



## What About Construction Equipment?



Treat equipment and vehicles with caution:

- Stay out of "blind spots."
- Communicate with operators by radio and/or eye contact.
- Don't approach until you communicate with the operator and he/she acknowledges you.
- Stay outside a "safety circle" around equipment. If you can't see the operator, he/she can't see you.
- Stay clear of vehicles. Know the traffic control plan.
- Use spotters when you must work with your back to equipment or traffic.



## Can We Be Safe When Placing TCDs?

Simple precautions make placement of Traffic Control Devices (TCDs) safer:

- Wear a Class III vest to be easily seen.
- Place, relocate, or remove TCDs when the traffic flow is light.
- When possible, work from a platform on the vehicle.
- Use seat, seatbelt, fall restraint, or guardrail and a handhold when the guardrail must be removed.
- Stay in constant communication with the driver.
- Use a shadow vehicle to warn drivers.



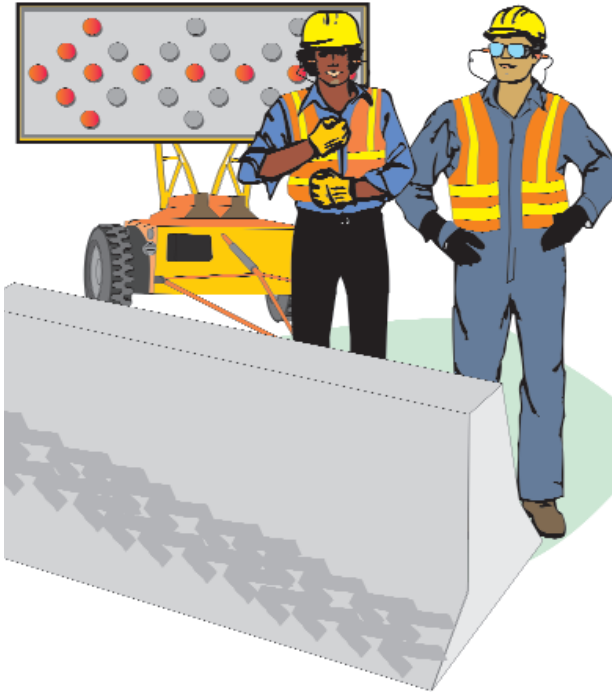
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## Runovers and Backovers

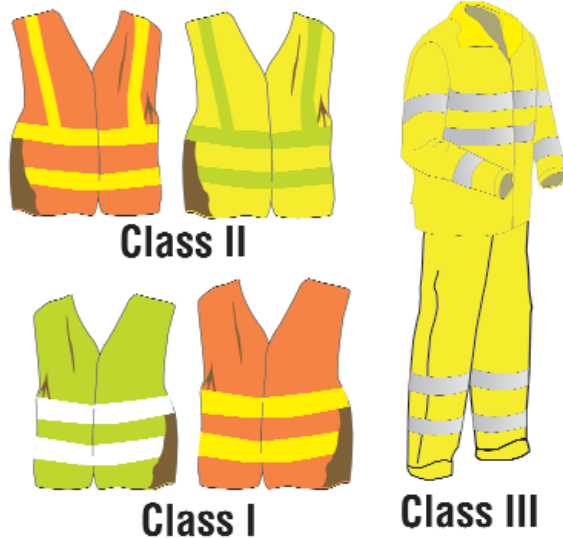


# Can We Be Safe Near Equipment and Traffic?

Being struck is the biggest danger in road work. Workers on foot must remain alert at all times. Check surroundings often. Listen for warnings. Keep a safe distance from traffic. Stay behind barriers where possible. Look out for each other. Warn coworkers.



## What Other Precautions Do We Need?



Employers must provide proper personal protective equipment (PPE). Workers must wear it:

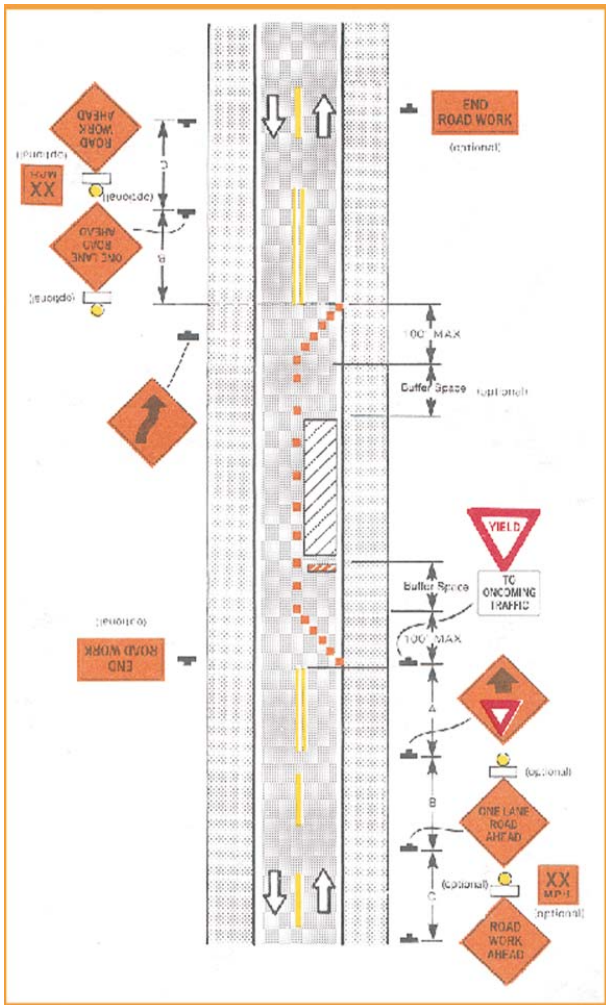
- Proper class of safety vest at all times in the work zone.
- High-visibility clothing and headgear.

Safety clothing for road work comes in Class I, Class II, and Class III categories.

**Class I** garments are for use in activities that permit the wearer's full and undivided attention to approaching traffic. There should be ample separation of the worker from traffic, which should be traveling no faster than 25 miles per hour.

**Class II** garments are intended for activities where greater visibility is necessary during inclement weather conditions or in work environments with risks that exceed those for Class I. Garments in this class also cover workers who perform tasks that divert their attention from approaching traffic or that put them in close proximity to passing vehicles traveling at 25 miles per hour or more.

**Class III** garments provide the highest level of visibility. Class III is for workers who face serious hazards and often have high task loads that require attention away from their work. Garments for these workers should provide enhanced visibility to more of the body, such as the arms and legs.



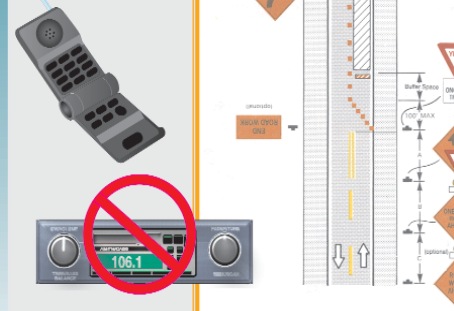
## How Can We Protect Other Workers?

Keep other workers in mind:

- Know the locations of other workers around you.
- Set up a means of communication with them.
- Never allow them to ride on equipment.
- Provide barriers between workers and equipment, when possible.
- Avoid excess speed and dangers caused by hills, obstacles, and curves.

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## Operator Safety







## How Can Operators Stay Safe?

Operate equipment only if you are qualified. Safe equipment operation includes these practices:

- Before starting vehicle, do a walk-around inspection.
- Test the back-up alarm and other safety devices.
- Locate and test controls.
- Know the equipment blind spots and the swing radius.
- Use equipment seatbelts.



When entering and exiting the vehicle:

- Climb with 3 points of contact to avoid falls.
- Look for other moving equipment or vehicles.
- Wipe up grease and fluid on equipment walking/working surfaces.

## What Are Other Safety Measures?

Stay alert and aware of the hazards. Report all repair needs to your supervisor. Always lock out and tag out equipment that cannot be operated. For general safety:



- Use personal protective equipment (PPE) supplied and required by your employer.
- Never use cell phones, AM/FM radios, CD players, or other distractions while operating equipment.
- Safely secure equipment before using employer-provided hand-held cell phones or walkie-talkies.
- Secure unattended equipment.
- Lock-out/tag-out before repair or maintenance. Set the parking brake and chock the wheels.



## How Can We Be Safe in the Work Zone?

The operator has special responsibilities. Know the job:

- Know the work zone and your position in it.
- Know the internal traffic control plan.
- Use designated equipment routes and areas.
- Identify rollover hazards.
- If you must move cones or barricades, return them to their original positions as soon as possible.



Trees and equipment maintenance are also hazards. To avoid being struck by trees, restrict worker access during felling, trimming, loading. Use protective structures on equipment. Use safe hoisting, rigging for logs and limbs.

To avoid being struck by equipment parts, do lockout/tagout and hazardous energy control during maintenance, repair, cleaning, and inspection.

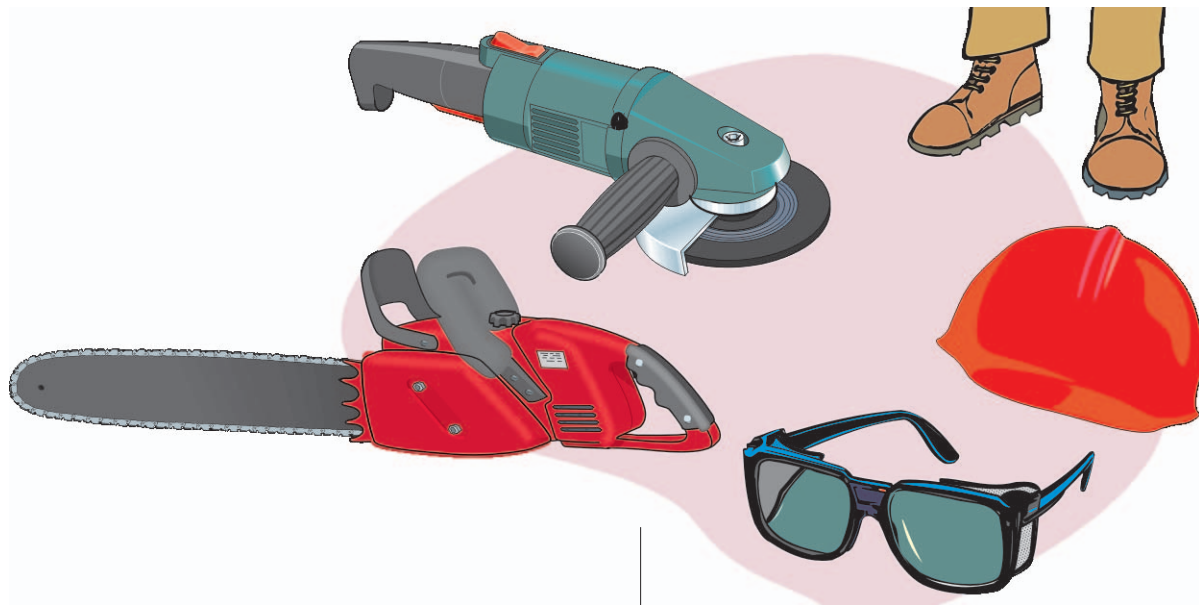


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## Struck or Crushed



# How Are Road Workers Struck or Crushed?



Tools and materials are two major hazards. To avoid being struck by tools:

- Use point of operation guarding on portable hand tools.
- Use a chain saw safety program.
- Use Personal Protective Equipment (PPE).

To avoid being struck or crushed by materials:

- Keep out of lifting areas, from beneath loads.



- Use safe methods for rigging, hoisting, and setting steel plates, jersey barriers, manhole frames and covers.
- Use PPE — hard hats, footwear, eye protection.





## What Should Flaggers Avoid?

Flaggers must avoid dangerous behavior. Here are some flagging DONT'S:

- Don't stand where you can be crushed.
- Don't stand in the shade over the crest of a hill or around a sharp curve.
- Don't leave your position until properly relieved.
- Don't stand near equipment.
- Don't stand in a group.
- Don't make unneeded conversation.
- Don't read or daydream on duty.
- Don't listen to music or use ear phones.
- Don't turn your back to the traffic.



## Flagger Safety



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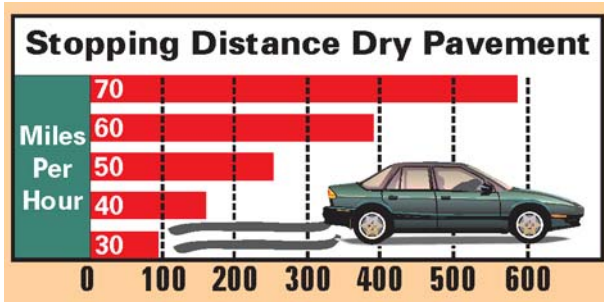


## What Is the Main Hazard of Flagging?

Motorists kill about 20 flaggers a year. Many more are injured. Flagging can be dangerous due to:

- High speed traffic.
- Angry or aggressive drivers.

After seeing a flagger, a motorist going 60 mph needs almost 400 feet to stop.



## How Can We Protect Ourselves?

The best way to protect ourselves is to be visible and to wear protective clothing.

Wear high visibility clothing:

- Orange, yellow, or green vest.
- Only retro-reflective vests at night.

Wear other protective equipment:

- Hard hat.
- Long-sleeved shirt and pants.
- Appropriate clothes for expected weather.



Stay alert and out of harm's way. Follow these tips:

- Stand alone on the shoulder in clear view.
- Never stand in the open traffic lane.
- Plan an escape route for emergencies.
- Stay alert, focused on work.
- Make sure your hand signals don't conflict with the traffic signals.
- Treat motorists with respect and courtesy. Don't pick fights or respond to anger. Notify law enforcement when motorists do not obey.





## How Can Our Health Habits Help?

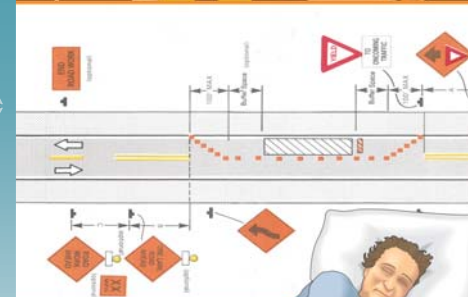
Night work is not normal. You must compensate and your health habits can make a huge difference. On the work site, eat protein-rich foods and avoid sugars and fats. Drink plenty of water and avoid caffeine.

At home, make sleep a priority. Follow a pre-sleep routine and have a light snack before bedtime. Keep daylight out, even if you have to install black out drapes.

Eat family meals together and plan daytime social activities. That way, you'll be ready for sleep when you come home from work.

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## Night Work





## What Are the Special Challenges of Night Work?

On the worksite, the challenges include:

- Poor visibility for motorists.
- Poor visibility for workers.
- Communication between shifts.
- Impaired or drowsy drivers.



Night work also causes physical and social disruptions, including:

- Sleep deprivation and disruption.
- Risk of injury from drowsiness.
- Impaired family or social relationships.

## How Can We Protect Ourselves at Night?



Use special precautions at the work site for night work. Above all, you must increase visibility and know your surroundings.

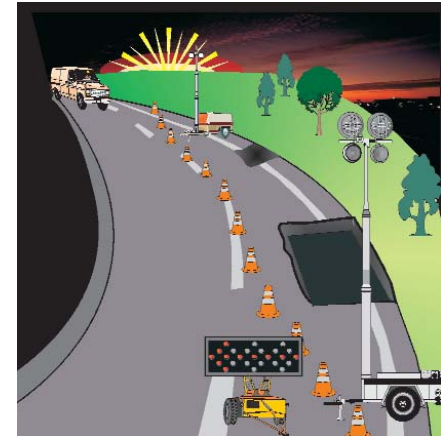
To increase visibility:

- Wear retro-reflective clothing. Retro-reflective clothing appears to light up when struck by headlights.
- Wear flashing lights on your body or clothing.
- Place retro-reflective tape on equipment.
- Use good work area lighting.

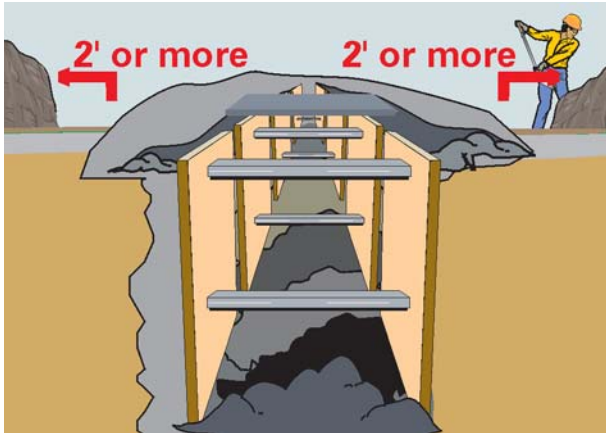
Know your surroundings:

- Know the vehicle and equipment paths.
- Know the assigned work areas.
- Know the safe paths to and from work.
- On foot, watch out for equipment.
- On equipment, watch out for workers.

Always provide clear signage. Space drums and cones closer together at night. For the best lighting, contrast the work lights from the warning lights.



Inspect the traffic control set up by test driving it to highlight problems and then inspecting it frequently.



- If there are nearby vibration sources such as railroads or piledriving.
- That no worker is more than 25 feet from an exit ladder.



The 'competent person' should stop work if a hazard exists.

## What Else Does Trenching Require?

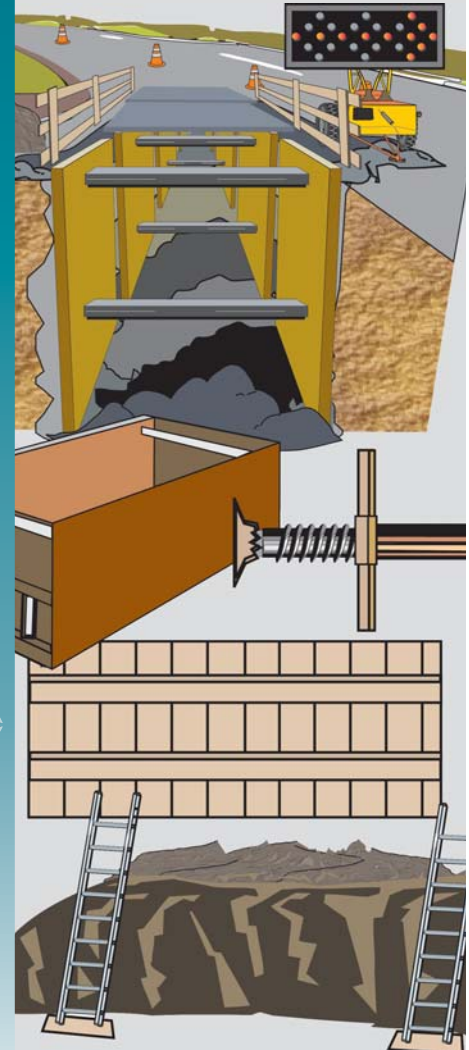
The employer must designate a 'competent person' in every trench job. The 'competent person' must inspect:

- At least daily and at the beginning of each shift.
- After precipitation, a thaw, and other events that could increase hazard.
- For disturbed ground, water, toxics, and other hazards.
- If walls sag or crack or if the bottom bulges.
- To keep spoil and equipment at least 2 feet from trench edge.

**Competent person means "one who is capable of identifying existing and predictable hazards in the surroundings or working conditions ... and who has authorization to take prompt corrective measures to eliminate them."**

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## Excavation







Trenches more than 4' deep meet OSHA's definition of a confined space.

## Why Are Trenches Dangerous?

A trench is an excavation deeper than it is wide. Trenches can kill:

- Workers can be buried alive.
- Cave-ins can result from stresses in walls, nearby moving vehicles and equipment, or spoil piles.
- Water can collect in the bottom.
- Flammable and toxic gases can build up.
- Gas from nearby sewer or gas lines can seep into the trench.

Before digging:

- Call electrical, gas, and communications utilities.
- Use extreme caution with equipment.

## How Do We Prevent Cave-Ins?

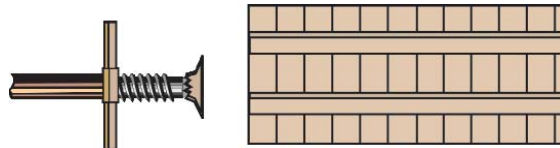
Protective systems are the methods or structures that *protect* us from cave-ins. A *protective system* must suit the soil type, the depth of the excavation, and other site conditions. It must resist without failure all loads intended or reasonably expected to be put on it.

The primary types of protective systems are:



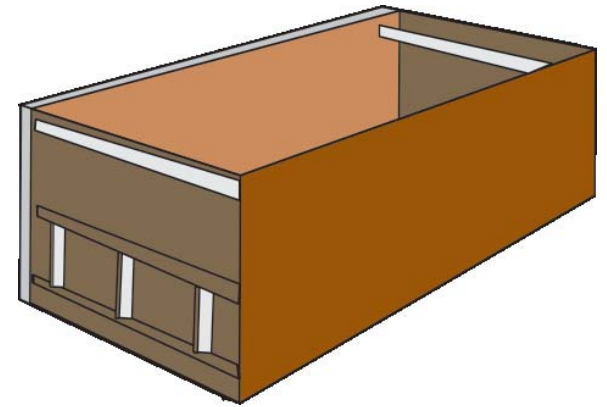
- Sloping — soil angled to increase stability.

- Benching — steps in the trench wall.



- Shoring — a support system made of posts, wales, struts, and sheeting or hydraulic shoring.

- Trench Shielding — a protective frame or box to protect rescue workers *after* a cave-in.

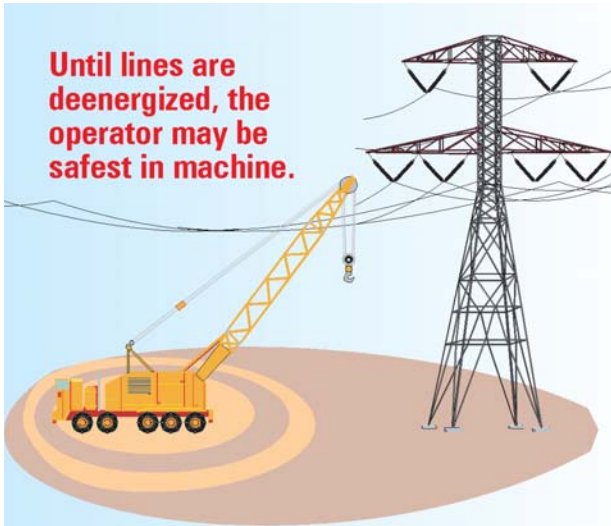


**Trenches 5 feet or deeper require support unless they are in stable rock.**



## What If Contact Happens?

Until lines are deenergized, the operator may be safest in machine.



Do not touch equipment or a person in contact with electricity. Get the line de-energized.

If you are in a vehicle that contacts electricity, stay in the vehicle and do not contact any metal. If you must exit, jump clear and slowly shuffle away. Keep your feet together to help prevent current from running through your body.

Until the lines are de-energized, the operator may be safest in the machine.

## Can We Be Safe Around Buried Utilities?

Before digging, call the electrical, gas, and communications utilities. Review marked out areas. The mark out may not be exact, so dig by hand within 3 feet of it.

When digging, look for:

- foreign debris in excavation,
- changes in mixed-up soil types,
- asphalt patches or depressions indicating previous digging, and
- concrete, plastic, or gravel.



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## Electrical Hazards



# What Are the Dangers of Electricity?



Contact with electricity can cause explosion, fire, and electrocution. Electricity can cause severe burns and death.

Equipment contacting a live electrical line can cause explosion, fire, or electrocution. Electricity can arc from the line to equipment.

Work around electricity only:

- when you are trained in all aspects of the job, and
- when you have a reason to be there.

## How Do We Treat Above-Ground Utilities?

Use extreme caution and keep your distance when you must work around above-ground utilities. The best practices are:

- Get the utility company to mark, flag, and shield line.
- Assume the line is live until it is tested. Have it de-energized and visibly grounded.
- If the line must remain energized, keep equipment and load at least 10 feet away and use a spotter to warn the operator.



Post warning signs at ground level. Make anyone who must enter the area aware of the overhead lines. Here are two tips for operators:

- Mark a safe route for repeated travel.
- Slow down.

### Minimum Safe Distances Overhead Power Lines

Voltage	Distance
50 kV or below	10
> 50 - 200 kV	15
> 200 - 350 kV	20
> 350 - 500 kV	25
> 500 - 750 kV	35
> 750 - 1,000 kV	45
More in fog or rain	

### Color Codes Painted on Surface

Gas Line - includes liquid and propane

Electric

Water

Sewer

Telecommunications - includes cable TV, copper, fiber optics





## What Can You Do to Prevent Injuries?

Do at least some of these measures:

- Plan and maintain a clear, level walking path.
- Don't lift too much by yourself. Get help.
- Use proper lifting technique. Lift with your legs, not your back when possible.
- Do stretching exercises before work.
- Keep fit.



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# Sprains & Strains



## What Injuries Are Most Common?



About 43% of lost work day injuries in roadway construction are sprains and strains. Common injuries include:

- Hand and wrist problems.
- Back injuries.
- Sprains, strains, and overexertion.



## What Causes These Injuries?

Think of the most difficult parts of your job. These injuries may be caused by some of these tasks, like:

- Working in awkward postures, such as raking asphalt.
- Handling heavy materials, like in concrete formwork.
- Repetitive work, like rebar tying.
- Using vibrating tools like a pavement breaker.
- Whole body vibration for operators.

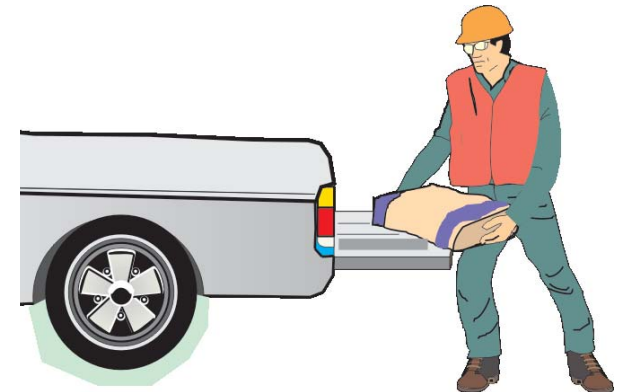
## How Can We Avoid Sprains and Strains?

Think of ways to do the job differently. We can make our work easier:

- Minimize manual materials handling with dollies, hoists, and other equipment.
- Better job planning (deliver materials where they're used).
- Store materials for easy access.
- Use tools that are comfortable and easy to handle.

Personal Protective Equipment (PPE) and breaks can help:

- Wear PPE, like kneepads and shoulder pads.
- Take breaks when possible, rotate difficult and easier tasks.

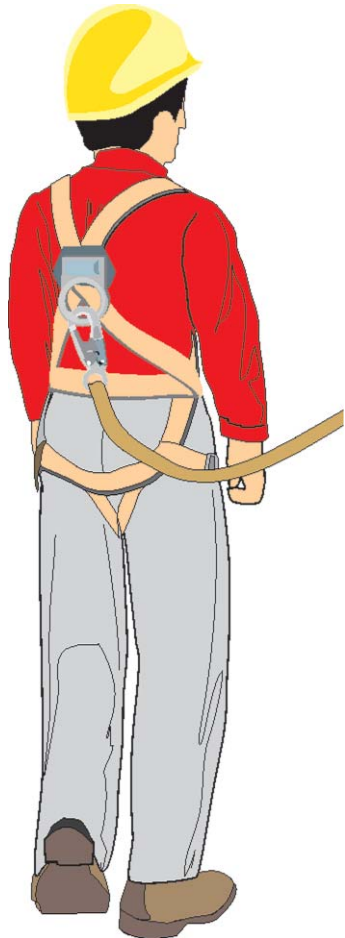




## How Do We Avoid Falls From Elevations?

Falls from elevations can be avoided by many methods. Some good ways to avoid falls from elevations include:

- The employer should have a 100% fall protection program in place.
- Work should be pre-planned to provide for the use of personal fall arrest systems (PFAS) anchor points or guardrail systems.
- Erect guardrails around large excavations.



- Wear seatbelts or restraints for riding in cars, trucks, and personnel carriers.
- Use modular form erection to avoid work at heights on forms.
- Use 3-point contact.

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## Fall Hazards







## What Causes Falls in Road Work?

Falls happen from one level to another or on the same level. Most falls in road construction are slips or trips on one level. Falls on walking/working surfaces include:

- Tripping over materials or debris.
- Falling on hills or embankments.
- Stepping in holes or walking on irregular ground.
- Stumbling while carrying loads that block vision.
- Slips or trips in muddy, wet, or icy conditions.

Less common falls from elevations include falls:

- From equipment.
- From bridges.
- From formwork.
- Into excavations.



## How Do We Prevent Falls on Same Level?

Best protection practices include:

- Try to avoid muddy, wet, or icy surfaces.
- Use footwear with ankle support and soles that grip.
- Don't carry heavy loads. Use hauling equipment.
- Practice good housekeeping. Remove tools and materials when not in use.
- Fill in or mark hidden holes in the ground.

- Clear walking and working surfaces of tripping hazards.
- Include walking routes in the site safety plan.

A very important way to keep yourself from falling is to maintain good physical strength and conditioning.





## How Do We Protect Our Hearing Now?

The best way to protect your hearing now is to wear personal protective equipment (PPE).

If you must shout to talk with someone 3 feet away, you need ear protection.



Use the PPE provided by your employer. Notify your employer if the PPE is not proper. Make sure your PPE fits and is comfortable. Follow the manufacturer's instructions for use.



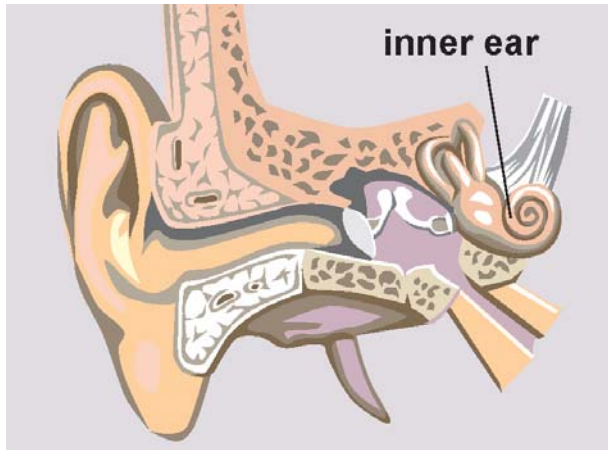
Get a baseline hearing test. Then, get a hearing test about once a year so you'll know your hearing protection is working. Hearing loss can occur gradually and you may not notice it if you don't get tested.

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# Noise Hazards



# Is Too Much Noise a Serious Problem?



If you are exposed to too much noise, you can lose your hearing — and you can lose your life.

On the job, too much noise can distract you. You may not hear warnings. Noise also damages the nerves in the inner ears. These nerves cannot be repaired.

After 15 to 20 years in the trade:

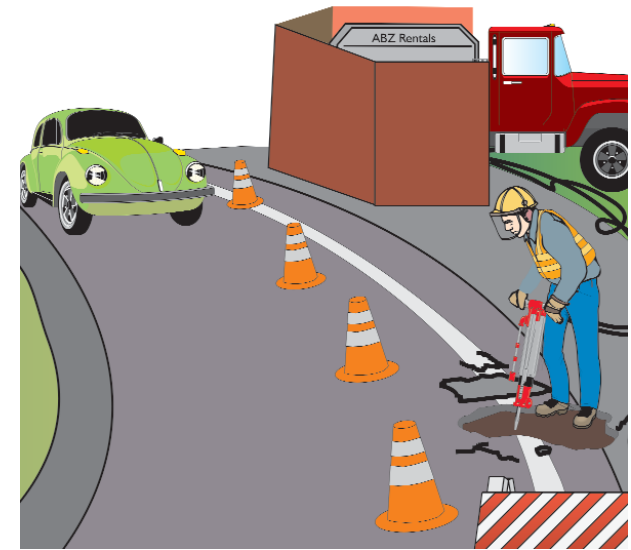
- You may suffer permanent hearing loss.
- You may hear constant ringing in your ears (tinnitus).

If you suffer hearing loss, you cannot hear well — especially when there is background noise. Hearing loss can adversely affect your family and personal life.

## What Noise Sources Are Most Common?

There are many noise sources in road construction. Some of the most common include:

- heavy equipment,
- pile driving,
- pavement breakers,
- traffic.



## Could Road Work Be Less Noisy?

Yes. There are efforts to make it quieter. Noise levels can be reduced by:

- Buy or rent quieter equipment.
- Keep equipment well maintained.
- Move noisy equipment away from workers.
- Put sound barriers around equipment.





## How Harmful Is Lead?

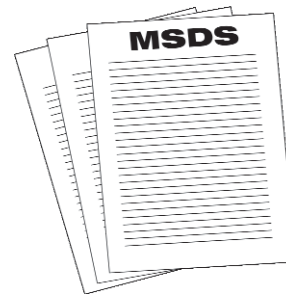
Lead damages the nervous system and the reproductive system. Lead may be found in paints during bridge renovations. Lead dust and fume can be inhaled or ingested during sandblasting, welding, and cutting. Lead dust can be carried home on clothes and can poison your family.

Prevent lead poisoning by:

- Removing paint before cutting or welding.
- Using long-handled torches.
- Using local exhaust ventilation.
- Wearing the proper respirator.
- Washing face and hands before eating, smoking, or drinking.
- Showering and changing clothes before leaving work.
- Getting your blood level tested periodically.

## Are There Other Health Hazards?

Other health hazards include common substances like solvents and carbon monoxide or special products such as sealants and paints. To avoid health hazards:



- Review the product Material Safety Data Sheets.
- Limit exposure as much as possible.
- Stay upwind of hazardous exposures.

- Make sure hazard controls like fans are working.
- Wear protective gear like respirators and skin coverings.

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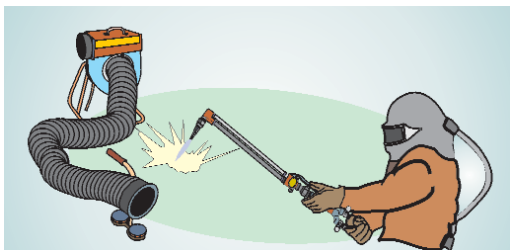
# Health Hazards



# How Do Health Hazards Harm Us?

Toxic substances can enter the body by three routes:

- breathing,
- swallowing, and
- skin contact or skin absorption.



The effects of toxic substances in the body may be:

- short-term (acute) — such as eye irritation or dizziness, or
- delayed (chronic) — such as cancer or chronic lung disease.

## How Harmful Is Silica?

Silica is in many construction dusts such as concrete and rock. Tasks that expose workers to large amounts of silica include sand blasting, rock drilling, and concrete drilling and grinding.

Long-term exposure to silica leads to lung disease (silicosis). Long-term exposure also increases the risk of cancer. You can prevent exposure to silica by:

- reducing airborne dust through ventilation and wetting and
- using NIOSH-approved toxic dust respirators.



## How Harmful Is Asphalt?

Asphalt fumes may cause eye and respiratory tract irritation. Hot asphalt can severely burn the skin.

To prevent exposure to asphalt:

- Work upwind whenever possible.
- Maintain a lower temperature to minimize fumes.
- Use ventilation on paving machines.
- Wear gloves and long-sleeved shirts to prevent skin contact.

## How Harmful Is Wet Concrete?

Wet concrete can cause dermatitis and skin burns. Dermatitis can be either an irritation from chemicals in the concrete or an allergic reaction. The allergic type is very difficult to cure.



The best practices for preventing dermatitis and burns include:

- Wear long-sleeved or gauntlet gloves.
- Keep concrete out of your boots.
- Change your gloves and your boots if they become contaminated inside.
- Wash your hands in clean water with pH-neutral soap.
- Try using a pH-neutralizing or buffering product.
- Protect all cuts with bandages.
- Wear eye protection.



## What Are the Hazards of Cold Weather?

Cold stress can lead to hypothermia and frostbite. Cold stress is caused by a



combination of cold or cool temperatures (50° F or less), wet weather and/or

conditions, high winds (40+ MPH), and inadequate clothing.

- Wear warm layers of correct clothing.
- Wear a head cover, warm gloves, and wool socks.
- Breaks in warm areas and hot liquids.
- Keep in good physical shape.
- Keep dry.

## How Are Plants and Animals Hazardous?

Plants and animals can cause rashes, illness, and even death. Outdoor work can expose you to animal bites, such as from



dogs or snakes, and to plants like poison ivy and poison oak.

To prevent problems:

- Steer clear of animals.
- Learn to recognize, avoid poisonous plants.
- Wear long-sleeved shirts and pants.
- Check for tick bites each day.
- Get prompt treatment.

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## Working Outdoors





## What Is Our Risk from Sun Exposure?



Skin cancer is the most serious risk. You are at greater risk if you have lighter skin with freckles or moles. Work at higher elevations and work around reflective material like concrete or water also increase your risk.

Sun exposure also causes sunburn. The full effect of sunburn may not be obvious for 24 hours. Severe reactions — known as “sun poisoning” — may include fever, chills, nausea, or rash.

You can protect yourself from both with:

- A long-sleeved shirt and pants in neutral colors.
- A broad-brimmed hat with a neck flap.
- Safety glasses with tinted polarizing lenses.
- SPF 15-25 sun block applied 30 minutes before work and reapplied every 2 to 3 hours.
- Frequent checks of skin for early signs of cancer and seeing a dermatologist for check-ups.

## What Are the Hazards of Hot Weather?

Hot weather can lead to heat stress, heat exhaustion, or heat stroke. Heat illness can be caused by a combination of:

- Heat exposure.
- High humidity.
- Non-breathing synthetic clothing.
- Not drinking enough fluids to replace sweat.
- Hard work, body heat, not being “acclimatized.”

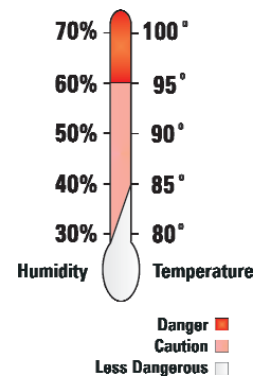


Heat stress can lead to heat rash, cramps, exhaustion, and stroke. Heat stress may be more likely if you are overweight and not fit. Alcohol greatly increases the risk.

## What Is Heat Exhaustion?

Heat exhaustion is a dangerous illness. Symptoms include:

- Extreme weakness or fatigue.
- Dizziness, confusion.
- Nausea.



- Clammy moist skin
- Pale or flushed complexion.
- Slightly elevated body temperature.

Heat exhaustion treatment includes resting in a cool, shaded place and drinking plenty of water.

## What Is Heat Stroke?

Heat stroke can cause hallucinations and death. Symptoms are red or spotted hot dry skin, no sweat, chills, high body temperature, mental confusion, and slurred speech. Call 911. Remove the victim to a cool shaded area. Soak clothes with water. Fan the body and apply ice to bring down temperature.

To protect yourself:

- Wear light-colored clothing.
- Gradually build up to heavy work.
- Schedule heavy work during coolest parts of day.
- Take more breaks in extreme heat and humidity.
- Drink lots of water, at least 2 to 3 quarts a day.





## How Do We Prepare for an Emergency?

You must know your employer's emergency plan.

Emergency planning includes:

- Warning system and signal to alert workers for evacuation.
- Everyone must know where emergency phone numbers are posted for hospital, fire fighters, utilities, etc.
- Everyone must know who the emergency coordinator is and who is trained in first aid/CPR.
- Everyone must be trained in the emergency plan and participate in regular drills.

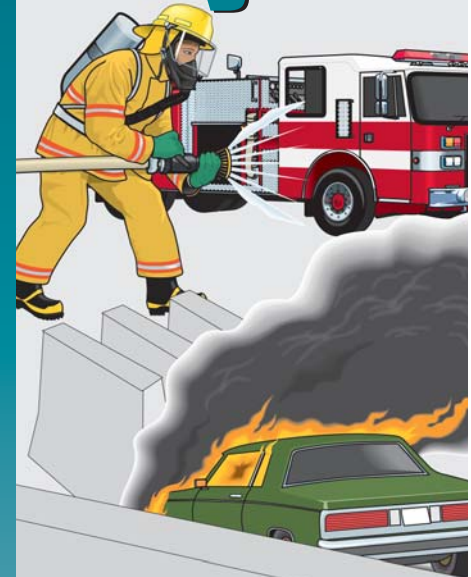


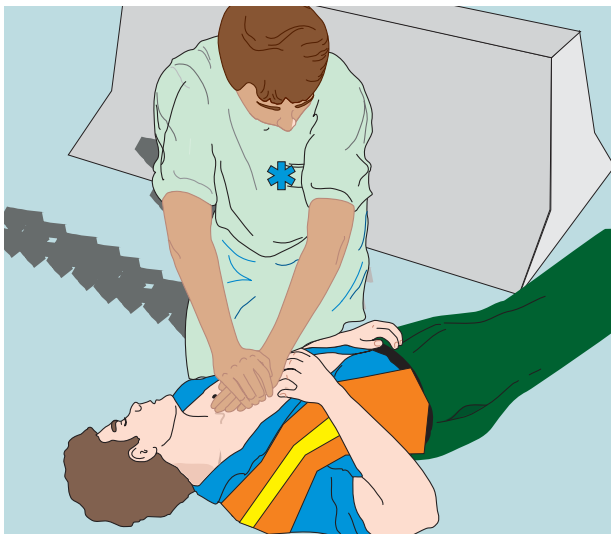
*The time for emergency planning is long before an emergency happens.*

*Unless everyone knows exactly what to do in an emergency, the result may be catastrophic.*

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## Emergencies

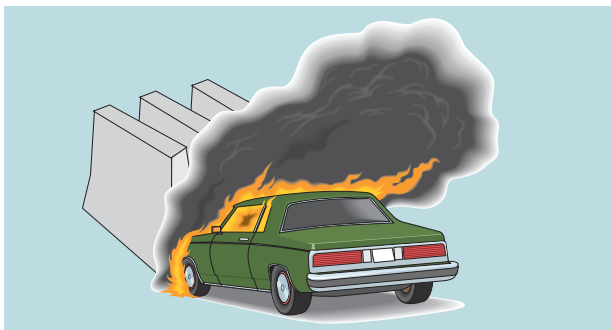




## What Emergencies Are Most Common?

There are many different types of emergencies that may happen on your job site. The most common types of emergencies that happen in road construction include:

- A worker is killed or seriously injured.
- Contact with a gas line or electrical power line.
- Trench collapse.
- Traffic entering the work zone.
- Toxic chemical spill.



## What Should We Do in an Emergency?

Your employer must have a plan for emergencies.

Everyone on the job site must know what the emergency plan is.

Here are some possible emergency steps:

- Call 911 and get medical help as soon as possible.



- Contact on-site first aid/CPR.
- Shut off any equipment and evacuate area if potential toxic exposures or explosions.
- On-site emergency coordinator contacts fire department/emergency response team.

- On-site emergency coordinator contacts utility company if applicable.



After an emergency, if you find you have been affected by a tragedy or near miss, ask for counseling.





## What Should Road Workers Remember?



Road workers face special driving hazards. Construction vehicle operators should:

- Keep cab clean to prevent slippery pedals and debris under brake pedal.
- Keep all window glass clean and in good repair to prevent distortion.
- Make sure all cargo is secured to prevent it from striking the cab.
- Be careful changing lanes. Change only when necessary.
- Keep a safe distance from vehicles in front of you.
- Back up as little as possible.
- Be especially cautious at rail crossings.

## What Should Road Workers Remember After a Night Shift?

Night work is not normal. You must compensate. Your health habits can make a huge difference.

On the work site, eat protein-rich foods and avoid sugars and fats. Drink plenty of water and avoid caffeine.

Only if you need it, drink coffee or another caffeinated beverage *after* work to help get you home.



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## Safe Driving



# How Do We Drive Safely?



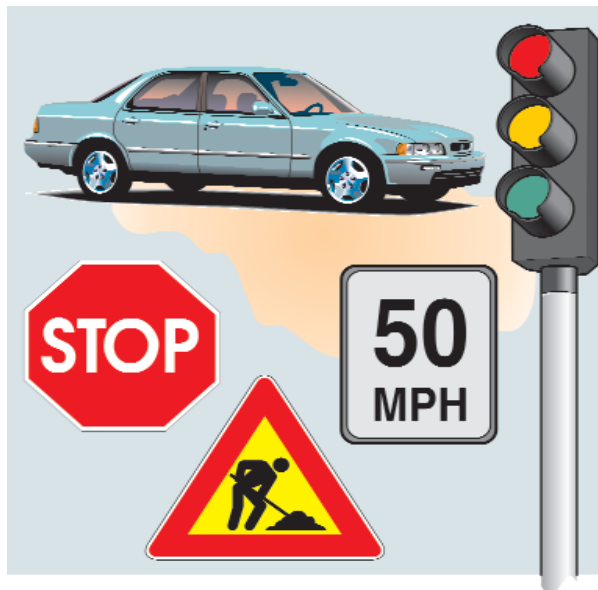
Each year many road construction workers die driving to or from work or between work sites.

Like other motorists, road construction workers should follow safe driving tips.

Safe driving tips include:

- Check the vehicle to make sure all safety devices (brakes, turn signals, headlights, tail lights, horn) are operable and effective.
- Adjust the mirrors to give yourself optimal views.
- Always wear your seatbelt.
- Avoid distractions — don't eat, drink, or talk on cell phone — pull over or ask passenger to make calls.

- Don't drive if you are drowsy or drunk. Even some prescription and over-the-counter (OTC) drugs can affect your driving.
- Don't speed. Go at or below posted limit — slower in bad conditions.
- Buy vehicles with front and side air bags and ABS brake system.
- Drive defensively.
- Avoid aggressive driving. For example, avoid quick lane changes and tailgating.



- Map out a route ahead of time if you are unfamiliar with where you are headed.



- Never let anyone ride in the bed of your pick-up truck.

