

An Exploratory Look at Thefts from Construction Sites

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Theft of construction equipment, materials, and tools from construction sites results in approximately one billion dollars in direct annual losses to the U.S. construction industry per year. A better understanding of theft characteristics is vital to reducing this figure. This study analyzes over 15,000 incidents from the National Incident-Based Reporting System (NIBRS) to understand characteristics such as theft prevalence, average monetary losses, and recovery rates. The study finds that contractors lost an average of about $6,000 per incident. Trucks are the most expensive theft targets, with an average loss of about $42,000 per incident, and also the most likely item to be recovered (55% of the time). However, recovery rate across all targets was less than 7%. The results of this study provide the most accurate and extensive statistics to date on construction theft characteristics. The study also identifies best practices to reduce thefts such as the use of survellience systems. Further, the use of advanced marking and tracking systems to safeguard expensive equipment and vehicles and aid their recoveries are discussed. The findings are expected to aid contractors and law enforcement agencies in formulating methods for reducing thefts of construction items and improving the likelihood of their recoveries.

Key Words: theft, vandalism, equipment, site-security, NIBRS

Introduction and Background

The construction industry faces a number of challenges. One of the challenges that is not discussed often is the theft of materials, tools, and equipment from construction sites. Construction sites are in many cases left unattended while no construction activities are ongoing. Oftentimes, only a fence is installed to protect the site, making it attractive to potential thieves. In some cases, the theft might be as minor as opportunistic thieves stealing some bricks, lumber, hammers, or ladders for their home repair projects, which may not be worthy of reporting to authorities or insurance companies (Berg & Hinze, 2005; Clarke & Goldstein, 2014; Goldman, 1999). In other cases, there are organized crime groups stealing expensive construction equipment, office equipment, and home appliances from construction sites (Clarke & Goldstein, 2014; Goldman, 1999; International Risk Management Institute, Inc. (IRMI), 2006; Johnson City Press, 2016; Schneider, 2018; Stewart, 2010).

Each piece of equipment can easily cost anywhere from tens of thousands to hundreds of thousands dollars. Existing studies have estimated that thefts result in up to one billion dollars per year in losses to the U.S. construction industry (Inland Marine Underwriters Association (IMUA), 2015; Stewart, 2010). Further, because of the low risk of being caught and potentially high rewards, theft seems to be increasing despite the reliance on modern tracking systems to combat it (Berg & Hinze, 2005; Clarke & Goldstein, 2014; Stewart, 2010). Additionally, the recovery of stolen items is estimated to be as low as 7% (Berg & Hinze, 2005). While the aforementioned statistics show only the direct cost of lost equipment and materials, contractors also experience indirect impacts. This includes costly job delays, downtime for operators, higher insurance premiums, possible cancellation of an insurance policy, jeopardized bonding and borrowing power, and liquidated damages (Berg & Hinze, 2005; National Equipment Register (NER) & National Insurance Crime Bureau (NICB), 2016). As a result, a major theft incident can easily result in loss on a project (Berg & Hinze, 2005). This potential cost is eventually reflected as the cost of doing business and added to the client's cost of construction.

Thus, thefts from construction sites is a serious issue for the industry (NER and NICB, 2016). However, a limited number of studies have been conducted on the topic, and many of those acknowledge that much work remains to be done (Berg & Hinze, 2005; Clarke & Goldstein, 2014; Donkor, 2008). Most studies are based on surveys of a limited number of contractors or data from equipment that uses tracking devices. This study takes a different approach by utilizing an extensive national database to explore the severity of construction thefts and their characteristics.

Literature Review

Existing studies on thefts from construction sites can be summarized into three primary categories: a) quantification of thefts, b) best practices to deter thefts, and c) the challenges of reducing thefts.

Quantification of Thefts

Several studies have quantified the extent of construction thefts (Berg & Hinze, 2005; CalAmp & LoJack, 2016; Donkor, 2008; Farinloye, Odusami, & Adewunmi, 2013; NER and NCIB, 2016). Donkor found that only 6% of survey respondents in the Southeastern U.S. experienced more than 10 theft incidents in the preceeding 3 years. However, almost half of the respondents reported experiencing 2 to 5 theft incidents during the timeframe, suggesting that it is far from uncommon. Another study based on a survey of 102 contractors in the Southeastern U.S. concluded that contractors are losing $1,388 per $1 million of work performed (Berg & Hinze, 2005). The majority of respondents stated that they report more than 75% of these theft incidents to law enforcement agencies. However, only about 7% of stolen items were recovered.

The NER, utilizing data from the NICB and National Crime Information Center (NCIC), estimated that for the year 2015, construction theft accounted for direct losses between $300 million and $1 billion (NER and NCIB, 2016). This is consistent with IMUA's estimates of $1.64 billion in losses over a *five*-year period (IMUA, 2015). Berg and Hinze offered a much higher estimate of the direct cost of theft from construction sites, placing the number at about $1.5 billion *per year* (Berg & Hinze, 2005). Though some variation exists in these estimates, even conservative figures suggest that thefts from construction sites are serious problem for the construction industry.

Best Practices to Deter Thefts

Typically, thieves will not attempt a theft from a jobsite if they cannot readily steal items and make a quick getaway (Berg & Hinze, 2005). As such, a thorough jobsite antitheft plan developed before the start of construction should reduce the possibility of thefts (Berg & Hinze, 2005; Donkor, 2008). Many best practices are documented by various authors to deter thieves and reduce thefts from construction sites (Table 1). As expected, firms utilizing more best practices have reported lower theft losses (Berg & Hinze, 2005).

Table 1

Best practices to reduce thefts from construction sites

Best Practices	Source
Strategic parking of construction equipment where smaller equipment are surrounded by larger equipment	(Donkor, 2008; IRMI, 2006)
Posting warning signs	(Donkor, 2008; Kennewick Police Department, 2007)
Security fencing	(Berg & Hinze, 2005; Donkor, 2008; IMUA, 2015)
Surveillance security system at the construction site and access roads	(Donkor, 2008; IMUA, 2015; IRMI, 2006; Kennewick Police Department, 2007)
Proper lightning,	(Berg & Hinze, 2005; Donkor, 2008)
Use of security guards and police patrol	(Berg & Hinze, 2005; Donkor, 2008)
Indelible marking of tools	(Donkor, 2008; Kennewick Police Department, 2007)

Challenges of Reducing Thefts

The NER and NICB listed several factors contributing to the high level of equipment theft in the United States: a) high value of heavy equipment, b) the ease of selling stolen equipment, c) poor equipment and site security, d) low risk of detection and arrest, e) employee involvement, and f) lenient penalties for thieves if prosecuted and convicted (Clarke & Goldstein, 2014; Equipment Trader, 2018; NER and NCIB, 2016; Stewart, 2010). Additionally, while stolen cars

are readily recognized and reported by owners to the insurance companies and law enforcement agencies, stolen equipment may not be readily noted and hence reported by the contractors, as there is no mandatory standard universal Product Identification Number (PIN) for construction equipment. This gives thieves more time to clear their trails. As such, while the recovery rate of stolen cars is more than 60%, the recovery rate of stolen equipment is anywhere between 7% to 22% depending on the study in question (Berg & Hinze, 2005; NER and NCIB, 2016; Stewart, 2010). Thus, there are several challenges faced by the industry to reduce the thefts from construction sites, all of which likely contribute to the relatively high prevalence seen within the United States.

Limitations of Existing Studies

Current studies are mostly based on survey data acquired from a very limited number of contractors. For example, Farinloye et al. analyzed responses from 42 contractors, Berg and Hinze from 102 contractors, and Donkor from 106 (Berg & Hinze, 2005; Donkor, 2008; Farinloye et al., 2013). This prevents a thorough understanding of the prevalence and characteristics of theft. Though the NER and NICB's analysis relies on a more exhaustive dataset comprised of law enforcement reports, it includes data for both construction equipment and farm equipment thefts, which cannot be disaggregated. CalAmp and LoJack's study included data tracked from the LoJack system only (CalAmp & LoJack, 2016). Further, existing studies focus mostly on construction equipment rather than theft of various items from construction sites. This study utilizes data from National Incident-Based Reporting System (NIBRS) to analyze the thefts from construction sites and account for many of these limitations. NIBRS provides information from law enforcement agencies nationwide, allows for an understanding of many forms of theft from construction sites, and offers the potential to explore several characteristics of such theft.

Purpose of the Current Study

The current study is exploratory in nature and designed to increase our understanding of the characteristics of thefts from construction sites. Relying upon data from NIBRS, the study attempts to provide insight into: a) theft prevalence, b) commonly stolen items, c) average monetary losses, d) recovery rates, and e) recovery time. Answering these research questions should provide a more thorough understanding of the nature of construction theft and serve to add to the limited number of studies that have been conducted to date.

Data and Method

The current project utilizes data collected by the Federal Bureau of Investigation (FBI) as part of its NIBRS program. NIBRS provides detailed information regarding the characteristics of each criminal incident reported by participating agencies (Jarvis, 2015; McCormack, Pattavina, & Tracy, 2017). As of 2017, 36 states submit annual crime data in NIBRS format, though only 16 feature 100% reporting (McCormack et al., 2017). NIBRS data sets include over 230 incident-specific measures (Jarvis, 2015). Of interest to the current research, these measures allow for a determination of the location of the theft (construction sites), the type of property stolen (e.g., heavy equipment, hand tools, building materials), financial losses incurred by the victim(s), and clearance/recovery rates. A detailed documentation of the data sets is provided in US Department of Justice (DOJ) (2017).

The current study relies upon information contained within the 2015 iteration of the NIBRS data set, as it is the most recent version available for public use. Two classification variables (*type of property loss* and *location type*) are used to determine incidents eligible for inclusion in the analysis. *Type of property loss* allows law enforcement agencies to indicate whether the incident resulted in the theft of property or some other outcome (e.g., vandalism, arson). Second, NIBRS allows for a determination of the location from which the property was taken. One coding option available to agencies is *construction site*, which is defined in the NIBRS User Guide as "all buildings/locations that are under some type of construction" (U.S. DOJ, 2017). Thus, only those incidents coded as "stolen" and occurring at a *construction site* are included in the analysis. These incidents were drawn from the larger NIBRS data set to allow for exploration of the established research questions. Because the questions are exploratory in nature, the analysis took a descriptive approach. The Statistical Package for the Social Science (SPSS) was used to allow for an understanding of the measures of central tendency relevant to each of the questions. The descriptive analysis included computation of theft incident counts, average monetary losses, and mean recovery times.

Results

The results from the analyses are categorized into three sections: a) theft incidents and targets, b) average monetary impact, and c) clearance and recovery. Please note that only the top items (i.e., theft targets) are tabulated in this section because of the page limits. The definitions of various property types (e.g. trucks, tools, etc.) discussed in this section can be found in NIBRS User (U.S. DOJ, 2017).

Theft Incidents and Targets

A total of 15,274 theft incidents at construction sites were reported by participating agencies in 2015. Targets of these thefts varied, though several items appear to be attractive to potential offenders based upon the frequency of their appearance in the data set (Table 2).

Table 2

Top 5 theft targets

Property Type	Count	Percentage of Incidents
Tools	6086	39.8%
Heavy Construction Equipment	1854	12.1%
Building Materials	1720	11.3%
Household Goods	833	5.4%
Vehicle Parts/Accessories	708	4.6%

As depicted within the results, the most frequently stolen item is tools (involved in 39.8% of all incidents), which are defined in the NIBRS User Guide as "hand-held implements that are used in accomplishing work" and inclusive of hand and power tools (U.S. DOJ, 2017). This finding suggests that offenders may be drawn to items which are easily removable and disposable. Though tools are likely less valuable than other potential targets, the relative ease of theft and disposing of them (via fences or other means) may overcome this concern. Heavy construction equipment, defined as "large-scale equipment used in the construction of buildings, roads, etc; cranes, bulldozers, steamrollers, oil-drilling rigs, backhoes, excavators, etc." constitutes the second most frequently targeted item (12.1% of incidents). While this equipment (e.g., bulldozers, backhoes) is likely the most difficult to remove without detection, the sheer value associated with various heavy machinery is understandably attractive to offenders.

Average Monetary Impact

As discussed, NIBRS allows for an assessment of the monetary losses associated with theft incidents from construction sites. Law enforcement agencies are asked to estimate the value of all stolen items via information provided by the victim(s) and/or referencing outside resources such as Ebay and Craigslist (Goodnight et al., 2008). It should be noted that most of the theft targets such as trucks, heavy construction equipment, and vehicles used in the construction industry are likely to be several years old, an accurate assessment of such properties is potentially challenging. With that said, based upon 2015 data, the average loss associated with thefts from construction sites is $5,864.69. For incidents involving the theft of multiple items, the average loss is slightly over $6,700, whereas the average loss for single-item incidents is approximately $5,600.

Further inquiry suggests that losses vary by the target of thefts. Table 3 contains a summary for these losses sorted by type of property stolen. Findings from the study by Berg and Hinze (2005) are also included for comparative purposes. Calculations are based upon the data for single-item thefts only to ensure vailidity in the estimates (as multiple-item thefts would be tied to an estimate of the value of all stolen items). Trucks, defined in the NIBRS User Guide as "motor vehicles specifically designed (but not necessarily used) to transport cargo on a commercial basis," sonstitute the highest value target (U.S. DOJ, 2017). Other motor vehicles (e.g., golf carts, all-terrain vehicles), automobiles and heavy-construction equipment comprise the remainder of the top five targets based upon average loss. NIBRS User

Guide defines truck. Pickup trucks and pickup trucks with campers are also classified as trucks, as they meet the definition specifically designed, but not necessarily used, to transport cargo." (U.S. DOJ, 2017).

The average value of automobiles stolen is consistent with the findings by Berg and Hinze. However, the average value of construction equipment is significantly different (Berg & Hinze, 2005). This is likely because their data is for construction equipment and not "heavy" construction equipment (and thus might have included smaller equipment).

Table 3

Top 5 highest average monetary loss by theft target

Property Type	Average Loss from This Study	Average Loss Based on Berg and Hinze (Berg & Hinze, 2005)
Trucks	$41,852.93	n/a
Other Motor Vehicles	$32,386.25	n/a
Automobiles	$27,965.10	$25,950
Heavy Construction Equipment	$15,570.71	$4,802
Money	$12,878.68	n/a

Clearance and Recovery

NIBRS data can be utilized to develop a better understanding of the clearance of construction site thefts (Roberts & Roberts, 2016). Specifically, data allows for a determination of the percentage of incidents that result in arrest and/or the recovery of stolen property. Less than seven percent (7%) of single-item thefts resulted in recovery (775 out of 11,723 total incidents) by the reporting jurisdiction and fewer than 5% (553 in total) led to an arrest. For multiple-item incidents, slightly over 5% featured recovery of at least one of the involved items (196 out of the 3,551 total incidents) by the reporting jurisdiction and arrests were made in approximately 4% of cases (145 in total). This is consistent with Berg and Hinze (2005)'s survey-based finding of recovery of 7% of stolen items.

It is important to consider whether the likelihood of an arrest or recovery of property differs by theft target. Utilizing data for single-item incidents reveals that this is the case. Table 4 contains data on theft targets ranked in the top five in terms of recovery and/or arrest. The most likely items to be recovered by the reporting agency are trucks, automobiles, other motor vehicles and trailers. The likelihood of arrest by the reporting agency is relatively low for all categories, with automobiles and money being the only targets that result in arrest in more than 10% of cases.

Table 4

Major recovery items and arrest data by theft target

Property Type	Number of Incidents	Percent Resulting in Recovery	Percent Resulting in Arrest
Trucks	73	54.8%	6.8%
Automobiles	142	47.9%	11.3%
Other Motor Vehicles	146	28.8%	4.8%
Trailers	167	13.8%	2.4%
Computer Hardware/Software	94	9.6%	5.3%
Metals (Non-Precious)	430	6.5%	8.8%
Money	132	2.3%	11.4%
Fuel	60	1.7%	6.7%

In addition, measures within the data set provide the ability to assess the average and median length of time that passes between the incident and each of the two outcomes (arrest and recovery). For multiple item incidents that result in recovery of at least one item, the average time to recovery is approximately 18 days. Single-item incidents feature a similar timeframe, with the average recovery taking place 19 days after the initial report. It should be noted that a good deal of variation exists across both multiple-item and single-item incidents, as most recoveries occur within a few days.

For example, over 50% recoveries occur within one day for single-item thefts, and three days for those involving multiple items.

As was the case with likelihood of recovery/arrest, time elapsed between the incident and each outcome differs by the target of the theft. Table 5 provides both the mean and median elapsed time (in days) for single-item incidents that resulted in recovery of the stolen property. Although the mean recovery time is over 10 days for the majority of the items (not all items are included here due to page space limitations), only four (Radios/TVs/VCRs/DVD Players; Trailers; Tools; Trucks) feature a median elapsed time of more than two (2) days. Taken as a whole, these findings suggest that recoveries occur relatively soon after the incident, and that the likelihood of recovery greatly diminishes with the passage of time.

Table 5

Top 5 longest mean recovery time by theft target (in days)

Property Type	Mean Recovery Time	Median Recovery Time
Radios/TVs/VCRs/DVD Players	53.7	34
Computer Hardware/Software	51.2	1
Trailers	37.4	14
Tools	25.2	5
Heavy Construction Equipment	24.3	1

Discussion

It is evident that thefts from construction sites are a significant challenge to the construction industry. Some of the best practices to reduce construction thefts, such as strategic parking of construction equipment, survellience system, use of security guards, and indelible marking of tools, are identified through literature review. These practices can reduce thefts of tools, equipment, materials, and goods but may not be sufficient – especially for expensive theft targets. Considering various types of vehicles and equipment are higher value theft targets, contractors should pay extra attention to safeguard those items. The use of advanced marking and tracking systems could be a potential solution. These include the use of a) Radio Frequency Identification (RFID), b) spray-paintable miniature chips that are visible only in ultraviolet light, and c) Global Positioning System (GPS) enabled location tracking systems (IRMI, 2006; Jaselskis, Anderson, Jahren, Rodriguez, & Njos, 1995; KeyTroller, LLC, 2018; Schneider, 2018; Stewart, 2010; The Equipment Lock Company, LLC, 2018). Some other methods to secure ignition systems or immobilize equipment using special locks are also available (KeyTroller, LLC, 2018; The Equipment Lock Company, LLC, 2018). Several equipment tracking service providers have published success stories of recovering stolen equipment, and insurance companies are supporting such services to reduce payout for stolen equipment (CalAmp & LoJack, 2016; IRMI, 2006; Stewart, 2010). Thus, contractors should find relevant marking and tracking systems to safeguard their expensive assets.

In regards to the loss of computer hardware, the value of data stored in the computer might overweigh the value of such hardware. As such, contractors should ensure that their data are regularly backed up properly in an online data backup system or in their main office computers that would be safer than computers in construction sites. Further, as building materials and household goods are common theft targets, purchasing and hauling such items only when necessary, would reduce the time for thieves to steal those items and deter them. Finally, while the practices stated above can reduce thefts, contractors should ensure that the benefits of safeguarding the items overweight the potential inconveniences and costs added by changing their business practices to safeguard the items.

Future Research

Current research is based on theft data from a single year (2015). Future research can focus on analyzing the trend of construction thefts over time and in various locations. This might be useful in identifying the locations where theft rates are increasing rapidly. Further, the number of construction thefts and other thefts can be analyzed to identify

correlations between the number of construction specific incidents and overall thefts. Lack of a strong correlation in a study of this type would indicate the involvement of thieves that specialize in construction thefts, something not yet explored in the research literature.

Conclusion

This study analyzed 2015 data from the National Incident-Based Reporting System (NIBRS) to investigate characteristics of thefts from construction sites, such as the number of incidents, commonly stolen items, average monetary losses, recovery rates, and average recovery time. It took a unique approach in relying upon a national-level data set provided by the Federal Bureau of Investigation, as opposed to a geographically limited survey of contractors. Such an approach should extend our understanding of the problem and provide more valid (and generalizable) insight into theft from construction sites. The analyses show that tools, heavy construction equipment, and building materials are the most frequently stolen items, accounting for over 63% of incidents.

Thefts cost contractors an average of $5,865 per incident, with trucks being the most expensive theft target (an average monetary value of $41,853). The recovery rates for stolen items were less than 7% for single-item thefts and slightly over 5% for multiple-item thefts. Trucks had the highest recovery rate at 55%, followed by automobiles (48%). The median recovery time for most items was five days or less, except for Radios/TVs/VCRs/DVS Players (34 days) and Trailers (14 days). However, mean recovery time was over 10 days for most items, indicating that some recoveries took weeks, if not months. In the case of heavy equipment, mean recovery time was 24 days and median recovery time was 1 day. Thus, most equipment recoveries occur quickly (though a few results in higher overall recovery time).

This study identified the best practices to reduce thefts including the use of survellience system, indelible marking of tools, and the use of security guards. However, the contractors should ensure that benefits of saving various items overweigh the costs of implementing the security measures. As heavy equipment and various vehicle types are more expensive theft targets, contractors should pay extra attention to reduce their thefts and improve the likelihood of their recoveries. This includes the use of various tracking systems that have been proven to aid in recoveries of stolen pieces of equipment.

It is important to bear in mind that the study has two key limitations. First, the validity of official data from law enforcement agencies is dependent upon officers accurately recording the characteristics of incidents. Though this is a potential concern, the FBI has instituted several measures to promote validity (such as training and audits) in recent years), increasing confidence in the accuracy of the data. Second, only a portion of agencies submit their crime data to the NIBRS program, meaning that the available data paints only a partial picture of construction theft across the United States. With that said, over 1/3 of all agencies nationwide do submit data. As such, this study provides the most accurate and extensive statistics to date on construction thefts. The findings are expected to aid contractors and law enforcement agencies in better formulating methods for reducing thefts and improving likelihood of recovering equipment, materials, and tools from construction sites.

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