

PREVENTING UNDERGROUND UTILITY STRIKES: ADDRESSING THE DAMAGE PREVENTION TRAINING NEEDS

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Underground utility damage during construction poses significant economic, environmental, and public service challenges. With over 35 million miles of underground utilities in the United States and an average of 470,000 damage incidents annually, existing damage prevention training practices remain inadequately addressed and assessed. To bridge this gap, a survey of 185 Michigan-based firms revealed critical gaps: only 54.6% provide general damage prevention training, 36.8% offer training specific to Michigan's one call center (i.e., MISS DIG) requirements, and a mere 26.8% conduct post-damage training. These findings highlight an urgent need to enhance damage prevention educational programs. Among others, the study emphasizes the importance of robust post-damage training that includes incident investigation, safety assessments, stakeholder communication, and comprehensive documentation. By providing valuable insights into current and recommended training practices, this research contributes to a deeper understanding of how damage prevention training can help mitigate utility damage risks and improve construction safety outcomes.

Keywords: One call system, Subsurface utility engineering (SUE), Excavator, Workforce training.

1 INTRODUCTION

The United States relies on an extensive network of underground utilities—spanning over 35 million miles in 2012 as suggested by Transportation Research Board (2012)—to deliver essential services like electricity, water, gas, and internet. New utilities are installed daily to meet growing demands, driven by population increases and the rapid expansion of internet usage (Ariaratnam and Proszek 2006). At the same time, climate change is reshaping infrastructure strategies, with underground systems gaining preference for their ability to withstand extreme weather events such as wildfires and hurricanes. For example, relocating power transmission lines underground is being considered to mitigate damage from these events (Homer 2023). While underground utilities offer resilience and reliability, they also face a significant challenge: the risk of accidental third-party damages during excavation. Third-party damage often refers to damage to underground utilities caused by excavators who are neither the owner nor the operator of the utility (Al-Bayati *et al.* 2024). Excavators working near these buried systems often strike underground utilities leading to thousands of incidents each day. These strikes can disrupt vital services, incur costly repairs, and pose serious safety risks to workers and the public. One-call centers were established to facilitate communication between excavators and utility owners to reduce damage by marking underground utilities before construction starts (Al-Bayati and Panzer 2020). Construction contractors and

subcontractors use one-call centers which is a free service to inform utility owners of their excavation plans.

There are several protentional causes to these damages which could be categorized into four groups: excavators' insufficient practices (EIP), locators' insufficient practices (LIP), utility owners' insufficient practices (UOIP), and general industry practices (GIP) (Al-Bayati *et al.* 2024). Basically, the undesirable actions of excavators, locators, and utility owners contribute to utility damages. As a result, one important aspect of damage prevention is communication between them and, consequently, their related behavior. Al-Bayati and Panzer (2020) suggested that stakeholders' behaviors, rather than technology limitations or current policies, significantly contribute to a breakdown of the damage prevention process. Thus, collaborative teamwork among stakeholders, known as shared responsibility, is essential for streamlining processes and effectively reducing damage (Al-Bayati and Panzer 2019). The system relies on a shared responsibility approach, emphasizing collaboration between excavators and utility owners. Accordingly, excavators should be aware of their role in the damage prevention process. This awareness can only be acquired through a robust training program. This study aims to assess current training practices among excavators.

2 RESEARCH METHODOLOGY

To achieve the study's objectives, a partnership was established with the Michigan One Call System (MISS DIG 811). As part of this collaboration, MISS DIG 811 provided contact information for excavators who used the system in 2023, totaling 55,022 email addresses. Accordingly, an online survey was designed, and an invitation to participate was sent out, resulting in responses from 185 excavators. The survey focuses on the following aspects of training:

- **General Damage Prevention Training:** Covers foundational practices to avoid damage during excavation activities.
- **MISS DIG Requirements Training:** Focuses on the rules and procedures for compliance with MISS DIG 811 guidelines.
- **Post-Damage Training:** Addresses protocols and corrective measures to take after damage has occurred.

3 SURVEY FINDINGS

Most participants use MISS DIG services several times a year (39.5%), while 23.2% use them multiple times a week, see Table 1. Damage incidents are rare, with 63.8% reporting damage only once a year and 30.3% experiencing it several times a year, while less than 5% report damage monthly or more frequently. Most of the participants represent residential builders (53; 28.6%), followed by utility companies (27; 14.6%), special trade contractors (25; 13.5%), civil and highway contractors (22; 11.9%), city or county (19; 10.3%), construction of buildings (13; 7%), and others (26; 14.1%), see Table 1. As for the firm size in terms of the number of employees, 74 (40%) of the respondents came for firms with less than ten employees followed by 65 (35.1%) from firms with 10-50 employees, 22 (11.9%) with 101-250 employees, 13 (7%) with 51-100 employees, and 11 (5.9%) with more than 250. Most participants (69.7%) have over ten years of experience, while 17.3% have less than five years. Most hold a BS or equivalent (39.1%), with 19.6% having a high school diploma and 10.3% holding a master's or higher. In job roles, 42.7% are in upper management, followed by 28.6% as supervisors, while only 6.5% are field workers.

Table 1. Firm information and MISS DIG utilization frequency.

Aspect	Percentage (%)
Utilizing MISS DIG Service	
Several times a week	23.2
Once a week	4.9
Several times a month	21.6
Once a month	10.8
Several times a year	39.5
Damage Frequency	
Several times a week	0.5
Once a week	1.1
Several times a month	2.2
Once a month	2.2
Several times a year	30.3
Once a year	63.8
Specialty	
Residential	28.6
Utilities	14.6
Special Trade	13.5
Civil and Heavy Construction	11.9
City or County	10.3
Construction of Building	7.0
Others	14.1
Firm Size - Number of Employees	
Less than 10	40
10-50	35.1
51-100	7.0
101-250	11.9
More than 250	5.9
Location	
Central Michigan	14.1
West Michigan	21.1
Southeastern Michigan	32.4
Upper Peninsula	3.2
More than one region	17.3
Northern Michigan	11.9

4 TRAINING PRACTICES

Damage prevention training is a proactive management approach that aims to reduce utility damage and efficiently manage workplaces after damage. This section discusses the current training practices related to third-party damage prevention based on the study sample. By examining the training landscape, the aim is to shed light on the industry's commitment to damage prevention,

identify prevalent trends, and offer valuable insights for stakeholders seeking to enhance their training strategies. Figure 1 provides a visual snapshot of the training landscape in construction firms based on the survey responses, the results suggested that only 54.6% of the surveyed firms offer general damage prevention training to their employees. This percentage dropped sharply to 36.8% when the participants were asked if their firms provided training specific to the MISS DIG requirements. Furthermore, the percentage dropped more to 26.8% when participants were asked if their firms provide post-damage training. The participants were queried about their awareness of MISS DIG's safe excavation online training. Results revealed that only 58.4% of participants were aware of it, leaving 41.6% without knowledge of its availability. The lack of awareness clarifies the decrease in percentage from 54.6% to 36.8% when participants were questioned about whether their firms provide training tailored to meet MISS DIG requirements. Consequently, participants' responses indicate that they primarily relied on in-house lectures and generic online videos to educate their employees about third-party damages and MISS DIG. Finally, post-damage training hinges on reviewing incidents afterward, analyzing them, and incorporating reporting procedures. This suggests the absence of a formalized post-damage training program which may indicate that full cycle management is lacking or not fully integrated into the current practices.

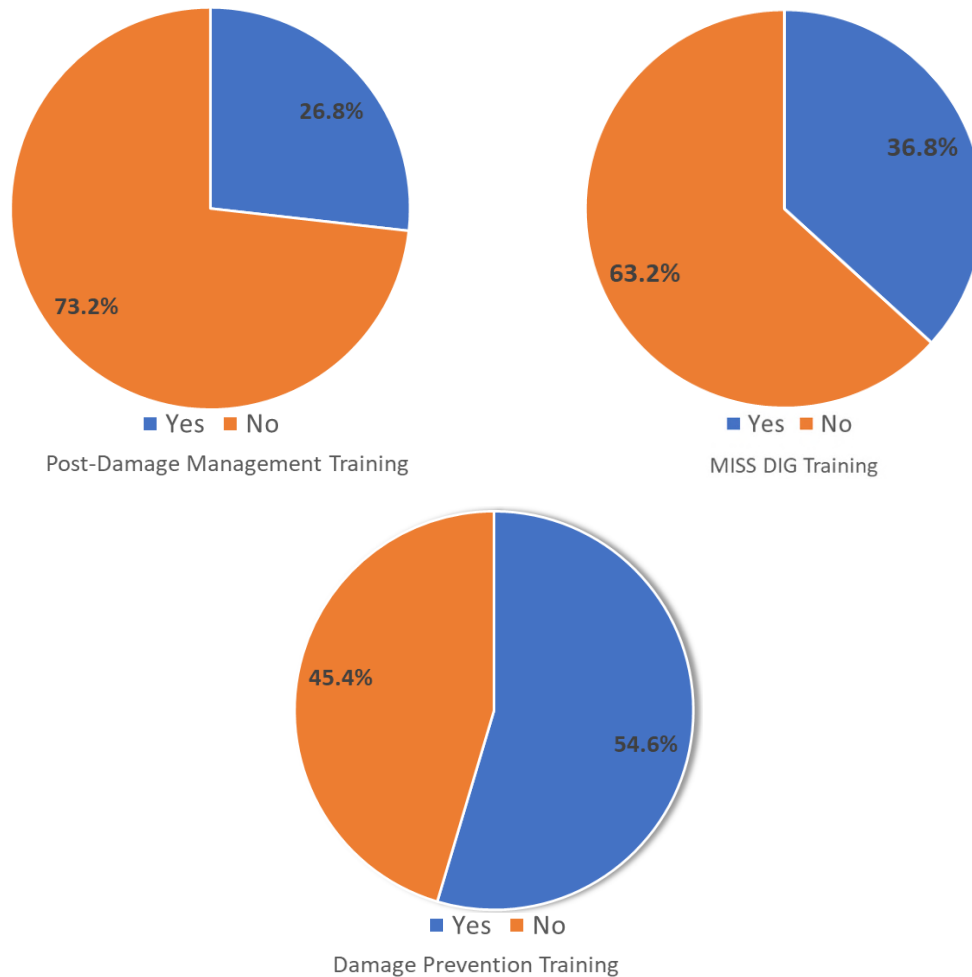


Figure 1. Damage prevention training landscape within the study sample.

5 CONCLUDING REMARKS

Workforce training plays a pivotal role in preventing third-party damages, ensuring employee well-being, and ensuring compliance with the damage prevention law. Training should provide a clear understanding of the damage prevention process, the different types of tickets available, the risks of using incorrect or false tickets, and the limitations of the current system, such as coupling effects, abandoned lines, broken tracers, and weather conditions (Al-Bayati and Panzer 2020). Effective communication with locators and the one-call center should be a key focus of awareness efforts. Excavators must fully grasp the process and the potential consequences of undesirable actions. On the other hand, the lack of post-damage training represents a wasted opportunity to improve overall damage prevention practices. Among others, post-damage processes are critical for the following reasons:

- **Safety Assessment:** It is crucial to assess the safety of the area after a workplace incident. This includes evaluating potential structural damage, electrical hazards, or any compromised safety measures. Post-striking practice may involve a thorough inspection to identify and address safety concerns promptly.
- **Immediate Notification and Communication:** Excavators must immediately notify utility owner/operators to repair their facilities. Relevant stakeholders, including construction workers, supervisors, and local authorities, need to be informed about the situation. This ensures that everyone is aware of the incident and can take appropriate action.
- **Documentation:** Documenting the details of the incident is crucial for insurance purposes, incident reoccurrence prevention, and potential litigation. This documentation may include photographs, written reports, and any actions taken to address the consequences of the damage.

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