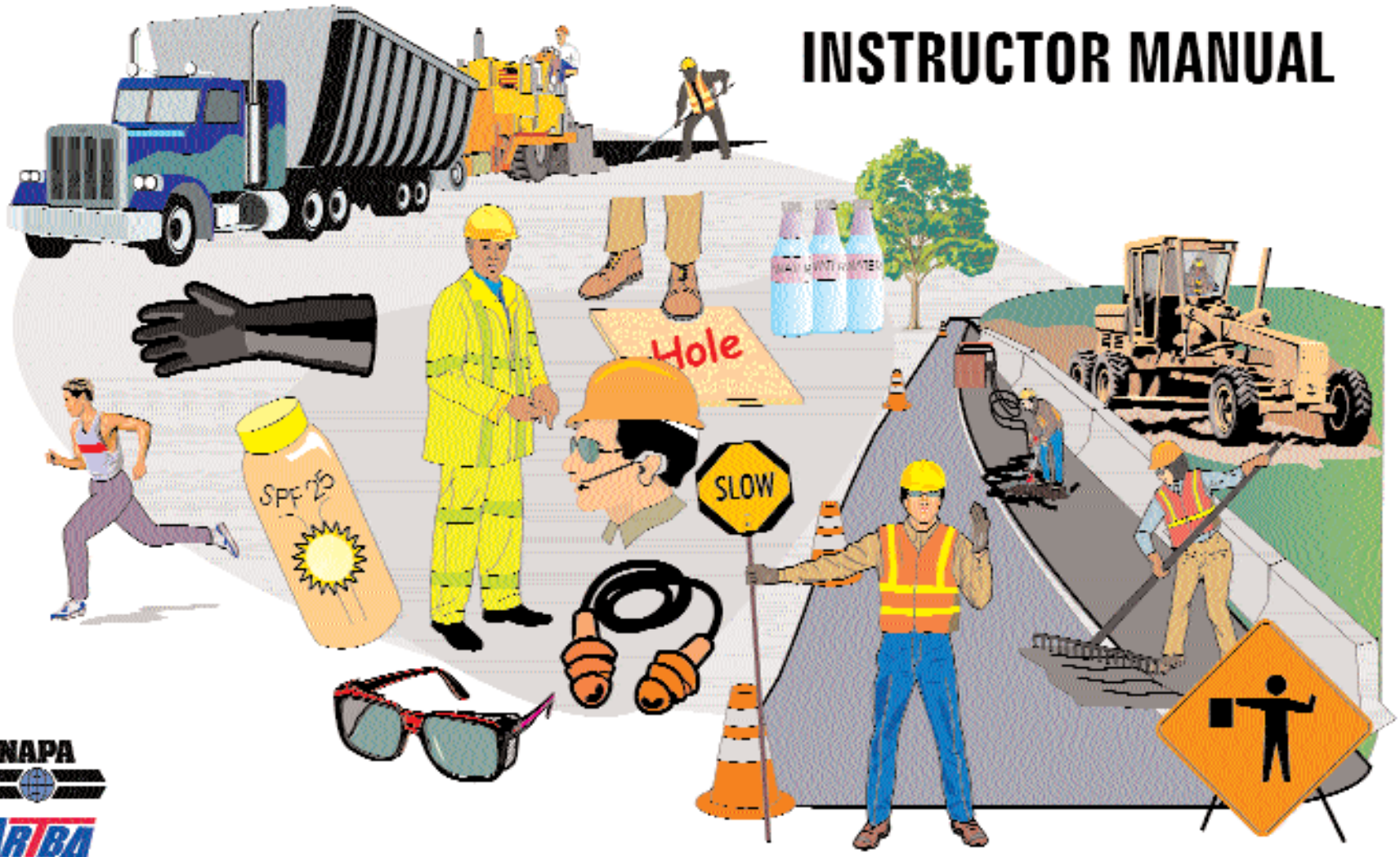
BEGIN INSTRUCTION ZONE

ROADWAY SAFETY

A Road Construction Industry Consortium Training Program

INSTRUCTOR MANUAL



NAPA

ARTBA

Laborers' International Union of North America
Laborers' Health and Safety Fund of North America

American Road & Transportation Builders Association

International Union of Operating Engineers

National Asphalt Pavement Association

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Who Can Deliver This Training Module?

The **Roadway Safety** Awareness Program is designed for use by supervisory personnel with some safety and health experience or by safety and health personnel to orient new workers as they arrive on the jobsite.

How Should an Instructor Deliver This Module?

As an instructor, you must do more than present knowledge. You must impact the trainee's attitude, belief, and behavior. Research shows that questioning interaction is the best method for influencing a trainee's attitudes and beliefs. Trainees must be able to voice their objections to new ideas and to contribute their own solutions to problems.

That is why the **Roadway Safety** Awareness Program is designed using the *QUESTIONING METHOD*. This manual presents a script which can be presented by any qualified instructor. The course content appears in the main column. The second column contains suggested questions and other relevant information designed to spark the interaction you need for effective classroom instruction.

Effective questioning helps you determine whether your trainees understand the information. It allows trainees to share their knowledge. Frank interaction helps trainees overcome their misunderstandings of the material. It helps instructors overcome resistance trainees may have to new information. Finally, frequent questioning prevents instructors from covering too much information too fast. Extensive use of questions is more time-consuming and requires a disciplined command of the topic. But it is the most effective method of classroom instruction.

What Does an Instructor Need to Deliver This Module?

1. A computer with CD drive, a projector, and the **Roadway Safety** CD, or
2. An overhead transparency projector and the **Roadway Safety** color overhead transparencies, or
3. The **Roadway Safety** color flipbook, and
4. **Roadway Safety** Trainee Booklets for all trainees.

Instruction Zone

Roadway Safety

A Road Construction Industry Consortium Awareness Program

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Introduction

ROADWAY SAFETY provides an overview of common hazards in highway and road construction and simple prevention measures. This program is not intended as a compliance guide. It is intended to help your company produce the worker awareness needed to achieve best practices. It is not a substitute for an OSHA 10 hour course or more in-depth training. It is a labor-management safety reminder before you start work on this site.

Building Roads and Highways Can Be Dangerous

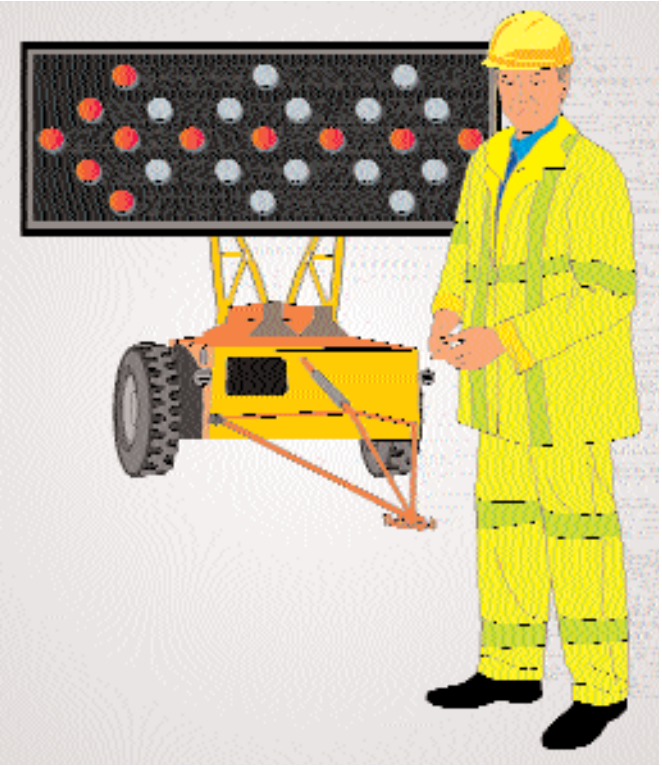
Each year:

- About 7,500 highway construction workers get hurt or sick.
- About 80 highway construction workers are killed.

Our work doesn't have to be dangerous if:

- We are made aware of the hazards.
- We are given ways to avoid the hazards.
- We raise safety concerns with our supervisors.

Working together, we can make sure everyone goes home safe and healthy.



NOTES:

Discuss here the purpose of the program - to provide an overview of the hazards as a reminder to new workers. It is NOT a stand-alone safety program. Not only does it not substitute for an OSHA 10-hour course, it is not sufficient training for workers in highway construction.

Ask trainees: How dangerous is highway construction?

NIOSH Workzone 2001 Report: 841 workers were killed in work zones from 1992 to 1998. About 60% were killed inside the work zone. 42% of these work zone fatalities were construction laborers, 9% were truck drivers, 8% were operating engineers, and 8% were supervisors.

In about 75% of work zone fatalities, a worker on foot was struck by a vehicle. Victims were as likely to be struck by a construction vehicle as by passing traffic.

NOTES:

Do Safety Programs Help?

Workers must follow company safety policies. Workers should:

- Follow all safety rules and practices.
- Avoid horseplay and reckless behavior.
- Join in safety discussions. Ask questions. Share your knowledge and experience.

Employers are responsible for determining whether employees understand the information.

Workers should join in safety discussions and ask questions. Share your knowledge and experience.

Module 1: Runovers/Backovers

Can We Be Safe Near Equipment/Traffic?

Workers on foot must:

- Remain alert at all times, in all places.
- Check surroundings often. Listen for warnings.
- Keep a safe distance from traffic.
- Stay behind protective barriers where possible.
- Look out for each other. Warn co-workers. Air horns can be used to warn co-workers.

Fig. RB-1. Stay behind protective barriers where possible.

NOTES:

(See Case Studies No. 3-5, pp. 55-56.)

Ask trainees: How many people are run over and die each year in highway work? (About 50 each year.)

In about 75% of work zone fatalities, a worker on foot was struck by a vehicle. About half of these vehicles were motorists and half were construction vehicles. So victims are as likely to be struck by a construction vehicle as by passing traffic.

About half the workers killed by trucks and construction vehicles were backed over. About 13% of the deaths were operators — more than a third of whom were not professional operators.

Workers can also be hit by debris from passing vehicles and by vehicle mirrors.

NOTES:

What Other Precautions Do We Need?

Employers must show the use of proper personal protective equipment. Workers must wear:

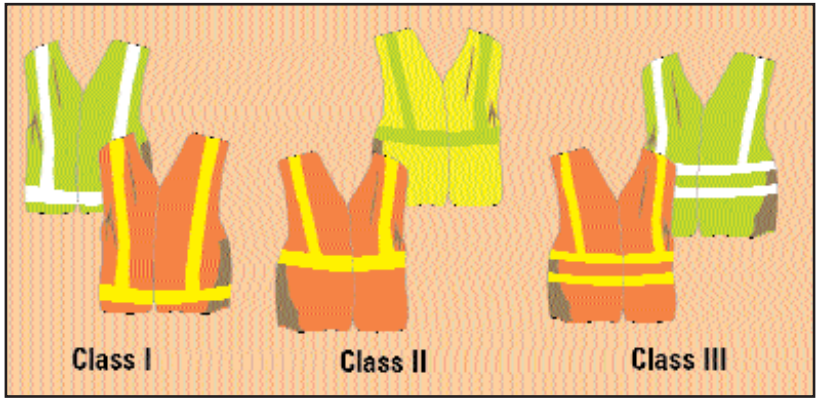


Fig. RB-2. Employers must show proper personal protective equipment (PPE) and train workers in its use. Workers must wear it.

- Proper class of safety vest at all times in the work zone.
- Other PPE as required.
- High-visibility clothing and head-gear. Bright-colored hard hats are more visible.

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. Examples of workers who wear Class I apparel include:

- Workers exposed to warehouse equipment traffic, and
- Roadside "right of way" or sidewalk maintenance workers.

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.

NOTES:

Examples of workers who use Class II apparel include:

- Forestry operations,
- Ship cargo loading operations,
- Roadway construction, utility, and railway workers,
- Survey crews,
- School crossing guards,

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. Examples of workers who use Class III apparel include:

- Roadway construction personnel and flaggers,
- Utility workers,
- Survey crews, and
- Emergency response personnel.

Class III applies most often in construction.

What About Construction Equipment?

Treat equipment and vehicles with caution. Around equipment and vehicles:

- Stay out of "blind spots."
- Communicate with drivers and operators by radio or hand signals, and/or eye contact.
- Don't approach until you communicate with the driver or operator and the driver or operator acknowledges you.
- Stay clear of vehicles. Know the traffic control plan.
- Have spotters to warn you when you must work with your back to equipment or oncoming traffic.

Fig. RB-3. Stay out of "blind spots."

Fig. RB-4. Communicate with the driver or operator and make sure the driver or operator acknowledges you

NOTES:

Blind spots can be very large on construction vehicles.

Are back up alarms enough warning? Why not? What else can you do?

NOTE: Systems available for preventing backovers include closed circuit TV cameras, back up radar systems. Additional mirrors are also helpful.

Remember: If you can't see the operator, the operator can't see you.

Recognize the swing radius on some equipment.

Be ready for possible sudden movements or changes in direction of equipment.

Module 2: Operator Safety

How Can Operators Stay Safe?

The first rule of operator safety is to unload and operate equipment only if you are qualified. Equipment operation basics include:

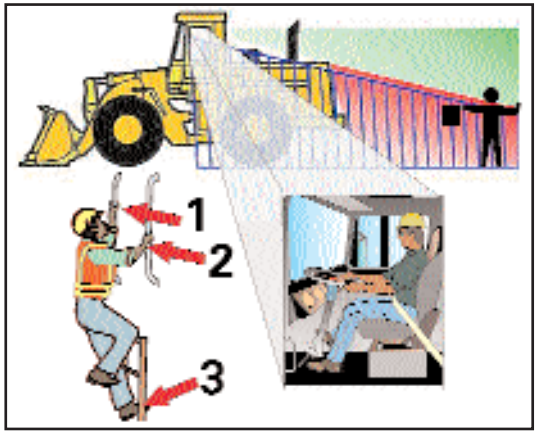


Fig. OS-1. Operate equipment only if you are qualified.

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

When entering and exiting equipment:

- Use 3 points of contact to prevent falls.
- Look for other moving equipment and vehicles.
- Wipe up all grease and fluids on equipment walking and working surfaces.

What Are Other Safety Measures?

Stay alert and aware of the hazards. When doing equipment maintenance and repair:

- Report all repair needs to your supervisor.
- Always lock out and tag out equipment that cannot be safely operated.

Fig. OS-2A. Lock out/tag out.

NOTES:

Note: Equipment should receive regular maintenance and repair. Maintenance inspections include hydraulics, brakes, parking brakes, lights, safety belts, etc.

Equipment Inspection Checklist
-Check fluid levels.
-Check tires for air pressure and excessive wear.
-Check for fluid leaks.
-Check safety devices: lights, back up alarms, safety belts.
-Check operator controls: brakes, steering, hydraulic controls, parking brake.
-Have operator manual available for operator.

Checklist should be modified for specific equipment and/or site conditions.

What about job stress? What kind of pressures is the operator under?

General safety tips:

- 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 and tag-out before repair or maintenance. Set the parking brake and chock the wheels. Block dump truck bed.

Fig. OS-2B. Never use cell phones, AM/FM radios, or CD players while operating equipment. Chock the wheels on locked out equipment.

How Can We Be Safe in the Work Zone?

The operator has special responsibilities in the work zone. You must know the job:

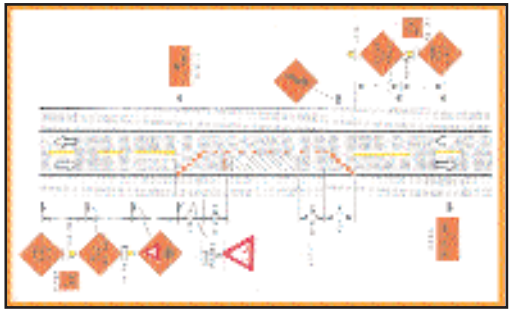


Fig. OS-3. The operator has special responsibilities in the work zone.

- Know the work zone and your position in it.
- Know the internal traffic control plan.
- Know designated routes for public and workers.
- Use designated equipment routes and areas.
- Identify rollover hazards such as unleveled areas, embankments, and unstable soil.
- If cones or barricades must be moved to perform a task, return them to their original positions as soon as the task is completed.

NOTES:

NOTE: AM/FM radios and CD players would just add to a worker's daily noise dose.

When possible, avoid parking equipment on grades. Use level areas.

To secure equipment, lower attachments such as buckets to the ground. Never leave equipment with suspended loads unattended.

How much is visibility a problem for operators? How can it be improved? What about backup video system? Has anyone experienced them?

What is an internal traffic control plan?

What about using spotters?

NOTES:

How Can We Protect Other Workers?

Fig. OS-4. Operators have a duty to watch out for other workers.

Always keep other workers in mind. On the work site:

- Know the locations of other workers around you at all times.
- Set up a means of communication with workers around you such as flaggers, grade checkers, and others.
- Never allow other workers to ride on equipment.
- Where possible, provide barriers between workers and equipment.
- Avoid excessive speeds and dangers caused by hills, obstacles, and curves.

Ask trainees: How do operators stay in better communication with workers on foot?

Use barriers around concrete breakers attached to heavy equipment to prevent injury or damage from flying concrete.

Suggest adding barricades around bike paths near the work zone.

Rope off or barricade cranes and backhoes to prevent injury from swinging machinery.

Module 3: Struck or Crushed

How Can Road Workers Be Struck?

Tools and materials are two major hazards:

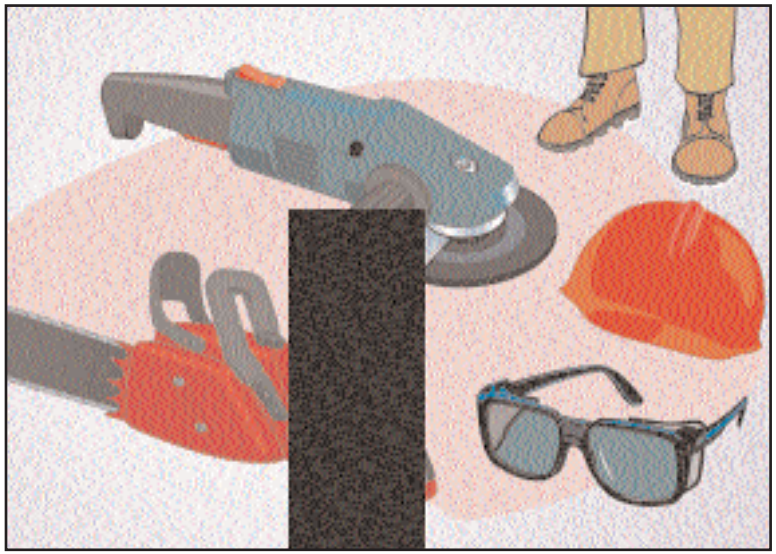


Fig. SC-1A. Tools and materials are two major hazards that can strike or crush workers.

- Use safe methods for rigging, hoisting, and setting steel plates, jersey barriers, manhole frames, and manhole covers.
- Use PPE — hard hats, footwear, eye protection.
- Use point of operation guarding on portable hand tools.
- Use chain saw safety program.
- Assess and use PPE.

To avoid being struck or crushed by materials:

- Keep workers out of lifting areas, from beneath loads.
- Use safe hoisting and rigging practices.

Fig. SC-1B. Keep workers from beneath loads.

NOTES:

Ask trainees: What percentage of the injuries are struck/crushed? (About 17% of all serious injuries in highway work involve workers being struck by things other than equipment. Another 3% are workers being crushed between objects. Together, these account for more than one-fifth of all serious injuries in highway work.)

What type of injuries do they get (fractures)?

Ask trainees: What kinds of things could you get hit by on our site? (Take examples from trainees.) How can we avoid this problem?

Operators should never swing loads over workers, traffic, or pedestrians.

NOTES:

Trees and equipment maintenance are hazards. To avoid being struck by trees:

- Restrict worker access during felling, trimming, loading.
- Falling Object Protective Structures (FOPS) on equipment.
- Use safe hoisting, rigging for logs and limbs.

To avoid being struck by equipment parts:

- Lockout/tagout/hazardous energy control during maintenance, repair, cleaning, and inspection.

Fig. SC-2B. Lock out and tag out during maintenance.

Fig. SC-2A. Trees and equipment maintenance are hazards that can crush or strike workers.

Ask trainees: What are some other items that we haven't discussed that can strike or crush workers in road work? (Answers include falling objects on bridge work, flying materials like plywood caught in the wind, rocks flying out from tires.)

Module 4: Flagger Safety

What Is the Main Hazard of Flagging?

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

- high speed traffic,
- angry or aggressive drivers, and
- after seeing flagger, a motorist going 60 mph needs almost 400 feet to stop.

Fig. FS-1A. Motorists kill about 20 flaggers each year.

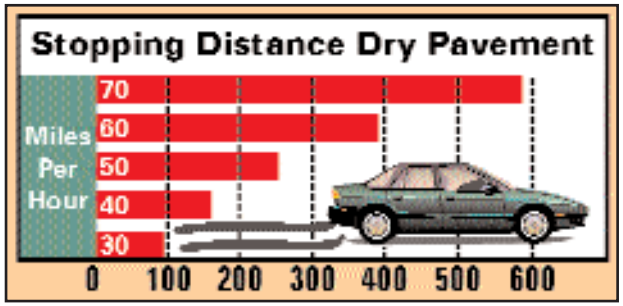


Fig. FS-1B. At 60 mph, a motorist needs 400 feet to stop on dry pavement.

Under the best road conditions, a motorist going 60 miles per hour needs 400 feet to stop. With wet road conditions, on gravel roads, and under other less than ideal conditions, motorists need many times that distance to stop.

NOTES:

Ask trainees to name the biggest hazard for flaggers.

Ask trainees: How long would it take you to get out of the way if you saw a speeding car?

CD DEMO: Stopping Distances
If you are using the CD, you can demonstrate various stopping distances like this:

At the bottom of the image of STOPPING DISTANCE DRY PAVEMENT is a green bar that says "Click Here to Look at Stopping Distances."
-Clicking this bar takes you to a separate screen. Here you must select a speed and a road condition from the two pull-down lists.
-Now click the START button.
-After the car starts, click the BRAKE button to see the stopping distance for that combination of speed and road condition.
-To see stopping distances for other speeds and distances, just make new selections and repeat.

How Can We Protect Ourselves?

Be visible and wear protective equipment. Wear high visibility clothing:

- orange, yellow, or green vest,
- retro-reflective vest at night.

Fig. FS-2A. Vests come in 3 classes, depending on the traffic conditions surrounding the work zone. Vests are orange, yellow, or green.

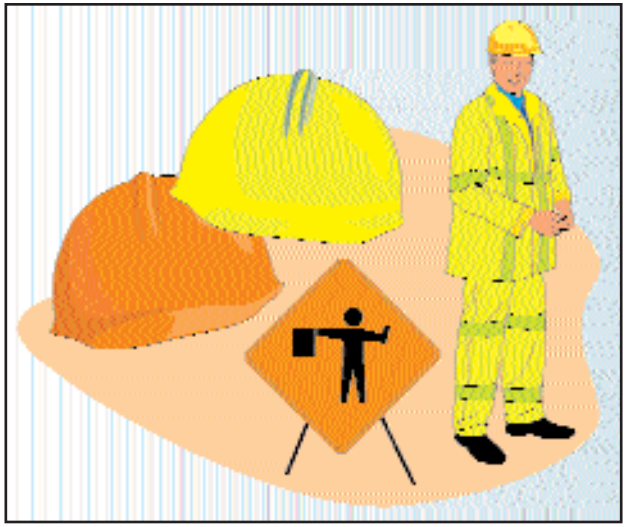


Fig. FS-2B. For flagging in cold or wet weather, wear retro-reflective overcoat or rain gear.

Wear protective equipment:

- hard hat,
- long-sleeved shirt and pants, and
- appropriate clothes for expected weather (rain gear, warm coat).

If you have questions about what clothing to wear or what protective equipment is required, ask your supervisor.

NOTES:

Flaggers should be trained and certified.

Describe the 3 classes of vests and what each is used for, as found on pages 8 and 9 in the Runover/Backover module.

If possible, safety vests and clothing should contrast with traffic control devices to make it easier for motorists to see a flagger.

In addition to wearing proper gear, flaggers must stay alert and out of harm's way.

Keep your guard up:

- Stand alone on the shoulder in clear view.
- Plan an escape route for emergencies.
- Stay in communication with other traffic control workers.
- Stay alert and keep focused on work.
- Make sure your hand signals don't conflict with traffic signals.

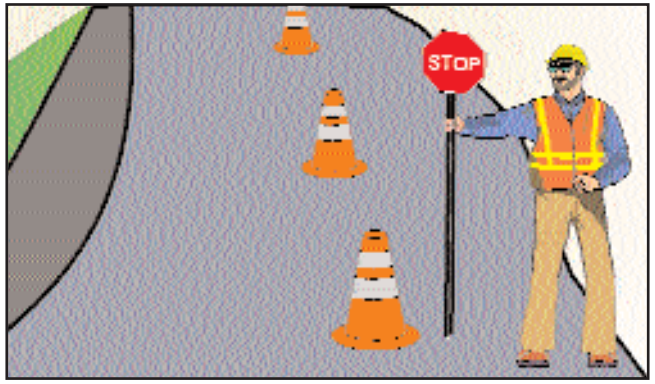


Fig. FS-3A. Keep your guard up. Stand alone on the shoulder in clear view. Plan an escape route.

Fig. FS-3B. Make sure your hand signals don't conflict with traffic signals.

- Treat motorists with respect and courtesy.
  Don't pick fights or respond to anger. Notify law enforcement when motorists do not obey flaggers.

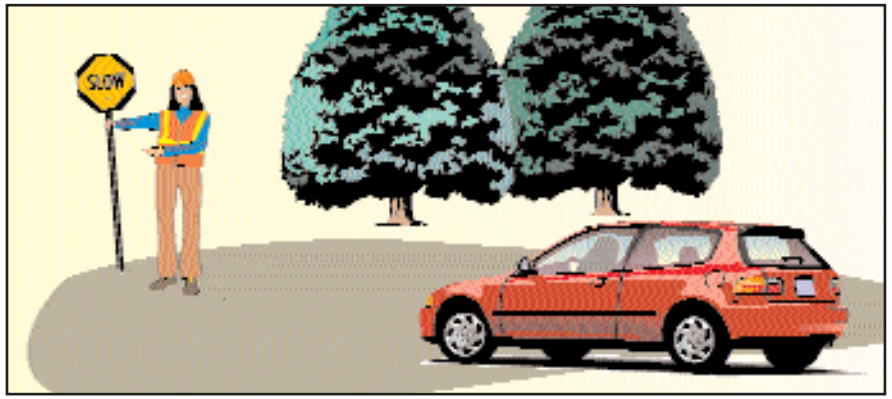


Fig. FS-3C. Treat motorists with respect and courtesy.

NOTES:

Use an air horn or cones equipped with air horns to warn co-workers of an incursion.

NOTE: The new remote control flagger stations provide additional protection for flaggers.

NOTES:

What Should Flaggers Avoid?

Flaggers must avoid dangerous behavior. Here are some flagging DON'TS:

- 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.

Fig. FS-4. Flaggers must avoid dangerous behavior.

NOTES:

Module 5: Night Work

What Are the Special Challenges?

Over the last 10 years the amount of road construction work performed at night has risen. As traffic congestion increases in urban areas, night work will continue to be a fundamental part of the road construction industry.

Fig. NW-1A. Night work changes the work environment and requires many adjustments.

Ask trainees: Have you ever worked at night before? How much more dangerous is night work? How did it affect your family life?

Night operations change the work environment. On the work site, we must deal with these night-time issues:

- roadway visibility for motorists,
- work zone visibility for workers,
- communication between shifts,
- impaired drivers, and
- risk of drowsy motorists.

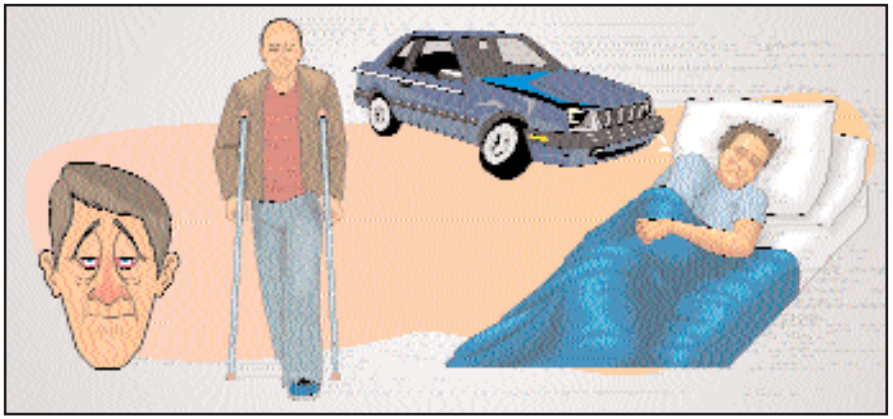


Fig. NW-1B. Night work causes physical and social disruptions.

Ask trainees: How far does a headlight beam shine compared with the stopping distance of the car?

Night work causes physical and social disruptions, such as:

- sleep deprivation or disruption,
- risk of injury from drowsiness, and
- impaired personal relationships.

How Can We Protect Ourselves at Night?

Use these SPECIAL PRECAUTIONS at the site for night work. First, increase visibility:

- retro-reflective clothing,
- flashing lights on body/clothing,
- retro-reflective tape on equipment, and
- adequate work area lighting.

Second, know your surroundings:

- vehicle and equipment paths,
- assigned work areas,
- safe paths to/from work locations,
- on foot, watch out for equipment,
- on equipment, watch for workers.

Fig. NW-2. Night work requires many special precautions, including increased visibility and knowledge of surroundings.

A typical roadway construction project is a fast-paced series of interconnected operations involving work crews, construction equipment and vehicles, and traveling motorists.

Construction work zones do not change significantly from day to night, but our perception of them is dramatically different.

Workers on foot especially need to consider the work site in general and note any potentially dangerous areas or potential situations. They should also be familiar with the internal traffic control plan for the job, if any, and especially understand the locations where they are to work and move about safely.

NOTES:

DEMONSTRATION:
Use a retro-reflective vest and a flashlight for this demonstration. Turn off the lights and shine the flashlight on the retro-reflective vest to demonstrate its effectiveness.

What is retro-reflective?
Next time you're driving at night, think about how the road signs magically light up so you can read them as you pass. These signs are retro-reflective. The sign surface has either glass spheres or triangular prisms (pyramids) that take the headlight beam and bend it back to the car driver and passengers. The retro-reflected light returns to the driver as a cone of light. Anyone outside the cone will not see the sign at night.

NOTE: Operators should check the lights on their equipment to make sure they are operational. Use flashing/strobe lights on equipment and trucks.

Fig. NW-3. Night work requires many special precautions, including increased visibility and knowledge of surroundings.

Third, provide positive motorist guidance. Increase visibility:

- position signs for best visibility,
- use changing message or arrow signs,
- space drums and cones closer together, and
- use proper lighting and contrast work lights from warning lights.

Fourth, inspect the traffic control setup:

- test drive to highlight problems and
- inspect it frequently.

How Can Our Health Habits Help?

Night work is not normal. You must compensate. On the work site:

- Eat protein-rich meals and avoid sugars and fats.
- Drink water. Avoid caffeine.

At home:

- Make sleep a priority.
- Follow a pre-sleep routine.
- Have light snack before bed.
- Keep daylight out.
- Eat family meals together.
- Plan non-nighttime social activities.

Fig. NW-4. Good health habits can help.

NOTES:

NOTE: Lighted flagger stations can be helpful.

CAUTION: Motorists may be blinded by work zone work lights.

Shadows on the work site can also be a hazard of night work.

Module 6: Excavation

Why Are Trenches Dangerous?

A trench is an excavation deeper than it is wide. Trenches more than 4' deep must be treated as confined spaces. An excavation with formwork 15 feet or less from a sidewall is also a trench.

Trenches can kill:

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

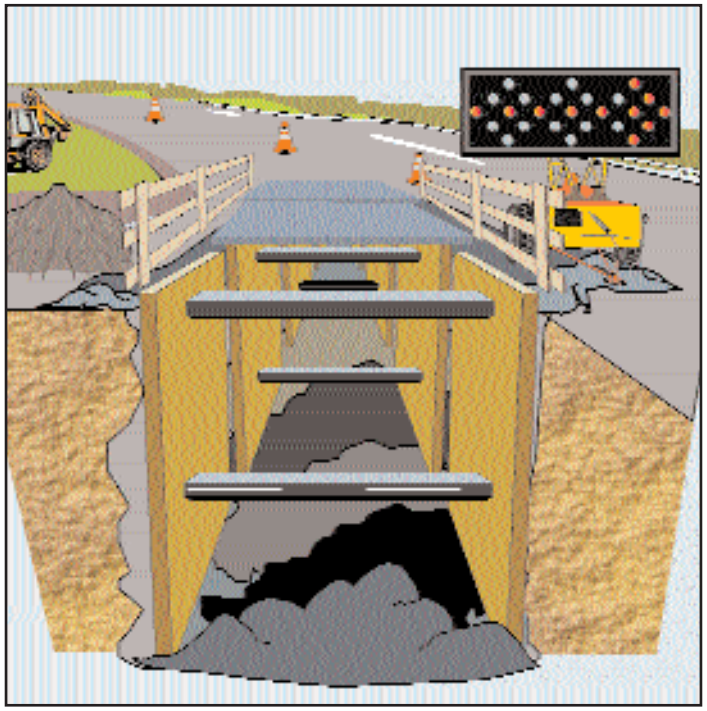


Fig. T-1. An excavation with formwork 15 feet or less from a sidewall is a trench.

Before digging:

- Call all electrical, gas, and communications utilities.
- Use extreme caution with equipment near the trench rim.

NOTES:

(See Case Studies No. 6 - 7, p. 57.)

Ask trainees: When does a trench become a confined space? Answer: OSHA Confined Space Standard 1915.4(p) defines "confined space" as a compartment of small size and limited access ... or other space which by its small size and confined nature can readily create or aggravate a hazardous exposure.

Ask trainees: How long does it take for a trench to collapse? (Answer: Seconds.) How much does the dirt weigh? (3,000 pounds per cubic yard.)

What if you are only buried up to your neck? Could you still breathe? (Answer: Usually not.)

CAUTION: If water collects in the bottom, it increases the potential for a cave-in.

How Do We Prevent Cave-Ins?

Trenches 5 feet or deeper require support — unless they are in solid rock.

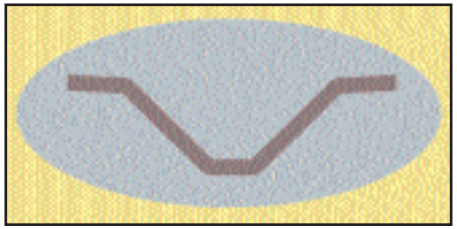


Fig. T-2A. Sloping.

The four basic types of trench support are:

- Sloping — soil removed at an angle to increase stability.
- Benching — a series of steps in the trench wall.
- Shoring — a support system made of posts, wales, struts, and sheeting or aluminum hydraulic shoring.

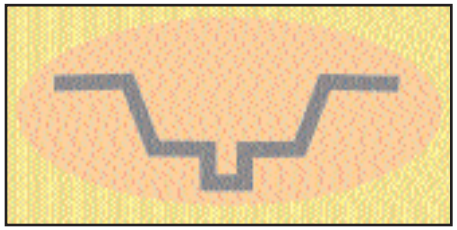


Fig. T-2B. Benching.

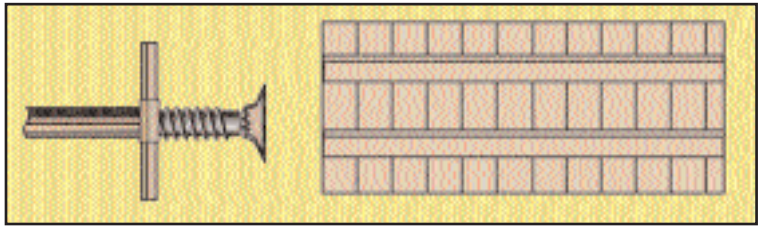


Fig. T-2C. Shoring.

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

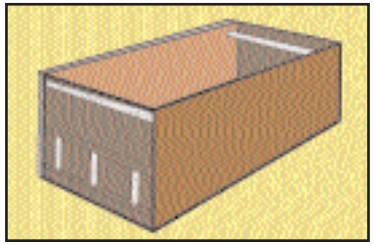


Fig. T-2D. Shielding.

Always keep spoil piles away from trench edge.

NOTES:

Remember: Soil weighs 3,000 pounds per cubic yard.

Ask trainees: Under what circumstances should you go into an unshored trench? (Answer: Never.)

What Else Does Excavation Require?

The employer should designate 'competent person' to monitor all trench work.

The 'competent person' must inspect the trench:

- At least daily and at the beginning of each shift.
- After precipitation, a thaw, and other events that could increase hazards.
- For disturbed ground, water, toxics, and other hazards.
- For sagging or cracked walls or bottom bulges.
- To assure that spoil is kept at least 2 feet from the trench edge.

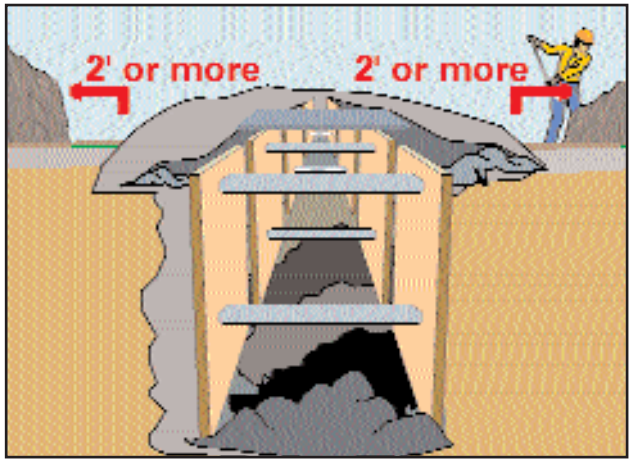


Fig. T-3A. The 'competent person' must assure that spoil is kept at least 2 feet from the trench edge.

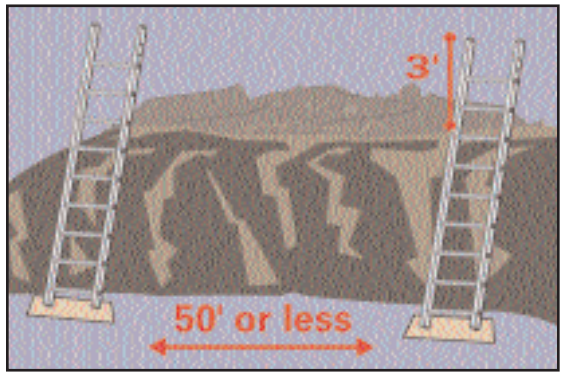


Fig. T-3B. The 'competent person' must assure that ladders are placed so that no worker is more than 25 feet from an exit.

- For nearby vibration sources such as railroads or pile driving.
- To assure that ladders are placed so that no worker is more than 25 feet from an exit.

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

NOTES:

'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."

Ask trainees: Who is the competent person on this job site?

Module 7: Electrical Hazards

What Are the Dangers of Electricity?

Contact with electricity can cause fire, explosion, or electrocution.

On the work site:

- Equipment contacting a live electrical line can cause fire, explosion, or electrocution.
- Electricity can arc from the electrical line to the equipment and cause the same outcome as if you had grabbed it with your hands.
- Electricity can cause severe burns and death.

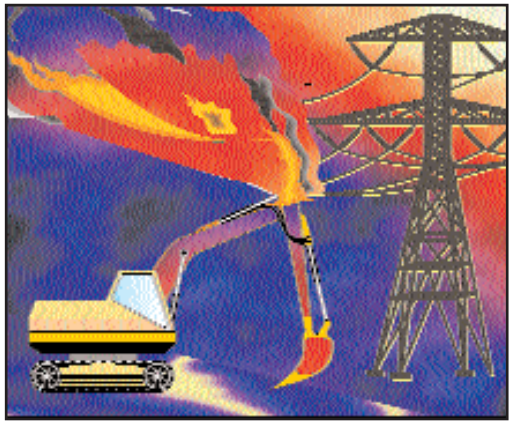


Fig. EH-1. The dangers of electricity include fire, explosion, and electrocution.

Minimum Safe Distances 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	

Fig. EH-2. Keep your distance from overhead power lines.

Work around electricity:

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

How Do We Treat Above-Ground Utilities?

Use extreme caution and keep your distance. Equipment, such as cranes or dump trucks, must not come within 10 feet of an energized power line.

When working around a power line:

- Get utility company to mark, flag, and shield lines.
- Assume it is live until tested. Have it de-energized and visibly grounded.

NOTES:

Ask trainees to name the dangers of electricity.

Electricity must always be respected. The best protection is distance. Only work around it if you have a reason to be there and you have been trained in all aspects of that job.

Ask trainees: How many workers die each year from electrocutions in highway work? (About 60-80 construction workers are killed each year by contact with overhead lines. Most work in the utility industry.)

(See Case Studies No. 1 - 2, pp. 53 - 54.)

Ask trainees: Are there any electrical hazards on our site? Where? How can we make sure people avoid disturbing them?

NOTE: A distance greater than 10 feet may be necessary if is foggy or windy.

- If it must remain energized, maintain the appropriate safe distance (Fig. EH-2) but in no case less than 10 feet.
- Post signs to mark a safe distance from the lines to help keep equipment away.
- Make all workers and drivers who must enter the area aware of the overhead lines.

Tips for operators include:

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

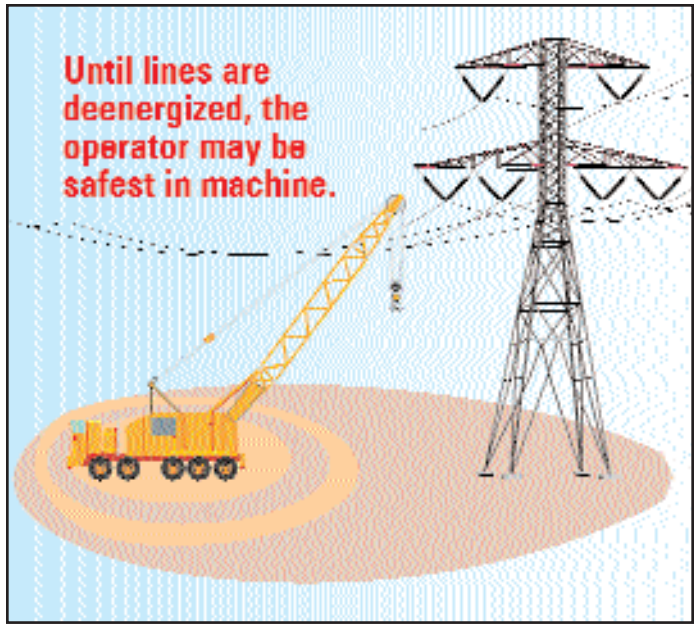


Fig. EH-3. Do not touch any equipment or any person in contact with a power line.

What If Contact Happens?

Never touch any equipment or person who is in contact with a power line.

If you are on the ground:

- Stay away from the vehicle!
- Do not touch any equipment or person in contact with the line.
- Get the lines de-energized.

If you are in the vehicle:

- Stay in the vehicle and do not touch any metal.
- If you must get out, jump clear, then shuffle slowly away, keeping both feet in contact with the ground. Keep your feet together to help prevent current from running through your body.

NOTES:

NOTE: The safe distance includes any part of the equipment, rigging, and load.

Use a spotter when cranes or other equipment work in proximity to overhead lines.

NOTES:

Can We Be Safe Around Buried Utilities?

Contact with buried utilities can cause explosion, fire, and electrocution.

Digging equipment used to open trenches and excavations can contact live buried utilities such as electrical, gas, and communication lines. This can result in explosions, fires, electrocutions and loss of essential services — and puts both the worker and the public in danger.

Before digging:

- Call electrical, gas, and communications utilities.
- Review marked out areas. Marked out areas may not be exact. Dig by hand within 3 feet of mark-out.

Be careful. Sometimes the utility can be wrong. When digging, look for signs of utilities:

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

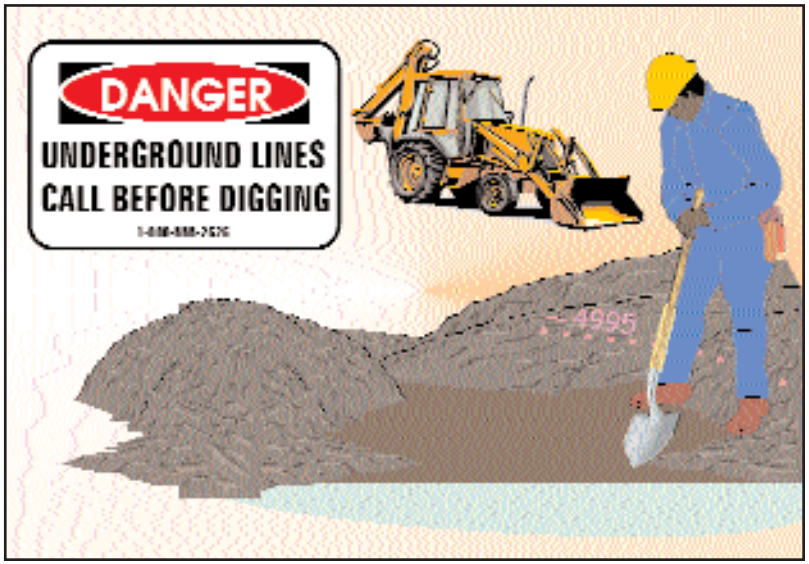


Fig. EH-4. Contact with buried utilities is just as hazardous as contact with overhead lines. It can cause explosion, fire, electrocution.

If a line is hit, you must report it to the utility company — even if you only dented or bent it. Even a small bend or dent in a utility line can lead to serious hazards later.

If you hit a gas line, evacuate the area, secure the area, and call the fire department.

Often there is one number to call about below ground utilities (for example, Miss Utilities).

Color code painted on surface:

YELLOW	*Gas Line*
RED	*Electrical*
BLUE	*Water*
ORANGE	*Telecommunications*
GREEN	*Sewer*

Some utility companies use ribbons as identifiers.

Ask trainees: What do you do if you hit a gas line?

NOTES:

Module 8: Sprains and Strains

What Injuries Are Most Common?

Sprain and strain injuries can happen once or can accumulate. Common sprain/strain injuries in road work:

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

43% of lost work day injuries in roadway construction are sprains and strains.

Out of 7,933 highway workers with lost workday injuries in 2000, 3,378 had sprains or strains.

Another 85 had carpal tunnel syndrome or tendonitis.

Back injuries are the most common sprains and strains in construction.

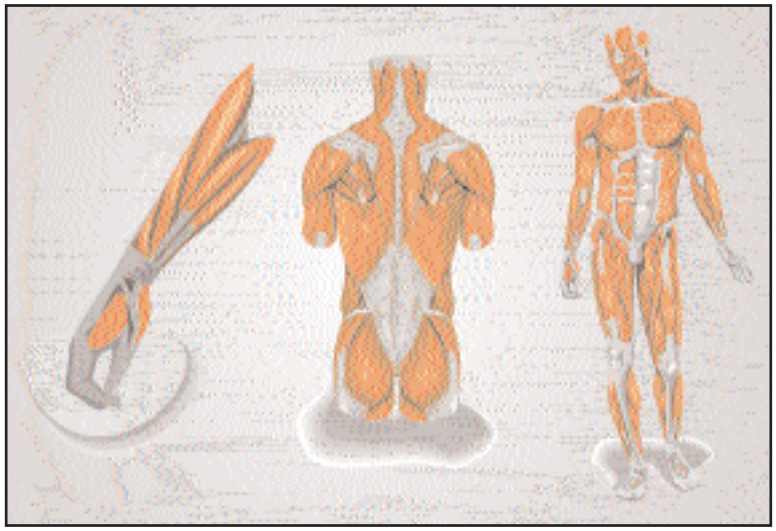


Fig. SS-1. Sprain and strain injuries can happen once or can accumulate.

Ask trainees: Do you ever have muscle aches and pains at the end of a work day? Where? Back, shoulders, knees?

Has anyone ever missed work because of a sprain/strain injury?

What Causes These Injuries?

Think of the most difficult parts of your job. These injuries may be caused by:

Fig. SS-2. Think of the most difficult parts of your job. Awkward postures, lifting heavy materials, repetitive work, and vibrating tools all can cause sprains and strains.

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

NOTES:

Report sprains or strains just as you would report any other injury.

How Can We Avoid Sprains and Strains?

Think of ways to do the job differently. Work can be made easier:

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

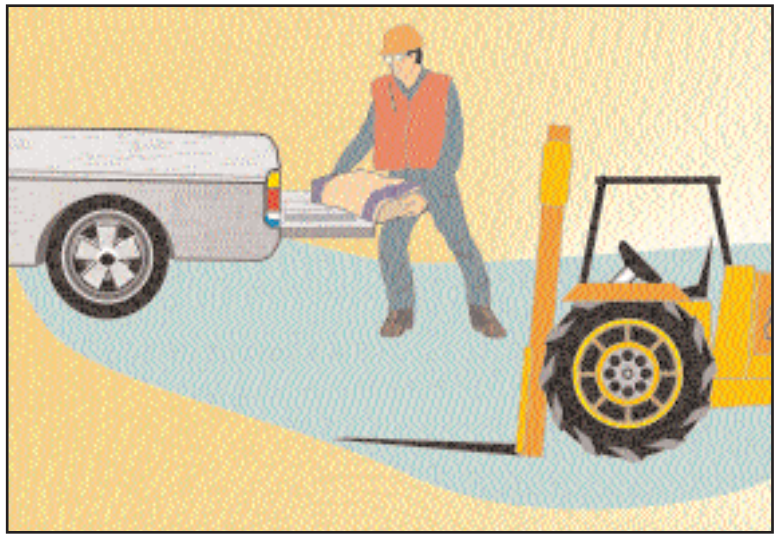


Fig. SS-3A. Work can be made easier by thinking of ways to do the job differently.

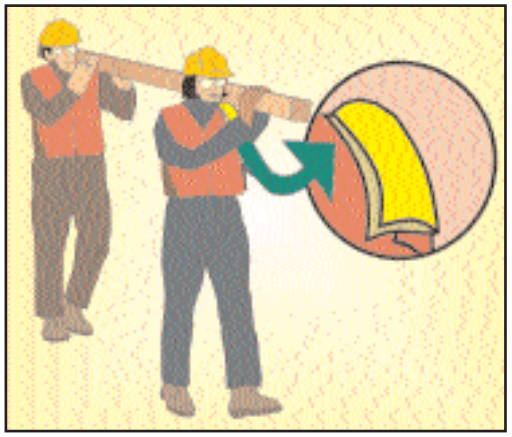


Fig. SS-3B. Use shoulder pads, knee pads, and gloves as needed.

PPE and breaks can help:

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

NOTES:

Ask trainees: What ways could your risk of injury be reduced? How could we work smarter, not harder? How could the work be made easier to prevent sprains and strains?

For operators, whole body vibration can be minimized by maintaining seat cushions and suspension.

NOTES:

What Can You Do to Prevent Injuries?

Do at least some of these measures. To prevent injuries:

- 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.

Fig. SS-4A. Don't lift too much by yourself.

Fig. SS-4B. Use proper lifting technique. Lift with your legs not your back.

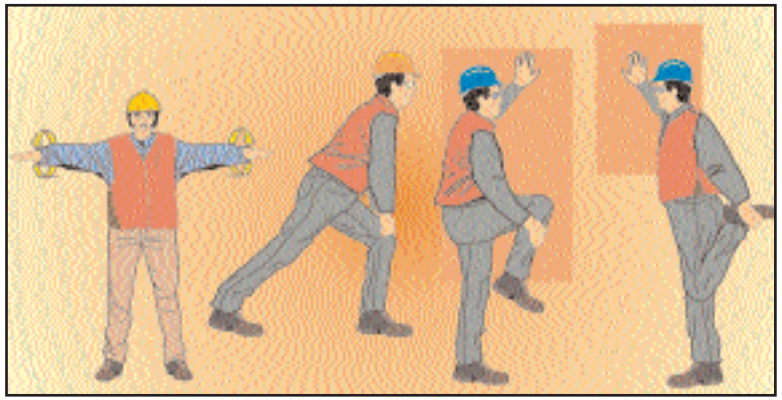


Fig. SS-4C. Do stretching exercises before work.

Module 9: Fall Hazards

What Causes Falls in Road Work?

Most of the work in heavy and highway construction — which excludes bridges and tunnel work — is done on or near the ground. This means that the most falls results from slips or trips on the same level. Falls on walking and working surfaces involve:

- 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, and

Fig. FH-1A. Most falls in road construction result from slips or trips on the same level.

- slips or trips in muddy, wet, or icy conditions.

There are some falls from elevations in road work. The most common include:

- falls from riding in or on moving equipment,
- falls while mounting or dismounting vehicles and equipment,
- falls from bridges,
- falls from formwork, and
- falls into excavations.

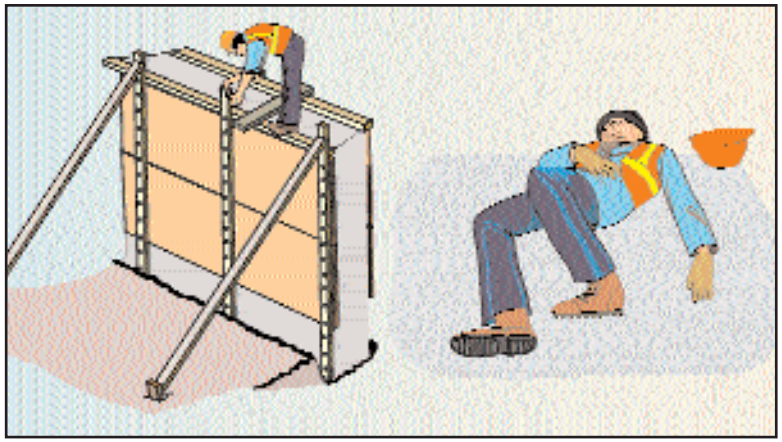


Fig. FH-1B. In road work, there are some falls from elevations. Even falls from a few feet can kill. OSHA requires fall protection for work at 6 feet above any surface.

NOTES:

Ask trainees: What percentage of injuries in highway work are due to falls? (Falls are the second leading cause of serious injuries in highway construction. Almost 17% of all lost workday injuries in highway construction are due to falls. About half of these falls were to lower levels and about half were falls on the same level.)

Can you get killed from even a short fall?

What are the most common tripping hazards?

Missing the last step when climbing off a vehicle is a big problem.

Many workers fall when crawling onto a truck to check the water level.

Note: OSHA requires fall protection above 6 feet. OSHA also requires fall protection below 6 feet if workers can fall into or onto dangerous equipment.

NOTES:

How Do We Prevent Falls on Same Level?

There are many simple methods for preventing falls on the same level in road construction. Try to do as many as possible. Just a few of them include:

- If possible, avoid walking on 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.
- Fill in or mark hidden holes in ground.
- Clear walking/working surfaces of tripping hazards.
- Include walking routes in site safety plan.

One of the best things we can all do to protect ourselves from all types of falls is to maintain good physical strength and conditioning. No matter what shape we're in, we can improve it.

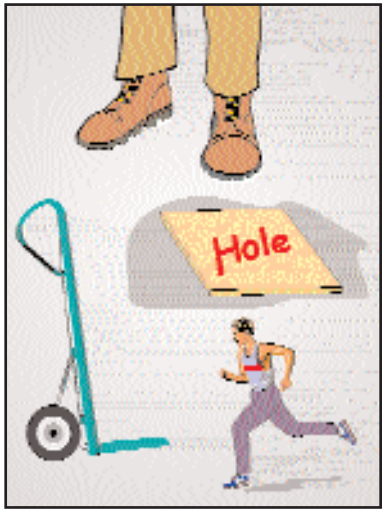


Fig. FH-2. There are simple methods for preventing falls on the same level.

How can we improve good housekeeping on this site?

How Do We Avoid Falls From Elevations?

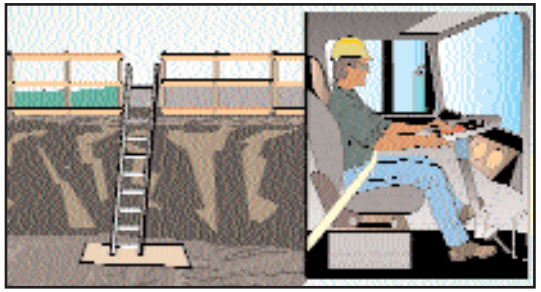


Fig. FH-3. There are many methods for preventing falls from elevations.

There are also many methods for preventing falls from elevations. Some of these methods include:

- a 100% fall protection program,
- pre-plan work for personal fall arrest,
- erect guardrails around large excavations,
- seatbelts or restraints for riding in cars,
- modular erection to avoid work at heights on forms,
- using 3-point contact on ladders.

These are OSHA-required fall protection methods. Ask trainees if they can think of smaller ways to prevent falls every day. For example, to eliminate the hazard of falling from a water truck while trying to see how much water is left, you can place a sight glass (mirrored device) on top of it. That way, workers can stay on the ground and still see how much water is left.

Module 10: Noise Hazards

Is Too Much Noise a Serious Problem?

Noise is probably one of the most common hazards in construction. But it often goes unrecognized because hearing loss creeps up on you. It doesn't happen all at once.

When you are exposed to too much noise, you can lose your hearing. You can also lose your life. On the job:

- Noise can distract you. You may not hear warnings.
- Noise damages the nerves in the inner ear. The nerves cannot be repaired.

After 15 to 20 years in the trade:

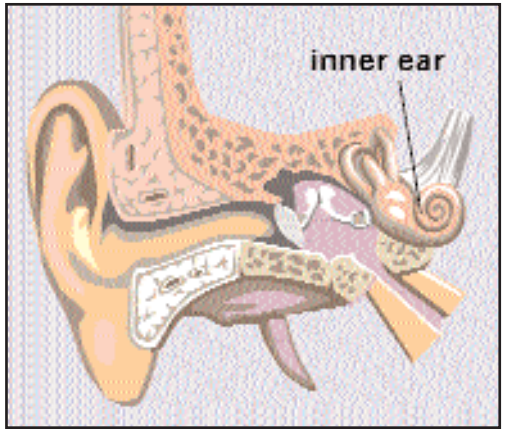


Fig. NH-1. Noise can distract you and cause permanent hearing loss.

Fig. NH-2. There are many noise sources in road construction work.

- You may suffer permanent hearing loss.
- You may suffer constant ringing (tinnitus).

Some of the most common noise sources in road construction are:

- heavy equipment,
- pile driving,
- pavement breakers,
- compressors,
- other noise sources.

NOTES:

Ask trainees: Do you know any co-workers with hearing loss? Family members? Grandparents?

Hearing experts say that our ears have a finite lifetime capacity for noise exposure. Even lower levels of noise use up this capacity. Exposure to higher levels of noise for continuous periods uses up your lifetime capacity too soon.

After years of too much noise, the nerve cells in the inner ear die. You slowly loose the ability to hear and understand speech. Then suddenly you realize you are hearing impaired.

Ask trainees: What are other noise sources? Examples: traffic, compactors, and milling machines.

Discuss non-occupational noise exposures and the need to protect from them as well (lawn mowers, rock concerts, headphones, motorcycles).

Could Road Work Be Less Noisy?

Yes. There are efforts being made by engineers, manufacturers, and contractors to make road construction more quiet.

Noise levels can be reduced by:

- buying/renting less noisy equipment,
- keeping equipment well maintained,
- trying to isolate noisy equipment,
- keeping equipment well maintained, and
- using sound barriers around equipment.

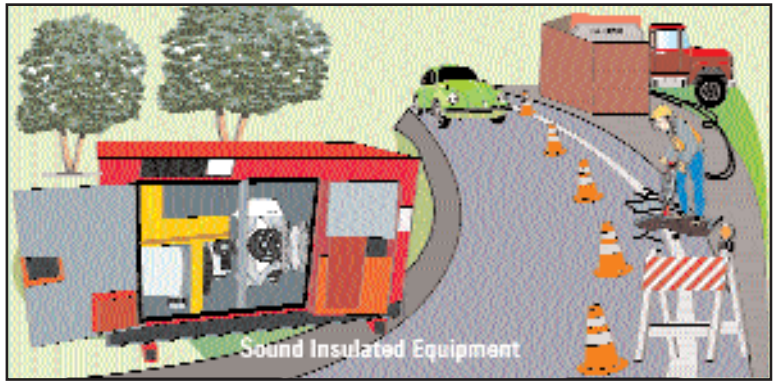


Fig. NH-3. There are many new and effective ways to reduce noise in road construction.

Fig. NH-4. PPE and hearing tests.

How Do We Protect Our Hearing Now?

Wear hearing protectors. If you must shout to talk with someone 3 feet away, you need protection from noise:

- Use hearing protectors provided by your employer.
- Notify employer if proper hearing protection is not available.
- Make sure hearing protection fits and is comfortable.
- Follow instructions for proper hearing protection use.
- Get a baseline hearing test. Then test about once a year so you'll know your hearing protection is working.

NOTES:

DEMONSTRATION:
Use a sound level meter (an inexpensive meter can be purchased from Radio Shack for about $35) to show trainees how it measures sound levels. Use it to measure non-occupational noise sources.

What are some early signs of hearing loss? Have you ever driven home with the car radio on and when you started it up the next morning it blasts in your face? You probably experienced some temporary hearing loss that previous day. Or do you have to turn up the TV to listen and your family complains that it's too loud? Or do you have a hard time hearing conversation in a noisy room or on the job site? If so, these may be early signs of hearing loss.

Hearing loss often comes on gradually and unnoticed. That's why hearing tests are so important.

Module 11: Health Hazards

How Do Health Hazards Harm Us?

Toxic substances can enter the body by 3 routes. The effects of toxic substances may be:

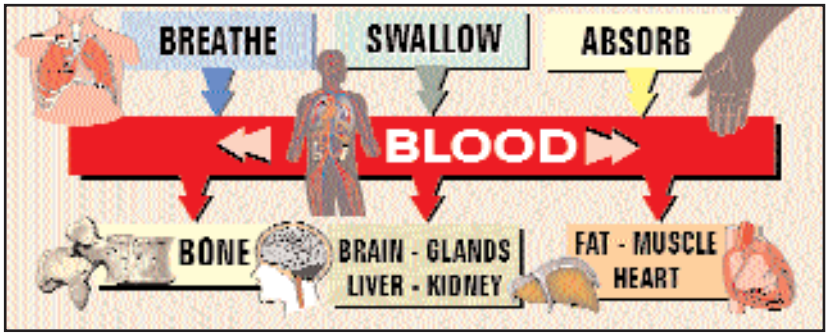


Fig. HH-1. Toxic substances can enter the body by 3 routes.

- Short-term or acute — effects such as eye irritation or dizziness.
- Delayed or chronic — effects such as cancer or lung disease.

Some toxics are a common part of the construction environment, such as silica. Others have special uses, such as sealants and paints.

How Harmful Is Silica?

Silica is common but can be very harmful. Silica dust is:

- Found in many construction dusts such as concrete and rock.
- High exposure tasks include sand blasting, rock drilling, and cutting concrete.
- Long-term exposure leads to fibrotic (lung-scarring) disease.
- Long-term exposure increases the risk of cancer.

Prevent silica exposure by:

- Reducing airborne dust through ventilation and wetting.
- Using NIOSH-approved toxic dust respirators.

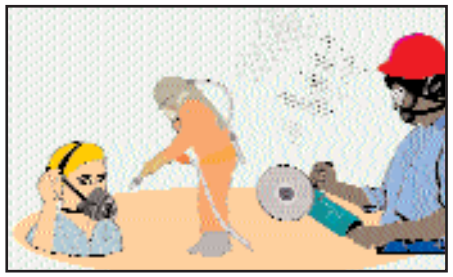


Fig. HH-2. Silica is common but can be very harmful.

NOTES:

This is not designed to be a Hazard Communication course. These are just some of the health hazards you could face in highway work. These are the major health hazards, but there are others.

OSHA PEL: 5 mg/m^3 respirable.

NOTES:

More About Silica

Silicosis is permanent lung damage caused by breathing dust containing extremely fine particles of crystalline silica. Crystalline silica is found in materials such as concrete, masonry, and rock. When these materials are made into a fine dust and suspended in the air, breathing in these fine particles can produce lung damage.

Silicosis can be totally disabling and may lead to death.

When workers inhale crystalline silica, the lung tissue reacts by developing fibrotic nodules and scarring around the trapped silica particles. This fibrotic condition of the lung is called *silicosis*. If the nodules grow too large, breathing becomes difficult and death may result.

Silicosis victims are also at high risk of developing active tuberculosis.

According to a 2002 NIOSH hazard review, ***Health Effects of Occupational Exposure to Respirable Silica***, recent epidemiologic studies demonstrate that workers have a significant risk of developing chronic silicosis when they are exposed to respirable crystalline silica over a working lifetime at any of these current exposure limits:

- OSHA permissible exposure level (PEL),
- the Mine Safety and Health Administration (MNSHA) PEL, or
- the NIOSH (National Institute for Occupational Safety and Health) recommended exposure limit (REL).

The estimated risk of getting silicosis after a 45-year working lifetime is 47% to 90% with cumulative silica exposures at the current OSHA PEL.

How Harmful Is Asphalt?

Asphalt fumes and skin contact can be harmful:

- Asphalt fumes may cause eye, respiratory irritation.
- Hot asphalt can severely burn skin.

Fig. HH-3. Asphalt fumes and skin contact can be harmful.

To prevent exposure to asphalt:

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

How Harmful Is Wet Concrete?

Wet concrete can cause dermatitis and skin burns. Dermatitis can be:

- irritation from caustic concrete or
- an allergic reaction to chemicals in concrete.

We can prevent dermatitis and burns by:

- wearing long-sleeved gloves,
- keeping concrete out of our boots,
- changing gloves and boots when contaminated inside,

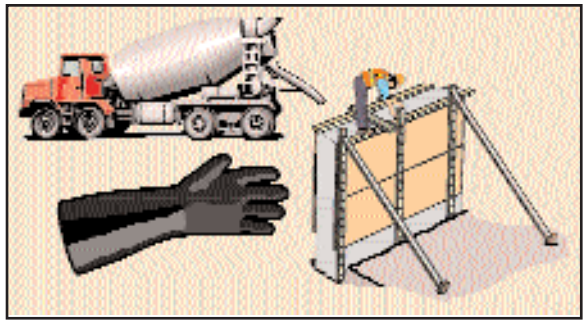


Fig. HH-4A. Wet concrete can cause dermatitis and skin burns.

NOTES:

Ask trainees: Do you know anyone who was burned by asphalt?

Suggested Treatment for Asphalt Burn:
-Completely submerge affected area in clean water.
-DO NOT apply ice directly to the affected area.
-DO NOT ATTEMPT TO REMOVE THE ASPHALT CEMENT with products containing solvents or ammonia.
-Natural separation will occur in about 48-72 hours.
-If necessary for early removal, soak bandage in mineral oil and place over affected area for 2 to 3 hours.

Ask trainees: Have you ever known anyone who had a skin problem from wet concrete?

NOTES:

- washing hands in clean water with pH-neutral soap,
- using a neutralizing or buffering product to neutralize the caustic pH of the wet concrete,
- protecting cuts with bandages, and
- wearing eye protection.

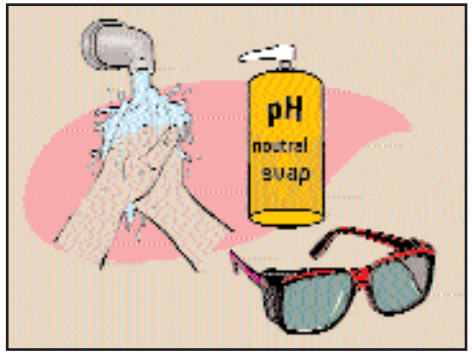


Fig. HH-4B. To prevent dermatitis from wet concrete, wash hands in clean water with pH-neutral soap. Also consider using a buffering product to neutralize the caustic pH of the wet concrete.

How Harmful Is Lead?

Lead damages nervous and reproductive systems. Lead is:

- a toxic metal found in paints on bridge renovation and
- a dust that can be carried home and poison your family.

We can prevent lead poisoning by:

- removing paint before cutting or welding,
- using long handled torches for cutting,
- using local exhaust ventilation,
- wearing the proper respirator,
- washing face and hands before eating, smoking, or drinking,
- using long handled torches for cutting,
- showering and changing clothes before leaving work, and
- getting your blood lead level tested periodically to assure you are not exposed.

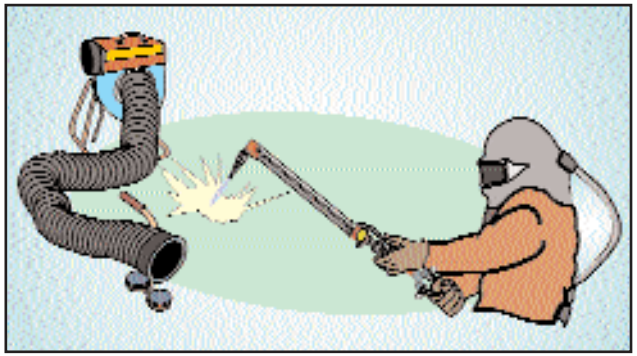


Fig. HH-5. Use long handled torches for cutting to prevent lead damage to nerves.

NOTES:

More About Lead

Lead is very toxic if you breathe or swallow it. The first signs of poisoning are:

- weakness,
- joint pain,
- weight loss,
- loss of sleep,
- low blood pressure,
- memory loss, and
- stomach upset.

Continued exposure can result in:

- kidney damage,
- anemia,
- high blood pressure,
- damage to the reproductive system (impotence, sterility),
- damage to the fetus (if pregnant), and
- reduced sex drive.

Severe exposures can cause damage to the central nervous system and even death.

Are There Other Health Hazards?

Most other health hazards in road construction can be avoided with basic protections. Other health hazards in road work include:

- common substances, such as solvents and CO, and
- special products, such as sealants and paints.

Avoiding health hazards means:

- Reviewing the product Material Safety Date Sheets (MSDS).
- Limiting exposure as much as possible.
- Staying upwind of hazardous exposures.
- Making sure that hazard controls such as fans are working.
- Wearing protective equipment such as respirators, skin coverings.
- Promptly reporting any health complaints to your supervisor.

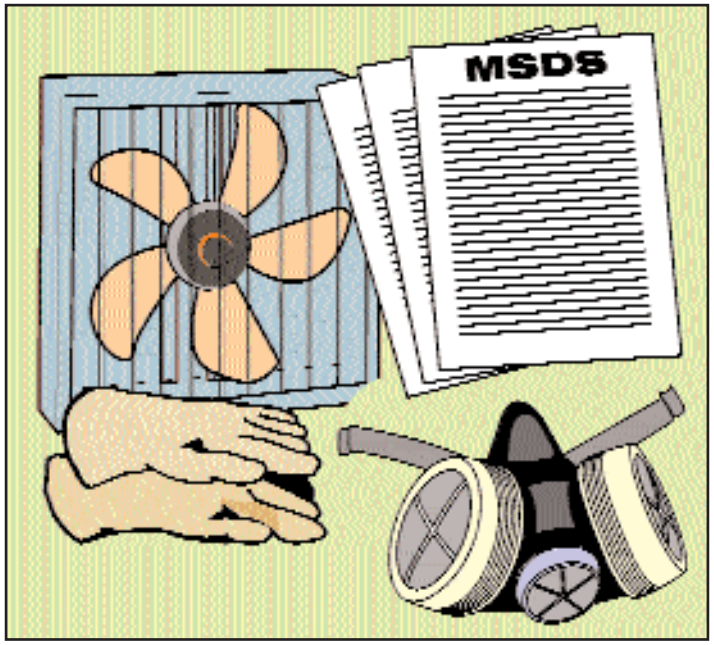


Fig. HH-6. Most other health hazards in road construction can be avoided with basic protections.

NOTES:

Ask trainees: What is CO? (Answer: carbon monoxide.)

OSHA PEL: 50 parts per million.

Carbon monoxide is a colorless, odorless gas given off by internal combustion engines. In confined spaces it can build up and kill construction workers by asphyxiation.

Module 12: Working Outdoors

What Is Our Risk from Sun Exposure?

Skin cancer is the most serious risk of sun exposure. You are at greater risk if you:

- Have lighter skin with freckles or moles.
- Work at higher elevations.
- Work around reflective material, like water or concrete.

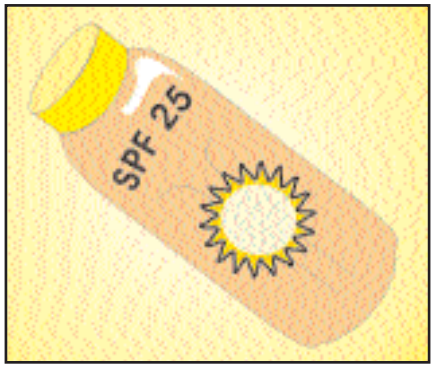


Fig. WO-1A. Apply sun block 30 minutes before work.

WO-1B. Skin cancer is caused mostly by sun exposure.

You can protect yourself with:

- Long-sleeved shirts and pants in neutral colors.
- Broad-brimmed hat with a neck flap.
- Safety glasses with tinted polarizing lenses (UV protective).
- SPF 15-25 sun block 30 minutes before work, reapplied every 2 to 3 hours.
- Check skin for early signs of skin cancer, see a dermatologist for check-ups.

These tips will also prevent sunburn.

NOTES:

Sunburn:
Sun exposure can cause sunburn. Sunburn is a painful skin condition that results from overexposure to ultraviolet rays. The time it takes to get a sunburn varies with age, skin type and color, geographical location, altitude, time of day, time of year, and reflection of water, sand, or snow.

Sunburn symptoms may not appear for a few hours, and the full effect may not be obvious for 24 hours:
-Skin is red, tender, and warm.
-Skin may be blistered, swollen.
-Severe reactions — known as "sun poisoning" — may include fever, chills, nausea, or rash.
-Sunburned skin may peel several days after the burn.

DO NOT:
-Apply petroleum jelly, ointment, or butter.
-Wash with harsh soap.
-Use creams/sprays containing benzocaine. Benzocaine may cause allergic reaction.

NOTES:

DISTRIBUTE SKIN CANCER CARDS.

How Can We Identify Skin Cancer?

Look for the warning signs. If you aren't sure, see a doctor. Here are some things to look for:

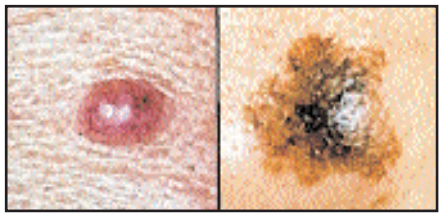


Fig. WO-2A. Asymmetry. At left is benign, at right is melanoma.

- ASYMMETRY: Most early melanomas are asymmetrical. A line through the middle would not create matching halves.
- BORDER: Borders of early melanomas are often uneven and may have scalloped or notched edges.

Fig. WO-2B. Border. At left is benign, at right is melanoma.

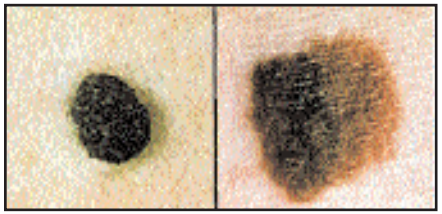


Fig. WO-2C. Color. At left is benign, at right is melanoma.

- COLOR: Common moles usually are a single shade of brown. Varied shades of brown, tan, or black are often the first sign of melanoma. As it progresses, the colors red, white, and blue may appear.

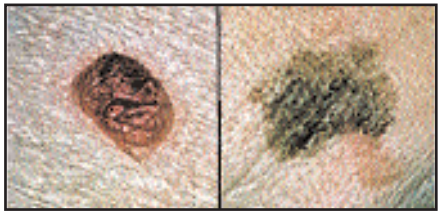


Fig. WO-2D. Diameter. At left is benign, at right is melanoma.

- DIAMETER: Early melanomas tend to grow larger than common moles - generally to at least the size of a pencil eraser (about 1/4 inch in diameter).

What Are the Hazards of Hot Weather?

It can lead to heat stress, exhaustion, or stroke. Heat illnesses 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, and not being "acclimatized."

Fig. WO-3B. Alcohol consumption and being overweight increase risk.

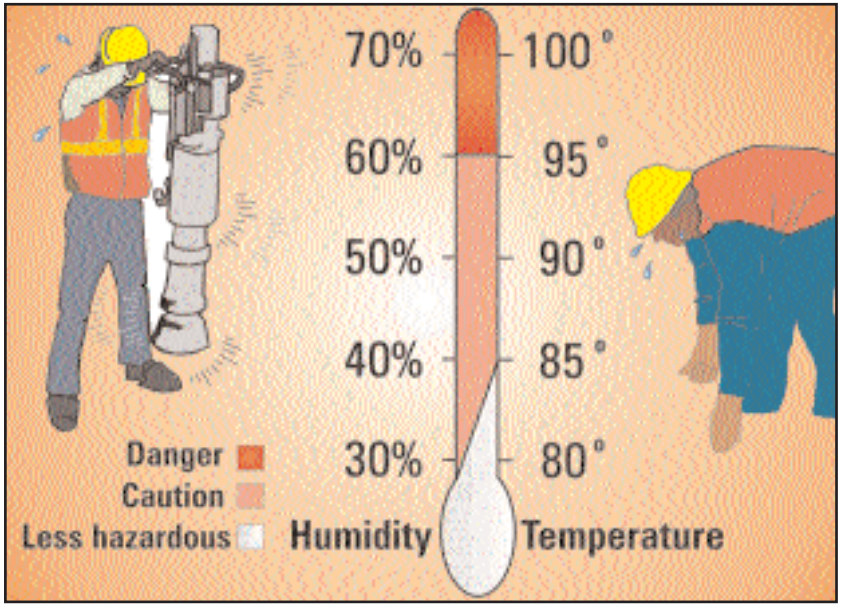


Fig. WO-3A. Hot weather can cause heat illnesses.

Heat stress :

- Can lead to heat rash, cramps, exhaustion, and stroke.
- May be more likely if you are overweight and not fit.
- Alcohol increases your risk.

NOTES:

During hot summer months, construction workers face even greater risk of heat stress. In 2000, 21 workers died and 2,554 others experienced heat-related occupational injuries and illnesses serious enough to make them miss work.

Ask trainees: Do you drink enough water on hot days? How much is enough? (2 to 3 quarts)

DISTRIBUTE OSHA HEAT STRESS CARDS TO TRAINEES.

When should you drink water? (Answer: Even if you are not thirsty.)

What Is Heat Exhaustion?

Heat exhaustion is a dangerous illness.
Heat exhaustion symptoms:

- Extreme weakness or fatigue.
- Dizziness, confusion.
- Nausea.
- Clammy moist skin.
- Pale or flushed complexion.
- Slightly elevated body temperature.

Heat exhaustion treatment:

- Rest in a cool, shaded place.
- Drink plenty of water.

Fig. WO-4. Heat exhaustion is a dangerous illness.

NOTES:

Ask trainees: Has anyone here experienced heat exhaustion? If so, what was your experience? What was the treatment?

NOTES:

What Is Heat Stroke?

Heat stoke can cause hallucinations and death. Heat stroke symptoms and treatment:

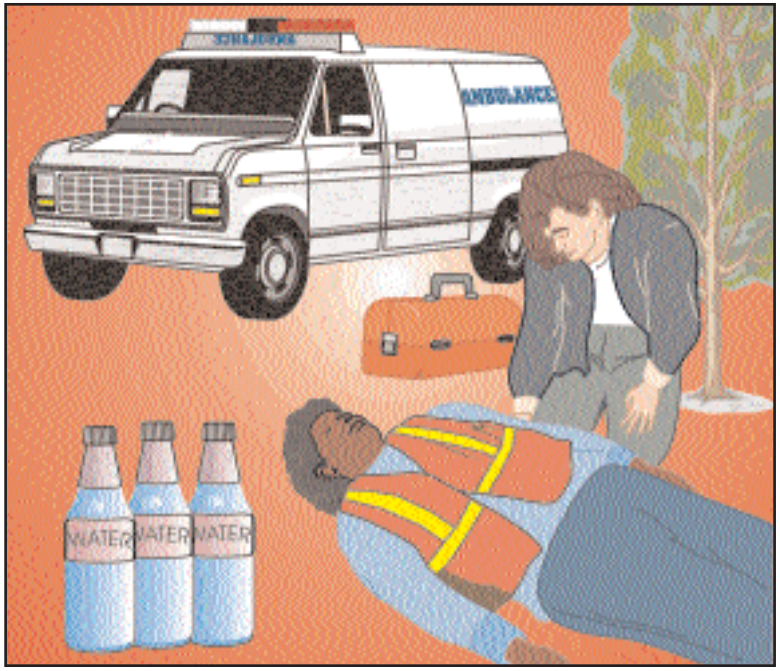


Fig. WO-5. Heat stoke can cause hallucinations and death.

- Hot dry skin, no sweating, chills, high body temperature, mental confusion, irritability, slurred speech.
- Call 911, remove to cool shaded area, soak clothes with water, fan body, apply ice to bring down temperature.

Protect yourself from heat:

- 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.

NOTE: With heat stroke, there is a 40% to 50% risk of dying.

Ask trainees: How much water should you drink if you are working in the sun?

Don't wait until you are thirsty to drink. By then you are already dehydrated.

NOTES:

What Are the Hazards of Cold Weather?

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

- Cold/cool temperatures (50° F and less).
- Wet weather and/or wet conditions.
- High winds (40+ MPH).
- Inadequate clothing.

Fig. WO-6. Cold weather can cause hypothermia and frostbite.

Cold stress is prevented by:

- Warm layers of correct clothing, head cover, warm gloves, and wool socks.
- Keeping dry.
- Breaks in warm areas and drinking hot liquids.
- Keeping in good physical shape.

Early symptoms of hypothermia include:

- Shivering,
- Fatigue,
- Loss of coordination, and
- Confusion and disorientation.

Late symptoms of hypothermia include:

- No shivering,
- Blue skin,
- Dilated pupils,
- Slowed pulse and breathing,

Ask trainees: How cold does it have to be for you to get frostbite? What if it is wet outside?

(See Wind Chill chart on page 49.)

- Loss of consciousness,
- Coma and death.

Frostbite results when it is very cold out. The body reduces blood flow to the hands and feet to keep core body temperature normal. The fingers or toes can freeze. This is called frostbite. Frostbite can also happen from skin contact with very cold objects such as metal equipment. Symptoms of frostbite include:

- Numbness, tingling, aching, and
- Skin turns white then bluish.

Pain occurs when the tissue thaws out. Frostbite can cause the tissue to die and force amputation. Early frostbite can be reversed by gradual rewarming of the tissue in warm water.

Fig. WO-7. Cold weather can cause hypothermia and frostbite.

Wind (mph)	Temperature (°F)																	
Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes; 10 minutes; 5 minutes

NOTES:

Wind Chill Chart CD DEMO: *The chart at left displays the effect of wind on temperature. Temperatures are displayed on the horizontal axis and wind speeds are displayed on the vertical axis. In general, wind lowers temperature and the wind's effect is greater at lower temperatures. For example, at -5° F the effective temperature drops to -40° F with a 60 mph wind. (Source: the National Oceanic and Atmospheric Administration and the National Weather Service.)*

How Are Plants and Animals Hazardous?

They can cause rash, illness, and even death. Outdoor work may expose you to:

- Bites from animals — like dogs or snakes — and from insects and arachnida — like bees, wasps, ticks, spiders, or mosquitoes.
- Plants — such as poison ivy, poison oak, and hogweed.

To prevent these problems:

- Steer clear of any animals.
- Learn to recognize and avoid poisonous plants.
- Wear long-sleeved shirts and pants. Use insect repellents.
- Check for tick bites and for lyme disease each day. The sign of lyme disease is a red bullseye.
- Get prompt medical or first aid treatment for any problems.

WO-8. Avoid any animals, even animals that do not appear to be dangerous.

Deadly West Nile virus may be carried by mosquitoes in most parts of the U.S. Malaria and other diseases are also mosquitoe-borne. Long sleeves and pants and frequent reapplication of repellent (DEET) help protect from mosquitoes and other insects. Be especially careful in the twilight hours and around standing water where mosquitoes feed.

NOTES:

Ask trainees: Have you ever gotten poison ivy while working outdoors?

Poison ivy:
Scratching poison ivy rash only spreads it if the plant oil still remains on the skin. No oil is in the blisters or in the rash. By scratching you can cause bacterial secondary infection which can get wider and more severe. Then you need a doctor and an antibiotic prescription. Poison ivy rash is not contagious. But the oil itself can be transmitted to others.

Poison oak:
Burning poison oak causes an extremely dangerous smoke. A severe allergic reaction from inhaling the smoke, "anaphylaxis," is life-threatening. Do not burn this plant!

Hogweed can cause 2nd degree burns.

NOTES:

Module 13: 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.

Fig. EM-1. Many different types of emergencies may happen in road construction.

Ask trainees: What are some of the most common kinds of emergencies in road construction?

NOTES:

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.

Fig. EM-2. Your employer must have a plan for emergencies.

Ask trainees: What are some of the items that might be in the emergency plan?

Fig. EM-3. You must know your employer's emergency plan.

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 emergency coordinator is and who is trained in first aid/CPR.
- Everyone must be trained in emergency plan and participate in regular drills.

Ask trainees: What is in the emergency plan for this job site?

NOTES:

Case Studies

Case No. 1 - One Death - Electrocution

On March 1, 1990, a 29-year-old worker was electrocuted when he pushed the crane cable on a 1-yard cement bucket into a 7,200-volt power line.

The victim was a member of a crew that was constructing the back concrete wall of an underground water-holding tank at a sewage treatment plant.

Before work on the tank began, the company safety director made sure that insulated line hoses were placed over sections of the power line near the jobsite and that a safe clearance zone was marked off for arriving cement trucks to use for loading their cement buckets.

After the wall was poured, the driver of the cement truck cleaned the loading chute on his truck with a water hose mounted on the truck. As he began to pull away, the crew supervisor yelled to him, asking if the crew could use his water hose to wash out the cement bucket suspended from the crane.

The driver stopped the truck under the power line and the crane operator — not realizing that the truck had been moved — swung the boom to position the bucket behind the truck.

The victim grasped the handle of the bucket door and pushed down to open it, bringing the crane cable into contact with the power line. The victim provided a path to ground and was electrocuted [NIOSH 1990b].

NOTES:

Case Studies

Case No. 2 - Two Deaths - Electrocutions

On March 31, 1993, a 20-year-old male truck driver and his 70-year-old male employer, the company president, were electrocuted when the boom of a truck-mounted crane contacted a 7,200-volt conductor of an overhead power line.

The incident happened while the driver was unloading concrete blocks at a residential construction site. The driver had backed the truck up the steeply sloped driveway under a power line and was using the crane to unload a cube on concrete blocks.

The company president and a masonry contractor watched as the driver operated the crane by a hand-held remote-control unit. The driver was having difficulty unloading the blocks because the truck was parked at a steep angle.

While all 3 men watched the blocks, the tip of the crane boom contacted a conductor of the overhead line and completed a path to ground through the truck, the remote-control unit, and the driver.

The company president attempted to render assistance and apparently contacted the truck, completing a path to ground through his body. He died on the scene.

The truck driver was airlifted to a nearby burn center where he later died as a result of electrical burns [NIOSH 1993b].

NOTES:

Case Studies

Case No. 3 Backover

On June 10, 1997 at about 11:00 a.m., a 20-year-old male construction worker was struck by a Caterpillar Model 966D front end loader at a construction site and died 13 hours later. The victim was collecting manifests and directing the traffic flow for incoming trucks, which were unloading stone and sand at a concrete batch plant. After directing a dump truck to unload its load of sand, the victim was struck by the left rear of the front end loader as it was backing from the ramp leading to the sand and gravel hoppers.

The front end loader backed over the victim with the left rear tire, which caused severe thoracic injuries that resulted in the victim's death. At the time of the incident, the back up alarm and front horn on the front end loader were not operational.

Case No. 4 Runover

On July 7, 1998, a 35-year-old male laborer was run over by a dump truck during resurfacing operations on a 2-lane municipal road. The victim, part of the 8-person paving crew, was assigned to rake and finish the grade of the abutment between the new pavement and the existing concrete curb. For an unknown reason, the victim left the curbside of the road, walked around the front of the paving machine, and continued walking back along the road centerline. At the same time a dump truck, leaving the work zone, was traveling behind the victim in the adjacent lane. As the truck approached, the victim walked in front of the truck's right front bumper. He was not seen by the truck driver and was struck and run over by the right front wheel of the truck. Co-workers yelled to the driver to stop. But the driver did not immediately hear the warnings and continued to drive forward until the rear wheels of the truck contacted the victim's foot. When he heard the shouts he topped the truck and was directed to back up to free the victim. Co-workers notified emergency medical personnel who responded within 12 minutes. Resuscitation attempts were started and the victim was transported to a local hospital where he died about a half hour after arrival.

NOTES:

Case Studies

Case No. 5 Runover

A 27-year-old laborer died when a speeding vehicle struck him as he picked up traffic cones at a construction site on an interstate highway. The speed limit was 70 miles per hour.

The victim was in a man-bucket attached to the rear of a staked flatbed traffic control truck. This truck was traveling in reverse in the number3 lane of a 4-lane highway as the victim was picking up the cones between the numbers 3 and 4 lanes and placing them on the bed of the truck.

A speeding vehicle knocked down more than 300 feet of traffic cones before colliding with the rear of the traffic control truck, which was equipped with flashing lights and an arrow panel board.

There was no traffic truck with an impact attenuator between the speeding vehicle and the traffic control truck to prevent the collision.

Visibility at the time of the incident was limited due to the darkness at 3:45 a.m. The traffic control plan did not require reduction of the speed limit. Therefore, traffic continued to travel at the same limit despite the fact that 3 of the 4 lanes were closed for construction.

There were no law enforcement vehicles assigned to the construction site at the time of this incident.

NOTES:

Case Studies

Case No. 6 - Trench Fatality

An employee was working in a trench 4 feet wide and 7 feet deep. About 30 feet away a backhoe was straddling the trench. The backhoe operator noticed a large chuck of dirt falling from the side wall behind the worker in the trench. He called out a warning. Before the worker could climb out, 6 to 8 feet of the trench wall collapsed on him and covered his body up to his neck. He suffocated before the backhoe operator could dig him out. There were no exit ladders. No sloping or shoring had been used in the trench.

Case No. 7 - Trench Fatality

A 4-man crew was replacing a concrete filter tank at a car wash construction site. After the small tank had been removed, 2 employees entered the trench to hand grade the bottom. The trench was 9 feet deep, 14 feet long, and 6 feet wide. The trench had vertical faces which were not shored or sloped One face of the trench collapsed, fatally injuring one worker and causing serious injuries to the other. The OSHA safety training requirement had not been carried out at the time of the incident.