AN ANALYSIS OF SAFETY CULTURE & SAFETY TRAINING:

COMPARING THE IMPACT OF UNION, NON-UNION, AND

RIGHT TO WORK CONSTRUCTION VENUES

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Introduction

Since the late 1940s, the St. Louis construction industry has been one of the more unionized markets across the USA, when it comes to the residential sector (Gaal, 2004). Accordingly, "In St. Louis, there are a number of joint labor-management apprenticeship and training programs that invest millions of dollars each year training apprentices and journey-workers in the latest and safest construction methods and techniques" (Aboussie, 2012). In fact, it was labor that led the efforts to further embed safety in the St. Louis construction market. Since the early 2000s, the St. Louis Carpenters' Union played a major role in implementing OSHA 10 and substance abuse testing across the industry (Nelson, 2011). In the mid-2000s, the St. Louis Carpenters' Union made further strides instilling a culture of safety by requiring all active members complete no less than eight hours of safety training per year (Nelson). This safety program has grown to cover more than 30 topics…many that provide—upon successful completion—portable, nationally recognized, industry-based certifications/qualifications. Based on their related findings, Becker and Morawetz (2004, p. 69) posit, "The [safety] training program appears to improve the efficacy of workers who attempt to make workplace change." Consequently, the authors set out to examine what impact, if any, investments in human capital might have on targeted subsets of union and non-union contractors within the residential industry at the local, state, and regional levels.

Literature Review

A Dangerous Industry

The construction industry has offered employment and acted as a significant source of revenue throughout history; however, the construction industry also has great renown for having hazardous work conditions that lead to heightened levels of accidents and fatalities. As of 2012, the construction industry accounted for 19 percent of occupational fatalities that occurred in the United States (Bureau of Labor Statistics [BLS], 2013). This percentage increased from 2011, with 781 occupational fatalities in the construction industry, to 817 fatalities in 2012 (BLS). Though, traditionally, these fatalities were often related to hazardous work environments, Zou (2011) emphasizes, "Research has shown that the majority of workplace incidents, injuries, and fatalities are attributed to unsafe work practices of employees rather than unsafe working conditions" (p.12). Zullo elaborates on this situation by including union impact, stating "Labor unions in construction are sensitive to these risks, and spend millions annually on safety training and accident prevention" (2011, p. 5). In fact, Weil (1992) asserts, "Union construction workers receive formal and on-going training on health and safety risks as well as their rights under OSHA" (p. 122). Several studies have observed the positive impact of safety training and accident prevention to promote safe work practices and safe work environments. To this end, safety culture and safety training act as key measurement tools in assessing this relationship.

Safety Culture in Construction

In construction, Zou (2011) defines safety culture as "…an assembly of individual and group beliefs, norms, attitudes, and technical practices that are concerned with minimizing risks and exposure of workers and the public to unsafe acts and conditions in the construction environment" (p. 12). Zou also acknowledges, "Developing a safety culture for a construction project or organization does not occur overnight; it is a journey rather than a destination, and it requires a commitment from top management right down to individual employees over an extended period" (p. 19). A firm background in safety knowledge can be achievable through training and safety education. However, safety culture calls on additional factors such as program awareness, employee accountability for safety (Jin and Chen, 2013), a strong relationship between employers and the workforce (Wilkins, 2011), and commitment and leadership in relation to safety from contractors and management (Zou).

Safety Training in Construction

In order to achieve a strong safety culture, training is required to increase knowledge and promote action (Griffin and Neal, 2000). Wilkins (2011) defines the main purpose of workplace training as educating "adults from various backgrounds who will consequently face different challenges" (p. 1018). This is especially important in the construction industry, where challenges and work environment can rapidly change (Choudhry and Fang, 2008). To emphasize the importance of training in the field of construction, Wilkins proclaims, "Non-compliance with safety procedures and inadequately delivered training are among the key factors resulting in such a high rate of injury and fatality in this sector [construction industry]" (p. 1017). Research also indicates that effective training is a characteristic of high performance and a positive safety culture in the construction industry (Lingard, 2002). A study conducted by Sokas et al. (2009) found, "Measurable improvements in knowledge and attitudes were demonstrated three months after a one-hour hazard awareness training session that was provided in the context of a union-based apprenticeship or journeyman training program" (p. 167). Griffin and Neal (2000) conducted research that expanded on this by including the outcome of an increase in safety knowledge, stating, "Safety knowledge was positively related to both safety compliance and safety participation" (p. 356).

Though training is important for construction industry employees, level of trainer competency and workplace requirements for training are equally significant in assuring worker safety and providing a positive safety culture. In relation to trainer competency, Wilkins (2011) affirms,

> "In seeking to address the worrying trend of non-compliance with safety standards, it is vital to implement a system which both inspires confidence and incorporates the expertise of well-trained and capable teachers equipped with appropriate materials to make the best use of the time available to them and their trainees." (p. 1022)

Wilkins also comments on requirements for training, insisting, "There is also a concern that where training is not mandatory, workers will not participate because of the personal financial impact involved" (p. 1022). Therefore, training involves several factors in order to be effective and have positive effects on job-sites.

Methodology

The authors utilized the United States Department of Labor's Occupational Safety and Health Web Search of Inspections by NAICS feature to gather data for this study. Specifically, the authors focused on the North American Industry Classification System (NAICS) code 238130, focusing on wood framing contractors engaged in wood framing of houses and buildings. In the union sector, the framing process is mainly performed by carpentry sub-contractors in the St. Louis market. These targeted data were then disaggregated into four data sets from January 1, 2010 through December 31, 2011:

1) union contractor inspections/violations for St. Louis;
2) non-union contractor inspections/violations for St. Louis;
3) non-union contractor violations for Missouri; and
4) the four contiguous Right to Work (Nebraska, Kansas, Oklahoma, and Arkansas) states to Missouri, solely under federal OSHA compliance (RTW4).

The rationale for limiting this study to the date range mentioned above stems from: 1) Various economists claiming the Great Recession resided by late 2009 and 2) Complete data were not available for 2012 due to a major shift by OSHA and BLS from Standard Industry Classification (SIC) codes to NAICS codes (W. McDonald, personal communication, August 27, 2013).

The authors used the number of job site violations based on the OSHA inspectors' initial field observations. The first t-test for independent samples was performed on the data collected for St. Louis union and non-union contractors. The St. Louis union contractors served as the control group while the St. Louis non-union contractors served as the experimental group (N = 73). The second t-test for independent samples was performed on the data collected for St. Louis union and Missouri non-union contractors. The St. Louis union contractors served as the control group while the Missouri non-union contractors served as the experimental group (N = 214). The third t-test for independent samples was performed on the data collected for St. Louis union contractors and the RTW4 mentioned above. Under this scenario, the St. Louis union contractors served as the control group while the RTW4 served as the experimental group (N = 385). Regarding the data mentioned above, statistical analyses were performed—on Microsoft Excel—utilizing a one-tailed t-test for independent samples. Note: Populations, not samples, were utilized for all groups.

Results & Findings

T-tests

Results. Observation #1—St. Louis Union and St. Louis Non-union (Refer to Appendix A for more details):

	Control Group—	Experimental Group—
$\sum X_1$		62
Mean		4.77
Std Dev		3.11
S_1^2		9.69
n_1		62
$\sum X_2$	11	
Mean	1.57	
Std Dev	1.13	
S_2^2	1.29	
n_2	11	

$N_P = 73$

$t = 3.35$

t_{crit} (.025, 60) $_{\text{One Tail}} = 2.00$

Reject the null hypothesis since 3.35 > 2.00. Thusly, there is a significant difference.

Findings. When comparing means, based on the data from the St. Louis Union (control group) and St. Louis Non-Union (experimental group) OSHA violations, the t-test for independent samples concluded that a statistically significant difference exists between the St. Louis Union and St. Louis Non-Union groups. Thusly, the St. Louis Union's issued OSHA violations were found to be distinct from Non-Union citations at a 97.5 percent confidence level. Based on this difference, indicating significantly less Union OSHA violations than Non-Union citations in St. Louis, a comparison of Union violations in St. Louis and Non-Union violations in Missouri was conducted.

Results. Observation #2—St. Louis Union and Missouri Non-union
(Refer to Appendix B for more details):

	Control Group—	Experimental Group—
$\sum X_1$		203
Mean		3.08
Std Dev		2.11
S_1^2		4.47
n_1		203
$\sum X_2$	11	
Mean	1.57	
Std Dev	1.13	
S_2^2	1.29	
n_2	11	

N_P= 214

t = 2.33

t_{crit} (.025, ∞) $_{\text{One Tail}}$ = 1.96

Reject the null hypothesis since 2.33 > 1.96. Thusly, there is a significant difference.

Findings. When comparing means, based on the data from the St. Louis Union (control group) and Missouri Non-Union (experimental group) OSHA violations, the t-test for independent samples concluded that a statistically significant difference exists between the St. Louis Union and St. Louis Non-Union groups. Thusly, the St. Louis Union's issued OSHA violations were found to be distinct from Missouri Non-Union violations at a 97.5 percent confidence level. Based on this difference, indicating significantly less St. Louis Union OSHA violations than Non-Union Missouri citations, a comparison of Union violations in St. Louis and Non-Union violations in four RTW states bordering Missouri (Oklahoma, Arkansas, Kansas, and Nebraska) was conducted.

Results. Observation #3—St. Louis Union and RTW4
(Refer to Appendix C for more details):

	Control Group—	Experimental Group—
$\sum X_1$		374
Mean		2.58
Std Dev		1.61
S_1^2		2.59
n_1		374
$\sum X_2$	11	
Mean	1.57	
Std Dev	1.13	
S_2^2	1.29	
n_2	11	

$N_P = 385$

$t = 2.06$

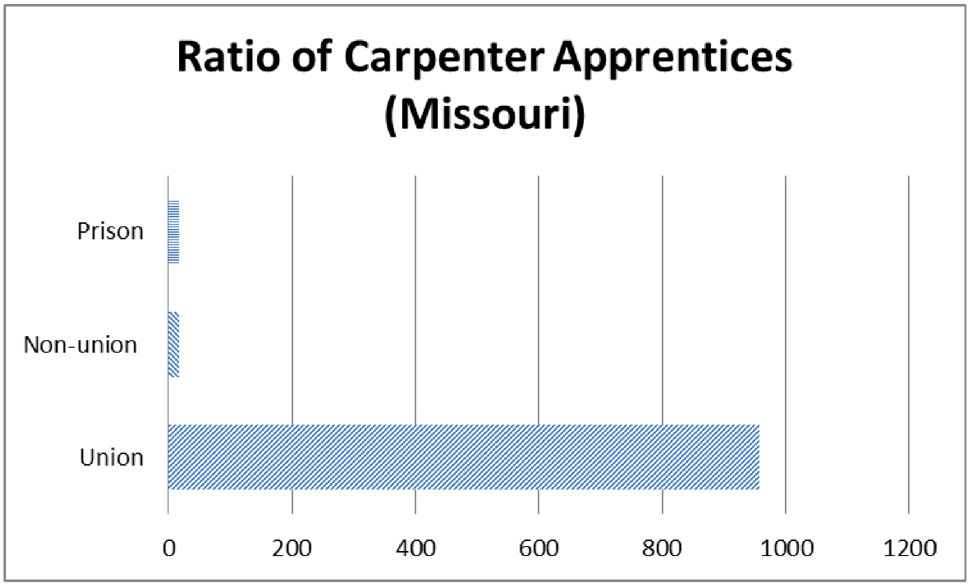
$t_{crit}\ (.025, \infty)_{\text{One Tail}} = 1.96$

Reject the null hypothesis since 2.06 > 1.96. Thusly, there is a significant difference.

Findings. When comparing means, based on the data from the St. Louis Union (control group) and the four bordering RTW states (experimental group) OSHA violations, the t-test for independent samples concluded that a statistically significant difference exists between the St. Louis Union and the RTW4 state groups. Thusly, the St. Louis Union's issued OSHA violations were found to be distinct from RTW4 Non-Union violations at a 97.5 percent confidence level.

Discussion

Findings in this study indicate higher levels of OSHA violations amongst non-union St. Louis residential job-sites, non-union Missouri residential job-sites, and non-union RTW4 residential job-sites when compared to unionized St. Louis residential job-sites. Recent data suggest (see chart below), excluding the 16 carpenter apprentices in state and federal correctional programs (<2 percent), there are 957 (>96 percent) registered carpenter apprentices in union and 17 (<2 percent) registered carpenter apprentices in non-union U.S. Department of Labor (US-DOL) approved-training programs in the State of Missouri (N. Perry, personal communication, December 10, 2012). To this end, it is the authors' belief that a heightened level of union



Source: US-DOL Office of Apprenticeship

apprentices in US-DOL training programs has contributed to a stronger safety culture and an established safety environment throughout unionized job-sties. Zullo (2011) emphasizes, "Construction unionization is associated with lower industry and occupation fatality rates" (p. 11). A strong safety culture, grounded in qualified safety training programs, contributes to workers who are knowledgeable of safe work practices and have motivation to conduct work safely. Unfortunately, Zullo also found that, "If unions are located in RTW states, they will have fewer resources to devote to safety training and accident prevention" (p. 5). Such diminution would have devastating effects on workers in relation to injuries and fatalities, and to contractors in relation to increased worker's compensation and violation penalties. Apart from the limited resources for unions in RTW states, non-union workers are also faced with obstacles. Kaskutas et al. (2013) found, "It is especially challenging to reach the small, nonunionized contractor who performs home building or remodeling and has no formal means to receive such information" (p. 40). Therefore, Kaskutas et al. states, "Researchers and safety professionals must diffuse results from research and share best practices with contractors, unions and the construction workforce" (p. 40). Unions serve an important role in providing construction workers, especially those new to the trade, with necessary safety related knowledge and best work practices. This resource serves workers in the field by decreasing accidents, injuries, and fatalities. To this end, Wilkins (2011) proclaims, "Since construction safety either directly or indirectly affects taxpayers, all of whom benefit from the product of the industry, a strong case could be made that it is in the public interest to subsidize a higher standard of employee care in this field" (p. 1025).

Conclusion

As the data above reveal, the outcomes of OSHA inspections of St. Louis union residential contractors were significantly different than non-union residential contractors at the local, state, and regional levels. Based on the findings in this study, these authors suggest that St.

Louis union residential contractors have made a strategic business decision to instill a safety culture by investing in structured safety training throughout their firms: from office managers to field personnel. To this end, Nicklaus (2012) claims, “Industry officials estimate that, areawide [St. Louis], the [union] building trades spend $30 million a year on training” (p. D3). Interestingly, Hung, Smith-Jackson, and Winchester’s (2011) study of small residential builders in VA and NC (both RTW states), “…workers were more inclined to ignore safety procedures because safety was not shown to be highly valued by immediate supervisory personnel” (p. 121). Ironically, Chockaligngam and Sornakumar (2011) contend, “…the management support to the workers is also very important in providing the best solution to safety related problems” (p. 16).

In closing, Lipscomb, Li, and Dement (2003) declare, “The factors that make residential construction workers particularly difficult to study—including small and dispersed job sites—are factors that are likely to influence the overall safety climate and diffusion of change” (p. 155). Accordingly, Gaal (2013), declares, “…complacency is the enemy of innovation and growth” (p. 7). To be sure, the findings in this study are limited to a specific sector of the construction industry and, therefore, care should be taken when making generalizations. As such, these authors acknowledge that an experimental or longitudinal approach may suggest other findings and are interested in performing further research. Nevertheless, the positive impacts—operating within a union environment—cited in the above observations provide empirical evidence that should encourage construction professionals, construction consumers, and/or legislators to consider the benefits of utilizing a safety cultured workforce (i.e., contractors and craftspeople) who are dedicated to effective safety training programs and systems.

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Appendix A

T-test for independent samples: St. Louis union residential vs St. Louis non-union residential contractors

$$t = \frac{4.77-1.57}{\sqrt{\frac{(62-1)\,9.69+(11-1)\,1.29}{62+11-2}\left(1/62 + 1/11\right)}}$$

$$t = \frac{3.2}{\sqrt{8.508\,(0.107)}}$$

$$t = \frac{3.2}{0.954}$$

$$t = 3.35$$

t_{crit} (.025, 60) $_{\text{One Tail}}$ = 2.00

Reject H_O: $\mu_e = \mu_c$ (Reject the null hypothesis: Experimental Mean is equal to Control Mean)

Reject the null hypothesis since 3.35 > 2.00

H_A: $\mu_e > \mu_c$ (Accept the alternative hypothesis: Experimental Mean is greater than Control Mean)

Thusly, there is a significant difference.

Appendix B

T-test for independent samples: St. Louis union residential vs Missouri non-union residential contractors

$$t = \frac{3.08-1.57}{\sqrt{\frac{(203-1)\,4.47 + (11-1)\,1.29}{203+11-2}\left(1/203 + 1/11\right)}}$$

$$t = \frac{1.51}{\sqrt{4.32\,(0.096)}}$$

$$t = \frac{1.51}{0.643}$$

$$t = 2.33$$

t_{crit} (.025, ∞) $_{\text{One Tail}}$ = 1.96

Reject H_O: $\mu_e = \mu_c$ (Reject the null hypothesis: Experimental Mean is equal to Control Mean)

Reject the null hypothesis since 2.34 >1.96

H_A: $\mu_e > \mu_c$ (Accept the alternative hypothesis: Experimental Mean is greater than Control Mean)

Thusly, there is a significant difference.

Appendix C

T-test for independent samples: St. Louis union residential vs RTW4 residential contractors

$$t = \frac{2.58-1.57}{\sqrt{\frac{(374-1)\,2.59 + (11-1)\,1.29}{374+11-2}\left(1/374 + 1/11\right)}}$$

$$t = \frac{1.01}{\sqrt{2.56\,(.094)}}$$

$$t = \frac{1.01}{0.489}$$

$$t = 2.06$$

$t_{crit}\ (.025, \infty)_{\text{One Tail}} = 1.96$

Reject H_O: $\mu_e = \mu_c$ (Reject the null hypothesis: Experimental Mean is equal to Control Mean)

Reject the null hypothesis since 2.06 > 1.96

H_A: $\mu_e > \mu_c$ (Accept the alternative hypothesis: Experimental Mean is greater than Control Mean)

Thusly, there is a significant difference.