variables extrapolated from the data. A total of 302 cases were viable, as two cases were missing data (i.e., an incomplete OSHA summary or a summary with no information provided). The summaries were read and interpreted for reasons leading to or causing the fatality. The variables Equipment Malfunction, Free Climbing, Electrocution, and External Cause were either plainly stated in the OSHA summary, or worded in such a way in that these reasons were evident of the cause. Free Climbing was only coded as Free Climbing if it was stated outright in the OSHA summary. Other variables such as Fall – Climber Error, Tower

Collapse/Tower Fall, Riding the Line, Gin, or Headache, or Improper Rigging were either out right stated in the OSHA report or were inferred given the information in the summary.

For example, several summaries were worded vaguely (OSHA inspection number 113331979): “Employee #1 was dismantling an FAA tower when he fell approximately 62 ft to the ground. He was killed.” Given this vague information, and the education of the most minimal nature, the inference here (given the information in the OSHA summary *only*) is that the climber must not have been 100% tied off to the structure; otherwise his safety equipment would have prevented the fall that resulted in the fatality. Similarly, OSHA Inspection Number

116109562 summary stated: “Employee #1 was painting a 300 ft radio tower using a fall restraint system consisting of a chain connected at both sides of his body belt and a center hook.

A cross member of the tower to which he was hooked was not fully bolted to the tower.

Employee #1 apparently leaned back, causing the cross member to come off the tower.

Employee #1 slid off the member, falling 240 ft to the ground. He was killed.” While the summary is much more detailed the previously mentioned summary, one can plainly see that the fatality was ultimately the result of climber error; he did not hook off to a well connected piece of the structure, and apparently did not have, or was not wearing, the appropriate fall arrest lanyard that is supposed to hook into the back of the harness’ D-Ring.

Table 1

Coded Reasons for Accident

Variable	Percentage	Frequency	p
Equipment Malfunction	3.32%	10	.000
Free Climbing	0.99%	3	.523
Electrocution	3.97%	12	.194
Fall – Climber Error	56.62%	171	.000
Tower Collapse/Tower Fall	10.26%	31	.031
Riding Line, Gin, or Headache	13.91%	42	.010

External Cause	8.61%	26	.000
Improper Rigging	2.32%	7	.326

Variable Descriptive Data

Succinctly, the descriptive data from the OSHA summaries revealed that climber error or climber/crew error accounted for an overwhelming majority of fatalities. Arguably, every variable in Table 2 could conceivably be construed as climber error except for the variables

“Defective Equipment.” The reasoning behind this statement is that if a technician is not 100% secured to the structure, the crew or climber improperly utilized equipment, rode the line, gin, or headache, or free climbed, it is reasonable to assume that the technician and or the crew was likely not following established safety protocols, whether that be personal fall protection standards or standards regarding proper use of equipment.

Table 2

Variables Contributing to Fatalities

Variable	Percentage	Frequency
Climber Not/Possibly Not 100%	*63.5%	193
Climber/Crew Improperly Using Equipment	*72.0%	219
Defective Equipment	*4.6%	14
Climber Riding Line, Gin, or Headache	*15.8%	48
Was Climber Free Climbing	*0.3%	3

percent and count totals will not match 100%, as one case may have fallen into more than one category (e.g., several cases may have been coded a yes to both possibly not 100% tied off and Climber/Crew improperly using equipment).

OSHA Fines – Descriptive Data

Descriptive analysis regarding OSHA fines revealed that the average OSHA fine for a fatality on the data list from 1984-2014 was $6,414.58. Interestingly, 74 (21.7% of cases) summary reports indicated a penalty of $0.00, with the next highest fine recorded as $999.00 to $1999.00 for 44 cases (14.5% of cases). The frequencies and the percentages of OSHA fines can be seen in Table 3 (below). Abatement of fines is a sensitive subject among professionals, families, and climbers. There is more in the discussion section of this paper in regards to OSHA fines. Data on the abatement process and what corrective actions were taken by companies will be researched in depth once this author receives the individual OSHA reports for all the fatalities.

Table 3

Zero $	66	21.7
.01 to 999	35	11.5
999$ to 1999	44	14.5
2000 to 2999	31	
3000 to 3999	21	10.2
4000 to 4999	22	6.9
		7.2
5000 to 5999	14	4.6
6000 to 6999	8	2.6
7000 to 7999	9	3.0
8000 to 8999	4	1.3
9000 to 9999	10 7	3.3
10,000 to 12,999		2.3
13,000 to 15,999	4	1.3
16,000 to 20,999	7	2.3
26,000 to 30,999	10	3.3

Freq.	%			
		31,000 to 75,999	6	2.0
		76,000 to 99,999	4	1.3
		over 100,000	2	.7
		Total	304	100.0

Differences in Fatalities: 1984-2013

As stated earlier, there has not been a statistically significant difference in the number of fatalities from 1984 through 1998 (M = 4.51, SD = 1.27) and 1999 through 2013 (M = 4.62, SD =

1.43) (t = .0576). A t-test was necessary to compare the two groups' fatality rates for the first 15 years to the later 15 years of data. It was anticipated that there would be a statistically significant decrease in fatalities given the introduction of new safety equipment and enhanced training within the industry. However, the data does not appear to bear this out. It should be noted however that there are other mitigating variables that may also be impacting this lack of statistical significance; this is addressed in the "study obstacles" (pg. 14) portion of the paper.

Chi Square Analysis

A chi-square test is a simple and widely used nonparametric test that describes the magnitude of the discrepancy between theory and observation (Gibilisco, 2004). In this case, it was determined that a chi-square test would prove useful in finding out whether one or more of the independent variables (IVs) (i.e., whether or not it was possible that the worker was not 100% secured during the execution of his/her duties, if the climber or another crew member was not properly utilizing the equipment, if there was use of defective equipment, whether or not the fatality was riding the winch, headache ball, or load lines, or whether the climber was documented in the summary as "free climbing.") would be associated with an industry fatality.

Results indicated that there is an association between whether a climber is 100% tied off and an industry fatality, $X^2 = (2) = 23.418, p = .000$, between whether the crew or climber improperly used equipment and an industry fatality $X^2 = (3) = 41.555, p = .000$, whether or not the equipment was defective and an industry fatality, $X^2 = (3) = 36.802, p = .000$, whether or not the climber was riding the line and an industry fatality, $X^2 = (3) =25.030, p = .000$, and an external cause and an industry fatality, $X^2 = (1) = 210.933, p = .000$. However, there was not an association between free climbing and an industry fatality, $X^2 = (1) = .135, p = .713$.

Given the limited amount of information in the summaries, the small sample size, and several chi-square cells containing fewer than five observations, more research should be conducted with an even larger sample to retest the associations.

Table 4

Chi Square Results

Variable	df	Value	Sig. Level
Climber Tied Off 100%	2	23.418	0.000
Climber/Crew Improper			
Equipment Use	3	41.555	0.000
Defective Equipment	3	36.802	0.000
Riding Line	3	25.030	0.000
Free Climbing	1	0.135	0.713
External Cause	1	210.933	0.000

Binary Logistic Regression – "Reason for Accident"

A binary logistic regression analysis was done when analyzing the recoded "reasons for accident." A binary logistic regression with a forced "Enter" model was most appropriate for this analysis, as selecting model variables on a theoretical basis and using the Enter method is preferred (Gibilisco, 2004). Put more plainly, a forced "Enter" procedure in a binary logistic regression takes all the predictor variables (1 = Equipment Malfunction, 2 = Free Climbing, 3 = Electrocution, 4 = Fall – Climber Error, 5 = Tower Collapse / Tower Fall, 6 = Riding the line, gin, or headache, 7 = External Causes, 8 = Improper Rigging, and 9 = Missing Data) and enters them in simultaneously and makes no assumptions about the importance of each variable.

Binary logistic regression analysis determined if the aforementioned variables were predictive of a technician's fatality. Alpha levels were set at a significance level of .05. The confidence level of 95% indicates that one can be 95% certain that the results of the analysis were not due to chance. This method was selected because prior quasi-research and limited academic research has consistently indicated that climber and/or crew error is consistently the root cause of telecommunication technician fatalities. The findings from this study are consistent with this previous academic and quasi-research, and it is anticipated that further research will provide more detailed evidence.

Free climbing did not make significant contributions to the model. However, it is possible if more actual recorded cases of free climbing in regards to fatalities were recorded in OSHA investigations (if it can be determined as fact and not speculation), it is quite possible it would be statistically significant as a predictor. Other variables that were not statistically significant included electrocution and improper rigging. All other variables made a statistically significant contribution to the regression model, and no outliers were located.

Interpretation of Findings

Because the information is limited in OSHA summary reports, this author will request full copies of every OSHA report from 1984 through 2013. While this will take time, some preliminary findings can be extrapolated from the summaries. First, these preliminary findings are consistent with previous limited quasi-academic and limited academic research (Landa, 2014) as industry assumptions/claims regarding fatalities within and outside of the industry. The descriptive information pulled from the OSHA reports do indicate that several variables were significant at $p < 0.05$; Climber Error ($p = .000$), Tower Collapses ($p = .031$), Riding the Line ($p = .010$), Equipment Malfunction ($p = .000$), and External Causes ($p = .000$) are statistically significant variables regarding fatalities. Conversely, free climbing (*p =.523*), improper rigging (*p =.326*), and electrocution (*p =.194*) were not statistically significant variables. Furthermore, analysis revealed that that a climber possibly not being tied off 100%, possible climber or crew error improperly using equipment (or not using equipment), and Climbers Riding the Line were responsible for an overwhelming majority of the fatalities from 1984-2013; 63.5%, 72%, and 15.8% respectively). Lastly, it was also revealed that free climbing and defective equipment contributed far less to fatalities; 4.6% and 0.3% respectively.

Discussion

OSHA Fining is Complicated

When looking at the possible reasons for the fatalities extrapolated from the OSHA summaries, one may argue that it is understandable that the number of fatalities that were likely due to climber or crew error would result in a fine of $0.00. If a fatality was in fact the fault of a climber or crew, no penalties would be issued against the employer. On the other hand, one could also make the argument that an employer should be fined even if it was the fault of the crew or climber, as the employer is responsible for creating a maintaining a safe work environment at all times. The reasoning behind fining the employer (even if the crew or climber were responsible) is that the employer did not have measures in place to ensure employees conducted the required workplace safety guidelines, thus resulting in death. Although an employer cannot be responsible for monitoring all crews 100% of the time, they are expected to utilize project managers and foremen for this particular function, thus, an argument can be made that the ultimate responsibility does lie with the company owner.

Conversely, others argue that an employer acts on good faith that the foremen will act accordingly on site and perform his or her job correctly; ensuring the safety of the crew in his or her charge. Unless reported by another crew member that the foreman is not acting in the interest of crew safety, it would not be feasible to hold the company owner responsible for a fatality in this instance, and a fine against the company owner would not be justified. However, this latter argument is contingent on the company owner fostering a workplace culture in which employees feel free from retribution or unfair termination for reporting a supervisor for not ensuring the safety of the crew. One would hope that in such cases an OSHA investigator would address whether company employees feel duress for reporting a supervisor. If that investigator finds that a company owner's workplace is not conducive to employees reporting violations, or that the company culture is one that places undue pressure on employees and foremen to complete jobs under a pressurized deadlines, thereby causing employees to perform unsafely, one might argue that fining the employer would be justified even if the climber or crew were at fault.

One could argue that ***even*** under the above scenario that ultimately the climber is responsible for his or her own safety, and should refuse to perform the work if they felt their life is being placed in jeopardy. Regardless of the point of view one may take regarding this, the dynamics of subcontracting, job performance, and company policies for completing jobs is complicated and laced with pressure from the carrier down to the technicians completing the purchase orders. Thus, there has been a culture created within the telecom industry that places pressure upon the employee to complete the job "no matter what." It is **not** unreasonable to assume that climbers fear being fired and not being able to provide their families or for themselves personally, climbers will often feel pressured to take unnecessary risks.

Obstacles, Mitigating Factors, & Recommendations

Study Obstacles

The most significant obstacle encountered during this investigation was the OSHA summary content and/or the completeness of the summaries examined. Due to the sheer volume of information that is collected during a fatality investigation, one might expect a summary of the report to contain vital information. However in approximately 30 % of the summaries examined, there was very little information provided. For example, many of the summaries examined had little information (e.g., Employee #1 apparently leaned back, causing the cross member to come off the tower. Employee #1 slid off the member, falling 240 ft to the ground. He was killed"). While the actual OSHA report contains more information, the limited amount given on the summary forced this author to code several summaries as "fall – Climber Error," when in fact there may be clearer data within the whole OSHA report that could later alter the coding. Given this, it is possible the generalizability of the results could be limited.

Other Mitigating Variables

As stated earlier, there are many other mitigating variables that may account for there not being a statistically significant difference in the fatalities from 1984-1998 as compared to 19992013. At their core, each variable is safety oriented in nature. These include, but are not limited to: subcontracting and pressurized deadlines by carriers, substandard or no training for technicians, technicians with limited experience being asked to perform duties beyond the scope of their capabilities, or improper / poor equipment being provided by employers. Many of these variables are not able to be addressed in the short term; rather they are long term issues embedded within the industry.

Each variable presents its own challenges and possible solutions, and no one issue can be adequately addressed by one group or organization within the industry without addressing the safety culture of telecommunications as a whole. There is also much debate among those within the industry to the validity of some of these variables as actual challenges. Where responsibility should begin, who should be held accountable, and to what degree any involved party should be involved in making changes to these issues is often debated. These are variables that should be and will be addressed in future research endeavors.

Recommendations

Further examination into the subcontracting paradigm within the industry should be evaluated to determine what safety risks are created by utilizing the subcontracting model. There is much debate within the industry as to liability when a fatality occurs, who should be held responsible, and to what extent. There is a litany of research regarding subcontracting and safety in relation to industries such as construction, mining, and chemical and nuclear energy. Subcontracting, as a business mechanism, has many benefits to those that initiate the work, and rather poor consequences for those executing the work in the field; more often, those industries that implement a subcontracting paradigm are likely to see an increase in injuries and fatalities (Nunes, 2012; Mayhew & Quinlan, 1995; Ofori & Debrah, 1998). Given that this is the case it becomes even more pertinent an issue given the particularly dangerous nature of the work performed by telecommunications technicians.

Embedded within the subcontracting paradigm is also the concept of pressurized deadlines and what effect those deadlines have on safety, and ultimately on the fatality rate. When work is executed by a second, third, or fourth party, it is not unforeseeable that work might be delayed for various reasons. Empirical data needs to be collected from company owners, turf companies, and technicians to determine if the pressure emanating from those deadlines effect the execution of safety measures in the field.

Additionally, further study is needed in the effectiveness of training new telecommunication workers, and the effectiveness of the continuing education of climbers that have been in the industry for a number of years. In this author's opinion, empirical data should also be collected and measurable outcomes should be utilized to evaluate training components

"train the trainer" programs as well as the new apprenticeship program that is to be adopted into the industry before the end of 2014. Creating a training system based on proficiency is crucial. Internal and external training sources must teach the same subject matter, but not necessarily in the same way. Adult learners are not taught in the same way that children are taught, so there will be some variation in the method of delivery; but the subject matter should be taught to the same level of proficiency. Proficiencies must be at the 80 percent level or higher; safety must be 100 percent proficiency. In addition, all evaluations must be objective.

Lastly, the use of substandard equipment or the lack of appropriate equipment should be addressed as a function of technician safety. Because employers are responsible for providing technicians the proper equipment, it is solely up to the employer to make sure the technician has safe and adequate fall protection. There is no streamlined method to ensure that all employees receive the same quality fall protection, or even every necessary component for fall protection. This is an area within the industry that needs attention sooner rather than later and it would be recommended that the organizations, advocates, carriers, turf vendors, technicians, and small business owners within the industry devise a mechanism for this to be addressed.

Conclusion

The examination of OSHA summary reports, while limited, has provided a small glimpse into the causes of fatalities within the telecommunications over the past thirty years, however, more data is needed to investigate more thoroughly. In understanding the underlying causes of fatalities within the industry, it is more likely government officials, company owners, carriers, turf vendors, and technicians will be better equipped to find more effective strategies to contend with those reasons. Possible changes to the subcontracting paradigm, data collection, training methods, and programs to encourage lasting change should not be dismissed in as key elements in changing the safety culture within telecommunications. On the contrary, delegation of accountability, existing and emerging training and apprenticeship programs, and carrier, company, and climber responsibilities should be specific and measurable to the nature of work and shared openly among all stakeholders within the industry.