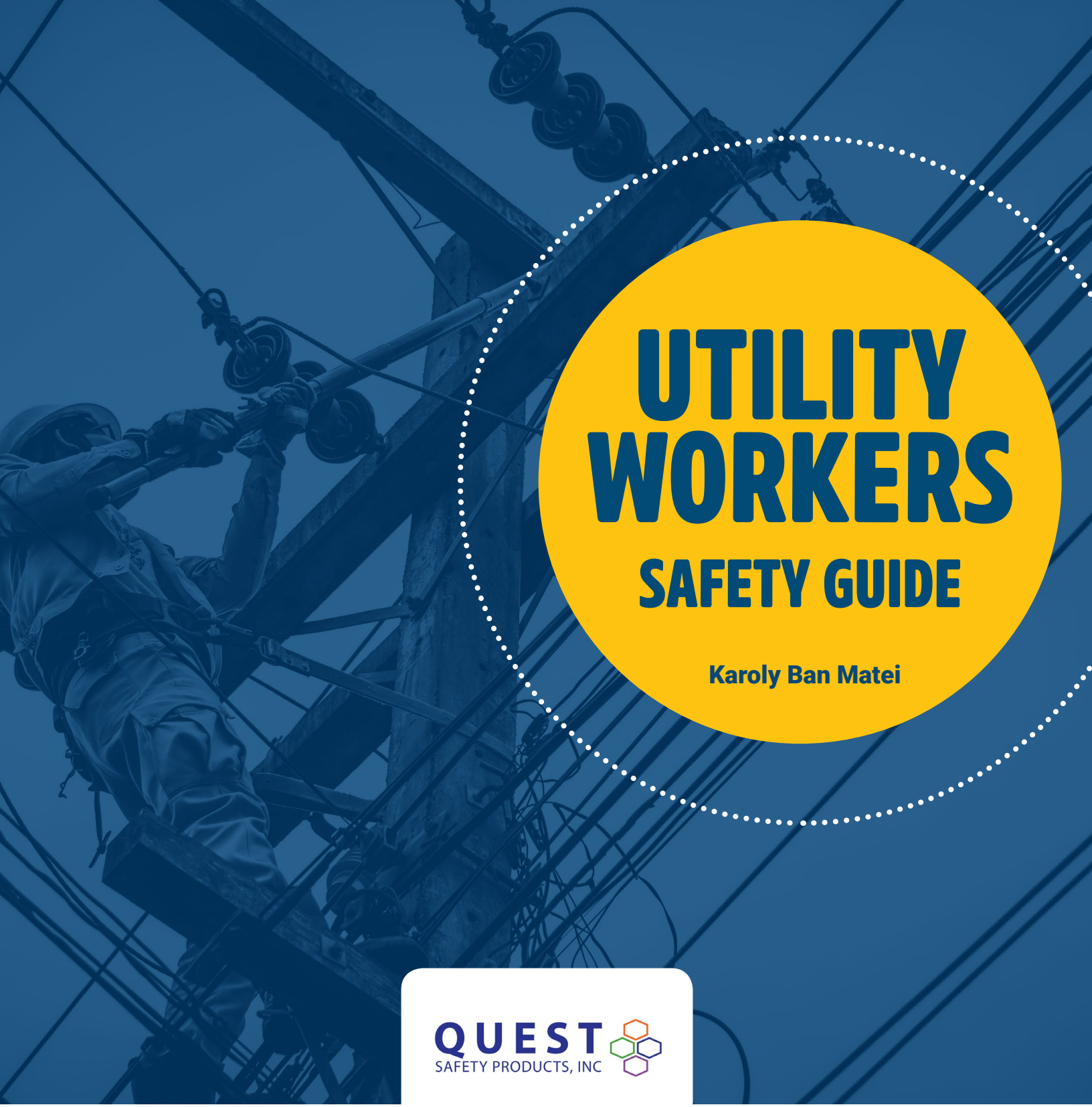

UTILITY WORKERS

SAFETY GUIDE

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Electrical workers are the first to come to mind when we think of utilities. In reality, utility workers are a diverse occupational group involved in building, maintaining, and repairing utilities infrastructure.

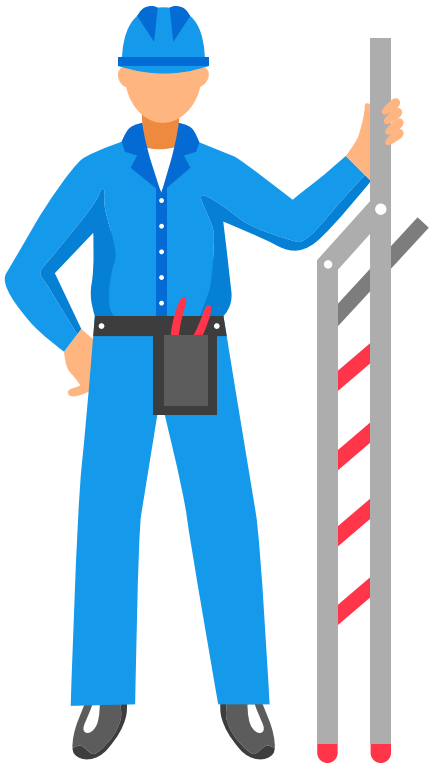
By utilities we mean any infrastructure that is designed to transfer or provide the necessities of modern life, such as electricity, communication, gas, water, or sewage. To help provide these services, utility workers must work at heights, at ground level, in trenches, and underground. As such, their work is varied in complexity and hazards.

This guide will go through some of the most common hazards utility workers encounter while carrying out their work and the controls we can put in place to mitigate these hazards.

Standards to Consult

The most relevant OSHA regulations that govern utility workers are listed below:

- Electrical – General Requirements (1910.303)
- Electrical – Wiring Methods (1910.305)
- Electric Power Generation, Transmission, and Distribution (1910.269)
- Personal Protective Equipment, Subpart I (1910)
- Fall Protection (1926.501)
- Hazard Communication (1910.1200)
- Respiratory Protection (1910.134)
- Lockout/Tagout (1910.147)
- Excavations (29 CFR 1926, Subpart P.)
- OSHA Technical Manual Section V Chapter 2,
  Excavations: Hazard Recognition in Trenching and Shoring



Hazards Faced by Utility Workers

Utility work is hazardous by its nature. It involves working outdoors in all weather conditions for long hours and under constant pressure to complete and energize facilities. Stress and fatigue are part of the job.

Utility work is also frequently done in conjunction with other construction work, meaning it takes place on congested worksites. Utility work is also often carried out beside highways and in residential areas, placing the employees at high risk of being struck by vehicles.

Some of the most common hazards for utility workers are:

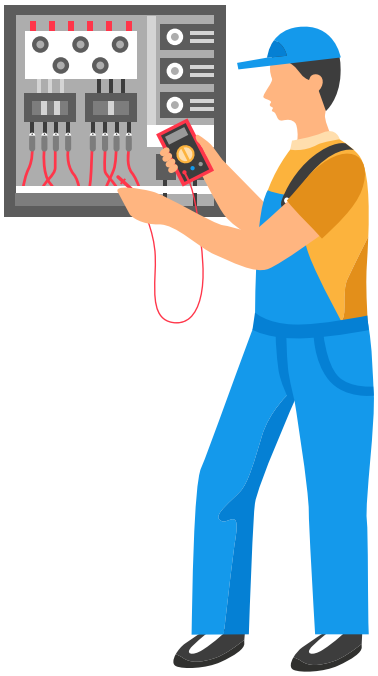
- Electrocution
- Explosions and fires
- Trench collapses
- Confined spaces
- Vehicle Collisions
- Falls

Electrocution

Electrocution is, by far, the leading cause of injury and fatality for utility workers. According to ESFI, in 2017 alone there were 136 fatalities and 2,210 reported injuries due to electrocution, with the utility industry accounting for 54% of electrocution fatalities. This is not surprising since utility workers are the ones installing or maintaining these utilities and, as such, they are exempt from the limits of approach – sometimes working on live utilities.

Electrical workers should be properly trained and often require a trade certification. Employers should supplement this by appropriate workplace training, familiarizing their employees with the job specific hazards, controls, and the employer's electrical code of practice.

Mitigating Electrocution Hazards



Unlike many other utilities, it is common practice for electrical utility workers to work on live wires. They do so mostly to avoid cutting power to a whole municipality, including emergency services and hospitals. Despite that inconvenience and the time it takes to do it, proper de-energizing is the most effective mitigation measure and it should be performed whenever practical.

When working on smaller lines, transformers or individual electrical components can be de-energized through lock-out/tag-out, which, according to ESFI, "safeguard workers from the unexpected energization, or startup, of machinery and equipment. They can also prevent the release of hazardous energy during service or maintenance activities. "

When de-energizing or locking out/tagging out, don't assume that the wires are not live. Test before touching and start working only after confirming the line is not live.

When elimination is not an option, most of controls are within the administrative and PPE area. For this reason, electrical companies need appropriate training and clear, well-defined procedures.

Arc flashes are the most common hazard when working on electrical utilities. Arc flashes are sudden releases of electrical energy through the air when a high-voltage gap exists and there is a breakdown between conductors. Arc flash awareness training and preparing for the job so that tools and equipment do not come close to electric wires can substantially decrease the risk.

The 2018 NFPA 70 standard formalizes the electrical job safety plan in ten steps and assesses, among other things, the risk of an arc flash. The process is geared specifically to electrical work and special emphasis is placed on the "Qualified Electrical Worker" who must complete the written Job Safety Plan. This ensures that the person making and communicating the plan is competent.

The following steps are needed to meet the new "Job Safety Plan" requirements under the new proposed standard:

- Document the Job Safety Plan and Pre-Job Safety Briefing
- Fully describe the job
- Describe each individual task
- Identify all electrical hazards associated with the task
- Complete a shock risk assessment
- Complete an arc flash risk assessment
- Describe safe work procedures to be used for each task
- Include all special precautions, such as use of spotters, etc.
- Lock out and tag out procedure if energy control is required
- Conduct a pre-job safety briefing with all personnel involved in the task

As for PPE, OSHA 1910.333 (a)(1)(i) states: "Employees working in areas where there are potential electrical hazards shall be provided with and shall use, electrical protective equipment that is appropriate for the specific parts of the body to be protected and for the work to be performed."

For electrical hazards greater than two calories or work above 600 volts, OSHA has determined that employees should be fully protected with FR garments and equipment. A non-comprehensive list of FR equipment is provided below:

- Non-conductive hard-hats, gloves and foot protection or insulating mats
- Eye and face protection whenever there is danger from electric arcs or flashes
- FR coveralls or FR shirt and pants
- Insulated tools or handling equipment
- Protective shields and barriers to protect against electrical shock and burns

Ground Disturbance – Electrocution, Explosions and Fires

Working with electricity and gas creates increase risks of explosion and fire. Not seeing where the utility line is when excavating or performing directional drilling creates the potential for equipment to come in contact with energized utility lines, whether underground electrical cables or gas lines. This can result in induced current in equipment, fires, and explosions, all of which can result in fatalities, injuries, and severe material damages.

Despite a sustained focus on ground disturbance, contact with underground utilities seems to have increased in recent years, as seen in the table below from the Common Ground Alliance (CGA):

Table 1 - Reported events, near misses, and damages in Canada and the U.S., over time

	2015	2016	2017
Reported Events (total entered in DIRT)	363,176	390,366	411,867
Reported Near Misses (unique events)	9,485	6,093	1,588
Reported Damages (unique events)	278,861	317,869	316,442

According to CGA, utility lines hits have resulted in over $1.7 billion in property damage, 1,906 injuries and 421 deaths over the last 20 years.

Boardman (2014) states that the most common causes of utility line strikes are:

- Failure to identify/recognize underground hazards
- Over-reliance on inaccurate site drawings or other records
- Inaccurate utility location or marking
- Improper use of utility locating technologies
- Failure to confirm known or suspected utility locations

Mitigating Ground Disturbance Hazards

As with other hazards, it all starts with proper hazard assessment and training. Companies engaging in ground disturbance should ensure that they have a code of practice for working around underground facilities, practices and procedures and that their employees receive ground disturbance training to be able to recognize GD hazards and know what they should or should not do.

- Preparing for forthcoming work is the best way to avoid contact with underground utilities. Gather all the information available from the people that have knowledge about the utilities that might be buried in your proposed work area. Gather drawings, as-builts, and aerial photographs.
- Arrange for the utilities to be located – call 811 at least two to three days before intending to dig to allow time for locators to identify and mark underground utilities. Each facility type is marked with a different color marker, so you should get a good idea of what facilities lay under your feet. Keep in mind that locators usually mark utilities on public land ad stop at the edge of public property. If you need to work on that public property you should hire a private geophysical investigation firm.
- Walk the site – look for the facility markers and compare with the drawings and maps you have to make sure they match. Look for other clues, such as gas meters, vents, electrical transformers, or manholes that might indicate the existence of underground facilities.
- If working close to identified underground utilities, ensure they are where the markers show them to be. Markers have a tolerance zone (also called hand exposure zone) of about 18 inches, so you should expose the facility through hand digging or hydro-vac. This will allow you to confirm you have the right facility – check the type of facility, size, and direction.
- If placing a post or a pile very close to an existing facility, use a hydro-vac to pre-drill a hole 10% larger than the diameter of the post or pile and deeper than the known depth of the facility to ensure they do not come into contact.
- Proceed with caution – if the excavator's bucket or the pile you are installing encounters resistance, slow down and reassess. If you uncover unmarked facilities, stop and call 811.

Confined Space

Utility workers either build or maintain different types of confined spaces. All should be aware of and follow the requirements of OSHA's 29 CFR 1926 Subpart AA standard dealing with the hazards associated with confined space.

The most common confined spaces for utility work are are trenches and manholes. And while both satisfy the criteria of confined space (spaces large enough to allow human access but not designed for human occupancy that offer limited access/egress), the main hazards differ so we will treat them separately.

Manholes and Sewers

Manholes and sewers will present an immediate risk to the health and safety of your employees. Besides the limited access and egress, there is frequently the potential for hazardous atmosphere. The greatest danger of a confined space is an employee not properly understanding or underestimating the hazards associated with the space.

The types of confined space work related to manholes and sewers might include:

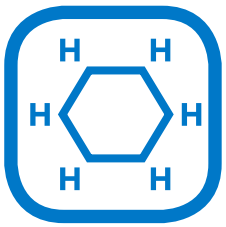
- Installing or upgrading a manhole
- Altering or upgrading sewer lines
- Making nonstructural upgrades to joints, pipes, or manholes
- Demolition work
- Installing new or upgraded pump equipment, cables, wires, or junction boxes

The following are hazards faced when entering manholes:

- **Oxygen** – Usually the problem is not enough oxygen rather than too much. When oxygen drops under 19.5%, it can lead to dizziness or lack of consciousness. This, by itself or in combination with other hazards, can lead to death.

- **Hydrogen Sulfide (H_2S)** – Depending on its quantity, H_2S could be an irritant or immediately lethal, sometimes with no warning signs. Hydrogen sulfide is often produced from the microbial breakdown of organic matter in the absence of oxygen gas, such as in sewers. It is also flammable, presenting a fire and explosion hazard.

- **Hydrocarbons** – Usually natural gas vapors, hydrocarbons can accumulate in sewers and other enclosed areas as a result of a leak. They can easily ignite and explode and produce flash fires once they surpass the lower explosive limit (LEL).



According to OSHA's Fact Sheet – Confined Spaces in Construction: Sewer systems, sewers might also present the following hazards:

- Electrocution (e.g., using electrical equipment in wet working conditions)
- Slips, trips and falls
- Falling objects
- High noise levels, low visibility, limits to communication, and long distances to exits

Mitigating Hazards in Manholes and Sewers

Mitigating confined space hazards revolves around proper entry procedures, as well as timely rescue. Before employees enter a confined space you should:

- Create a confined space policy and code of practice adequate for the task, making provisions for training, monitoring, permitting, etc.
- Ensure we have provided training appropriate for the task assigned to our employee (entry or rescue)
- Create a rescue plan and resources for its execution
- Provide enough personnel for the task, ensuring you always have an attendant and a rescue team

- Assess the confine space for the presence of gas hazards (see above) before and during the entry using gas monitors. Use an aspiration gas detector to test the atmosphere without entering the space. In sewers, test for gases at different levels (stratified testing) as they have different densities and their level might be dictated by the presence (or absence) of other gases.
- Continuously monitor the atmosphere in the confined space using gas monitors

  Provide appropriate PPE and training for using the PPE (respirators)

A modern approach is using drones that can not only test the atmosphere but also provide a video feed of the workspace before being entered.

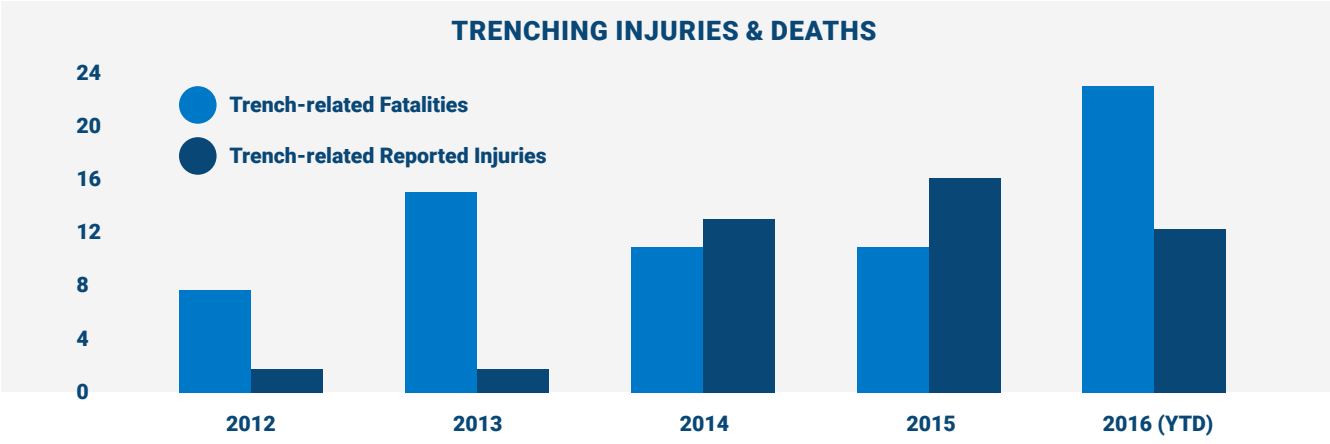
Trench Cave-Ins

Many utilities are installed underground. While trenches can present the same hazards listed under manhole and sewer systems, as well as contact with existing underground utilities, caving is the major hazard in trenches.

Digging trenches and laying utilities in them exposes utility workers to the risk of the trench caving in and entrapping them. This can result in crushing injuries or asphyxiation – 1 cubic yard of soil can weight as much as 3,000 pounds, which is as much as a small vehicle.

OSHA states that employee injury from collapse is the primary hazard of excavation, most often due to a lack of protective structures.

According to OSHA, 23 employees died at work in 2016 due to trenches collapsing.



Trench cave-ins are influenced by the following factors:

- The type of soil in which the excavation is made
- The size of the trench
- The presence of heavy or vibrating equipment in vicinity or spoils placed too close to the edge of the trench
- The slope of the trench
- Weather (usually water seeping through ground making trenches unstable)

Other trenching hazards:

- Falls into trenches
- Tripping over equipment, debris, and soil
- Excavated material or other objects falling on workers
- Exposure to underground services or overhead electrical cables
- Unstable adjacent structures
- Mishandled or poorly placed materials
- Hazardous atmosphere (noxious gases/lack of oxygen)
- Toxic, irritating, or flammable and explosive gases
- Incidents involving vehicles and other mobile equipment

Mitigating Trench Cave-In Hazards

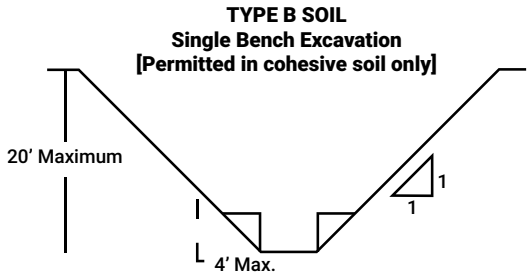
OSHA revised Subpart P, *Excavations*, of 29 CFR 1926.650, 29 CFR 1926.651, and 29 CFR 1926.652 to make the standard easier to understand, permit the use of performance criteria where possible and provide construction employers with options when classifying soil and selecting employee protection methods. Employees performing excavations and employees working in excavation should receive training to familiarize them with the hazards and controls specific to trenching.

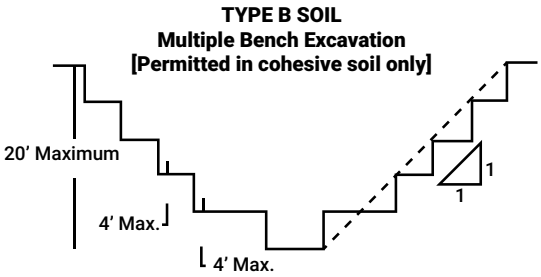
The most common methods for mitigating cave-ins are:

- **Shoring** – This method stabilized vertical trench walls by placing a solid surface against the wall (plywood or metal) then bracing the two walls with struts. Only competent employees should install shoring.
- **Sloping** – Depending on the type of soil OSHA's Technical Manual Table V:2-1. Allowable Slopes recommends the following slopes:

Soil type	Height:Depth ratio	Slope angle
Stable Rock	Vertical	90°
Type A	¾:1	53°
Type B	1:1	45°
Type C	1½:1	34°
Type A (short-term)	½:1	63°
(For a maximum excavation depth of 12 ft)		

- **Benching** – The trench can have a single benching or multiple benches. The rule of thumb is that the bottom vertical height should not exceed 4 ft (1.2m) for the first bench. Subsequent benches, if cut, can have a vertical of maximum 5 ft if we have Type A soil, and 4 ft in Type B soil. Here is an example for a multi-bench system, as shown in OSHA Technical Manual Section V Chapter 2:





- **Spoils** – Spoils should be placed at an adequate distance to prevent them from sliding and falling on the employees in the trench. The minimum distance from the edge of the excavation is 2 ft for temporary spoils, while OSHA does not provide a minimum distance for permanent soil.
- **Ingress and Egress** – All trenches exceeding a depth of 4 ft must have fixed means of egress. Ladders should be spaced at maximum 50 ft (so the employee does not have to travel more than 25 ft to nearest egress). The ladders should extend minimum 3 ft beyond the landing point to allow workers to comfortably grasp them when entering or exiting excavations.
  - A competent person will inspect for water hazards trenches after rain events to ensure they are still structurally sound. Water accumulations should be removed from the trench before allowing employees to return.
  - Have an emergency response plan.
  - A good business practice is to have at least one person outside the trench to monitor the employees in the trench and summon assistance in case of emergency.

Falls

For 2014, the BLS reported 247,120 slips, trips, and falls, while the Canadian Centre for Occupational Health and Safety reports that 42,000 injuries are reported annually due to the same causes. It's no surprise, then, that falls are a leading cause for death for utility workers, especially given that their work is often done at heights – in an aerial work platform, on a ladder, or beside open excavations.

Keep in mind that even short falls can result in a serious injury or death. OSHA 1926.501 requires adequate fall protection when working over six feet. However, if there is an unusual potential for injury, you should provide adequate fall protection for falls under six feet.

Work positioning is another consideration for electrical and other utility workers performing tasks close to electrical lines. If a fall happens, the employees should not come into contact with live wires and you must ensure that the wires do not impede rescue operations.

If working on poles or towers there are different fall protection requirements. OSHA 1910.269 (g)(2)(v) requires "fall arrest equipment, work positioning equipment, or travel resisting equipment shall be used by employees working at elevated locations more than 4 feet (1.2 m) above the ground ... if other fall protection has not been provided."

To complicate things more, OSHA's 1926.501(b)(7)(i) allows utility workers to not utilize fall protection if they work by the edge of a trench and the employee can easily see the edge of the trench.

Mitigating Fall Hazards

The best control is eliminating the task or substituting it with one that carries a lower risk. However, this is seldom possible given the way projects are constrained for personnel and resources these days. While engineering controls are sometimes possible and adequate, the variable nature of the jobs and their location dictates that the most common controls are the ones that are "portable," such as administrative controls and PPE.

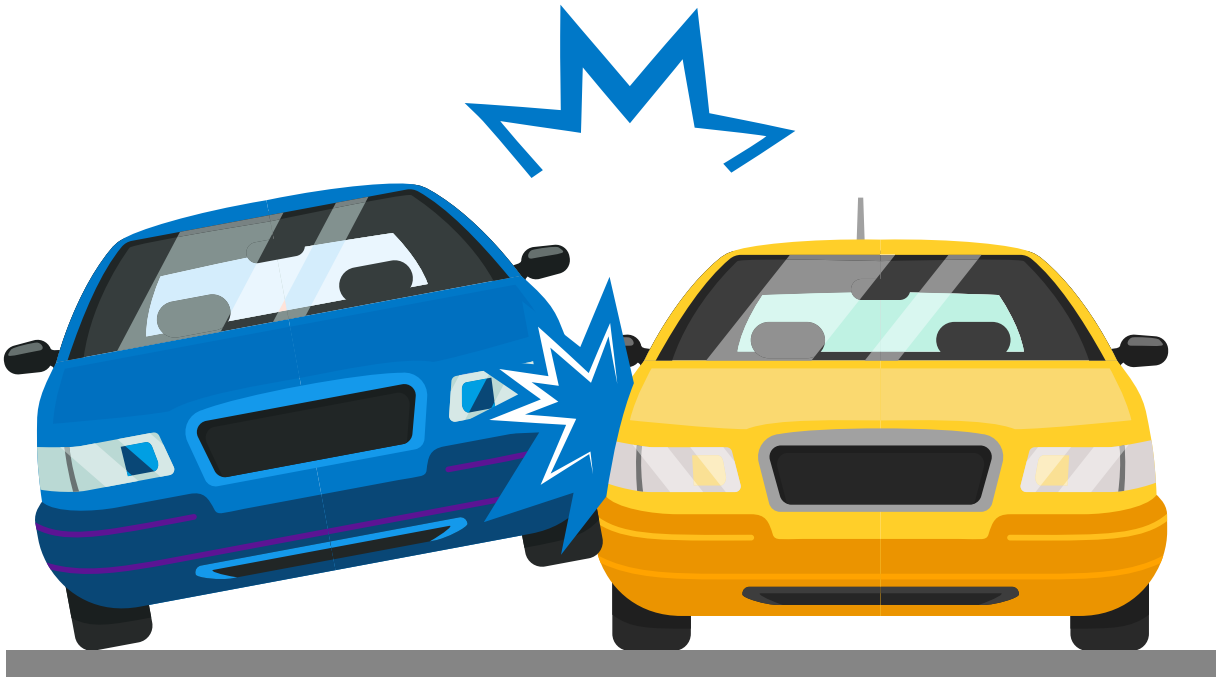
Training all employees that might work at height in fall protection is a must, providing them with the tools and knowledge to fill the gaps between the work as imagined in the office when they're handed a JHA and the work as done in the field, where the many variables require them to adapt on the go. As good business practice, the fall protection training should comply with the voluntary ANSI Z359.2 standard, "Minimum Requirements for a Comprehensive, Managed Fall Protection Program" and the level of training (there are six levels) should be appropriate for the functions that the employee is doing.

- Provide proper equipment selection for the situation your employee is confronting. Electrical and telecommunication work is often done at heights, so wherever possible an aerial work platform (AWP) is a better choice than ladders or climbing a post, providing workers with better access, more stability, and allowing them to use their hands for work without fear of loosing their balance.
- If using an AWP, ensure that the employees are trained to operate it.
- If using a ladder, ensure the ladder is appropriate for the work:
  - Allowing the employee to reach the work area without over-reaching, extending at least 3 ft over the landing point if landing on a flat surface (such as the top of a trench).
  - Is built of non-conducive materials, as per 1926.1053(b)(12) if they are used where the employee or the ladder could contact exposed energized electrical equipment.
  - Workers are trained in the safe use of ladders.
- When covering holes with covers, the covers have to withstand twice the weight of employee and materials potentially walking over them, be secured against accidental dislodgement, and have to be clearly marked with “HOLE” or “COVER.”
- When entering manholes deeper than 6 ft, a fall protection system is required. Considering the hazard, it is recommended the fall protection system includes a retrieval options (see confined spaces).
- Extend shoring 4 ft above the trench line to provide an adequate barrier to protect employees from falling into trenches.
- Whenever possible design the system and the work so a travel restrain system can be employed, thus negating the potential for a fall.
- Whatever the circumstances (AWP, ladder, trench, manhole), have an appropriate rescue plan in place and test it to ensure it will respond adequately to your employee needs when they need to deploy it.

Vehicle Collisions

Electrical, gas, telephone, cable, water, and sewer work are extremely challenging because most of the time it takes place in areas where there is already residential and construction traffic. This places utility workers at high risk of injury and death due to being struck by a moving vehicle or piece of equipment. Many utilities are located within or just outside the right of way. While newer developments host the utilities besides or under walkways, older facilities are placed directly under the road surface.

Due to the variety of work utility workers carry out, it is hard to come by concrete statistics regarding the number of vehicle injuries and fatalities sustained by utility workers. If we judge only by how often we hear about them in the news, these accidents are fairly common. A report prepared by Wayne State University and Bradley University for the US DOT places utility workers as the third highest risk group for vehicle fatalities, after construction and maintenance workers. We can argue that due to the tight relationship between maintenance and utility work and the fact that the fourth highest group was “Unknown,” the vehicle fatality rate for utility workers could be higher.



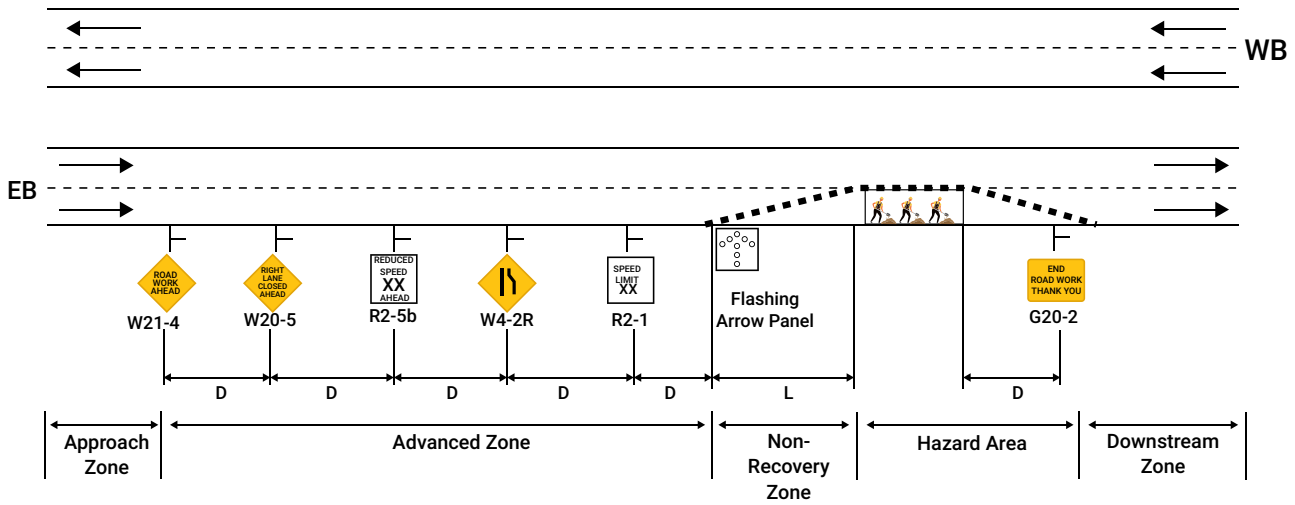
Mitigating Vehicle Collision Hazards

Among the recommendations made be the study mentioned above are:

- Analyze the work site including traffic patterns and plan the work zone before you begin working
- Position work vehicles to create an obstacle to prevent oncoming traffic from hitting you
- Minimize exposure to moving traffic
- Drivers should not engage in activities that distract them from driving or hinder driving performance

While the recommendations are good, I think it is worth mentioning that proper signals are essential to raise awareness among motorists and make them reduce speed and prepare for the forthcoming hazards.

In residential areas, space limitations makes it difficult to deploy proper signage. When working besides or on highways, the report recommends a placement as below:



Many of these activities typically require substantially less time to execute as compared to roadway construction and are generally done in conjunction with these or with short notice. A utility worker can be in several worksites in a day, which decreases the time the employee spends planning the job. Also, it might take more time to set up the signs than to execute the work itself, so often workers do not install proper signage. To mitigate this, you can reduce the number of signs, but increase their impact:

- Flashing speed limit signs are very effective not only for reminding motorists they're driving faster then recommended, but also that their unsafe conduct can be noticed by other drivers and law enforcement.
- Increase the use of electronic warning devices, such as strobe lights, channelizing devices and hazard lights on stationary vehicles.

The visual impact of the worksite can be increased with the right kind of PPE. High visibility clothing will make the employees more visible to oncoming traffic. In high traffic areas and during night work (which is not as frequent as nighttime construction work) it is recommended that employees wear Type R class 3 hi-viz garments, as defined by ANSI/ISEA 107-2015.

High-viz clothing is even more important for the flaggers and traffic controllers that are usually present on the roadway to control and direct traffic.

Vehicle mounted impact attenuators are also a newer and effective measure that can be used to protect workers in high traffic areas. These impact attenuators are mounted at the back of the vehicle that has been parked in advance of the work zone and by crumpling will absorb the force of the impact and will ensure the parked vehicle is not projected over your work area.

However, the most important control is proper work procedures. All the controls above have to be clearly described within our safe operating procedures and your employees need to receive adequate training regarding what controls and when should they deploy.

Takeaway

There is actually no such thing as a “utility worker” – at least not in the sense that there is a single job that can fit neatly into one job description. Utility workers are a large, heterogeneous group. They perform many different tasks and are exposed to many different hazards. Each employer should train their employees for the specific type of work they are doing, follow best industry practices, and equip them with adequate PPE for the task at hand.

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