

Construction Site Security – The impact of company size and loss history on security measures

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Construction theft and vandalism is a major problem with an estimated annual loss of one billion dollars. This research was conducted to investigate contractor site security practices for the prevention of construction theft and vandalism. The samples selected for the study were members of the Industry Advisory Board (IAB) of the Construction Science and Management Department at Clemson University, South Carolina. A questionnaire was prepared to obtain data on security measures adopted by the sample and the findings were analyzed using hypothesis testing. Two sets of tests were conducted, dividing the companies on basis of their annual volume for Test-I and dividing the companies on basis of annual loss due to theft for Test-II. Results show the security measures that were found to be statistically significant. Test-I showed differences in security measures including termination of employees caught stealing or committing vandalism, conducting background checks while hiring staff and supervisory personnel, using site security lighting, security fence, after hours security guards, surveillance cameras, LoJack and GPS locators on equipment. Test-II showed differences in security measures including prosecution and termination of office and subcontractor employees caught stealing and the use of security lighting on the project.

Key terms: Clemson, Construction, Theft, Vandalism

Introduction

Site security is an often ignored problem of construction projects. Industry experts estimate construction theft results in an annual loss of approximately \$1 billion. A recent study found that the average annual contractor direct cost due to theft was \$1,388/million of construction volume (Hinze, 2004). 71% of construction equipment owners have experienced theft and 29% have had five or more incidents of equipment theft (Cygnus, 2008). Construction theft includes theft of material, tool and equipment from the construction site, of which tool and appliance theft is most popular (Crime Prevention Unit, 2008). Two key factors that determine the type of equipment, tools and materials stolen are its value and mobility (NER, 2008). Primary equipment loss includes bulldozers, backhoes and portables such as generators and welders. Material loss often includes timber and other valuable commodities such as scrap metal and copper (Crime Prevention Unit, 2008). Types of vandalism include broken glass, graffiti, destruction of constructed work and damage to equipment and vehicles on site (Hinze, 2004).

Theft and vandalism can directly impact the success of a project and everyone related with the project including the owner, project team, contractor, equipment dealer and insurance companies (Hinze, 2004). Apart from monetary losses, these acts can result in delay of project, lost productivity, rework, re-ordering of stolen goods, and increased and/or canceled insurance (Hinze, 2004). Construction sites are most vulnerable to theft on weekends and an estimated 90% of all construction thefts take place between 6 pm Friday and 6 am Monday (McDowell, 2002). The most targeted areas for construction theft in the United States are New Jersey, Miami and Southern California. Most theft recoveries occurred in Florida (35%), California (17%), Georgia (12%), Texas and Arizona each at 10%, Massachusetts (7%), New York (5%), and Michigan and Connecticut with 2% each. The chance of recovery of tools, equipment or materials is low (McDowell, 2002).

Theft and Vandalism are the most frequent, most costly, and also a type of loss that good prevention measures can dramatically reduce (NER, 2008). Company and project security decisions can directly influence and impact the incidence and severity of jobsite theft and vandalism (Berg, 2005).

Methodology

Sample: The members of the Industry Advisor Board corporate partners of the Construction Science and Management Department at Clemson University had shown a keen interest in the topic of construction theft and site security. The cumulative services offered by these twenty-four contracting entities covered a very diverse field. The range of company expertise included architecture, engineering, construction, construction management, contracting, design build, maintenance and sustainable design. The selection of this sample afforded the research team an opportunity to gain insight on construction theft and vandalism from a diverse and representative pool of contractors.

Survey Instrument: A self-administered questionnaire was designed using a total of 6 sections and 84 questions. The first portion of the questionnaire solicited general company and contact information. The second section investigated the significance of theft and vandalism, the firm's tracking of theft and vandalism, and the dollar estimate of annual losses. The next two sections solicited input regarding the frequency and effectiveness of certain security actions and the type of theft and vandalism that the firm had experienced. The final section of the questionnaire solicited comments and suggestions. The questionnaire was primarily structured with targeted questions of simple category permitting multi-choice single response or multi-choice, multi-response options. Typically, a Likert response scale was used throughout the questionnaire.

A cover letter was designed along with the questionnaire. This letter explained the nature, objectives and goals of the study along with mentioning the expected return duration of the questionnaire. A time span of one month was provided for the companies to complete and return the questionnaire. A copy of the survey is included in the appendix.

Survey Response: The survey was sent to the 24 construction companies and 20 completed and returned the questionnaire netting a response rate of 83.33%. The responses were fed into a database prepared using Microsoft Excel. Visual charts including histograms were used to analyze the results. T-tests were used to analyze the data and identify the significant findings. The responses submitted by the participating construction companies are assumed to be honest views and facts of the respondent and representative of the company position. In the statistical analysis a confidence level of 95% ($\alpha = 0.05$) was incorporated and paired testing was performed using an assumption of unequal variances for the pairs.

Analysis and Findings

Test I – Higher annual volume vs. Lower annual volume

T-tests were conducted to compare the responses on site security measures taken by construction companies with an annual volume of USD one billion and above (higher annual volume group) and measures taken by construction companies with an annual volume of less than USD one billion (lower annual volume group) to check if there are any statistically significant measures. Based on the division of the companies, there were 6 companies with an annual volume of one billion USD and above and 14 companies with an annual volume of lower than USD one billion. The mean of the statistically significant measures from these groups are shown in table 1. The measures of site security which are found to be statistically significant between construction companies with an annual volume of USD one billion and above and construction companies with an annual volume of less than USD one billion include the following:

1. *Frequency of termination of employees caught stealing or committing vandalism*

Construction companies with higher annual volume terminated employees caught stealing or committing vandalism more frequently than construction companies with lower annual volume.

2. *Effectiveness of background checks while hiring staff and supervisory personnel*

Construction companies with higher annual volume believe that conducting background checks while hiring staff and supervisory personnel is a more effective security measure than construction companies with lower annual volume.

3. *Frequency of using general site security lighting*

Construction companies with higher annual volume used general site security lighting, as a security measure, more frequently on projects than construction companies with lower annual volume.

4. *Frequency of using security lighting inside the building*

Construction companies with higher annual volume used security lighting inside the building, as a security measure, more frequently on projects than construction companies with lower annual volume.

5. *Frequency of using security fence around the perimeter of the site*

Construction companies with higher annual volume used security fence around the perimeter of the site, as a security measure, more frequently on projects than construction companies with lower annual volume.

6. *Frequency of using security fence around the storage compound*

Construction companies with higher annual volume used security fence around the storage compound, as a security measure, more frequently on projects than construction companies with lower annual volume.

7. *Frequency of using after hours security guards*

Construction companies with higher annual volume of USD one billion and above used after hours Security guards, as a security measure, more frequently on projects than construction companies with lower annual volume.

8. *Effectiveness of using surveillance cameras positioned inside the building*

Construction companies with lower annual volume believe that the use of surveillance cameras positioned inside the building is a more effective security measure than construction companies with higher annual volume.

9. *Effectiveness of using LoJack on major material*

Construction companies with lower annual volume believe that the use of LoJack on major materials on project site is a more effective security measure than construction companies with higher annual volume.

10. *Effectiveness of using GPS locators on equipment*

Construction companies with lower annual volume believe that the use of GPS locators on equipment is a more effective security measure than construction companies with higher annual volume.

11. *Frequency of loss of office equipment at the project site*

Construction companies with higher annual volume experienced a more frequent loss of office equipment at the project site than construction companies with a lower annual volume.

Table 1

Results of Test -1 (*Higher annual volume vs. Lower annual volume*)

Statistically Significant Site-Security Measures	Mean value of group 1(Billion group)	Mean value of group 2(Million group)
Frequency of termination of employees caught stealing or committing vandalism	4.50	3.50
Effectiveness of background checks while hiring staff and supervisory personnel	4.60	3.76
Frequency of using general site security lighting	4.16	3.17
Frequency of using security lighting inside the building	4.33	3.42

Frequency of using security fence around the perimeter of the site	4.33	3.78
Frequency of using security fence around the storage compound	4.33	3.64
Frequency of using after hours security guards	3.66	2.50
Effectiveness of using surveillance cameras positioned inside the building	1.66	3.00
Effectiveness of using LoJack on major material	1.00	3.33
Effectiveness of using GPS locators on equipment	1.33	2.83
Frequency of loss of office equipment at the project site	2.66	1.71

Note: The scale used for frequency measurement is 1-5, 1: never 2: seldom 3: sometimes 4: often 5: always
the scale used for efficiency is 1-5, 1: ineffective 2: minimally effective 3: somewhat effective 4: effective 5: very effective

Test II- Lower annual theft loss vs. higher annual theft loss

T-tests were conducted to compare the responses on site security measures taken by construction companies facing an annual loss due to theft on project sites of lesser than USD 10,000 and measures taken by construction companies with an annual loss due to theft on project sites of USD 10,000 and above to check if there are any statistically significant measures. Based on the division of the companies based on annual loss incurred due to theft on project site, there were 12 companies facing an annual loss due to theft on project sites less than USD 10,000 and there were 8 companies facing an annual loss due to theft on project sites of USD 10,000 and above. The mean of the statistically significant measures from these groups are shown in table 2.

The measures of site security which are found to be statistically significant between construction companies facing an annual loss due to theft on site of USD 10,000 and above and construction companies facing an annual loss due to theft of less than USD 10,000 include the following:

1. *Effectiveness of prosecution of employees caught stealing*

The group facing a lower annual theft loss believes that the prosecution of employees caught stealing is a more effective security measure as compared to the group facing a higher annual theft loss.

2. *Effectiveness of prosecution of subcontractor employees caught stealing*

The group facing a lower annual theft loss believes that the prosecution of subcontractor employees caught stealing is a more effective security measure as compared to the group facing a higher annual theft loss.

3. *Effectiveness of termination of employees caught stealing or committing vandalism*

The group facing a lower annual theft loss believes that the termination of employees caught stealing or committing vandalism is a more effective security measure as compared to the group facing a higher annual theft loss.

4. *Frequency of use of security lighting of the storage compound*

The group facing a lower annual theft loss used security lighting of the storage compound more frequently than the group facing a higher annual theft loss.

5. *Effectiveness of use of security lighting of the storage compound*

The group facing a lower annual theft loss believes that the use of security lighting of the storage compound is a

more effective security measure as compared to the group facing a higher annual theft loss.

6. *Frequency of use of security lighting inside the building*

The group facing a lower annual theft loss used security lighting inside the building more frequently than the group facing a higher annual theft loss.

Table 2

Results of Test -2 (*Lower annual theft loss vs. higher annual theft loss*)

Statistically Significant Site-Security Measures	Mean value of group 1(Loss of theft under USD 10,000)	Mean value of group 2(Loss of theft of USD 10,000 and more)
Effectiveness of prosecution of employees caught stealing	4.11	2.83
Effectiveness of prosecution of subcontractor employees caught stealing	4.11	2.42
Effectiveness of termination of employees caught stealing or committing vandalism	4.44	3.16
Frequency of use of security lighting of the storage compound	4.00	3.12
Effectiveness of use of security lighting of the storage compound	4.00	3.28
Frequency of use of security lighting inside the building	4.09	3.12

Note: The scale used for frequency measurement is 1-5, 1: never 2: seldom 3: sometimes 4: often 5: always the scale used for efficiency is 1-5, 1: ineffective 2: minimally effective 3: somewhat effective 4: effective 5: very effective

Conclusion

In spite of having a comparatively small sample size, there are statistically significant differences found in the results obtained. On conducting the hypothesis t- tests based on the annual volume division of the companies, the areas of site security which were identified to be statistically significant included frequency of termination of employees caught stealing or committing vandalism, effectiveness of background checks while hiring staff and supervisory personnel, frequency of using general site security lighting, frequency of using security lighting inside the building, frequency of using security fence around the perimeter of the site, frequency of using security fence around the storage compound, frequency of using after hours security guards, effectiveness of using surveillance cameras positioned inside the building, effectiveness of using LoJack on major material, effectiveness of using GPS locators on equipment, and frequency of loss of office equipment at the project site.

On conducting the hypothesis t-tests based on annual losses due to theft on project sites, the areas found to be statistically significant included effectiveness of the prosecution of employees caught stealing, effectiveness of the prosecution of subcontractor employees caught stealing, effectiveness of termination of employees caught stealing or committing vandalism, frequency of use of security lighting of the storage compound, effectiveness of use of security lighting of the storage compound and frequency of use of security lighting inside the building.

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Statistical Data: To obtain a copy of the statistical data please contact the author at dennisb@clermson.edu