

2 Safety

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2.1 Introduction

This section of the *Surveys Manual* is intended to: a) provide safe operating procedures, guidelines, and practices, specific to Caltrans surveying operations; and b) supplement the policies, procedures, and practices set forth in the *Caltrans Safety Manual*.

http://www.dot.ca.gov/hq/opo/safety/safetymanual_toc.htm

The *Caltrans Safety Manual* provides detailed instructions for managers, supervisors, and employees to assist them in their individual efforts to conduct Caltrans business in a safe and healthy manner consistent with current law, rule, and technology. Every supervisor and leadworker should have a copy of the *Caltrans Safety Manual* available for use.

2.1-1 The Caltrans Safety and Health Policy Statement

Caltrans safety and health policy is defined in the *Caltrans Safety Manual*. According to the manual:

“It is Caltrans policy to conduct its business, provide services, and to construct and maintain transportation facilities in the safest possible manner consistent with applicable policy, procedure, or work practice, and promote, through an effective injury and illness prevention program, a safe, healthful, and secure work environment for employees and visitors, including persons with disabilities, that is free from violence, threats, harassment, and intimidation, and protects the public from harm in connection with its operations.”

2.2 Caltrans Code of Safe Surveying Practices

The *Caltrans Code of Safe Surveying Practices* was developed to summarize the “Safety Chapter” of this *Manual*. The code should be posted as a reminder of the importance of safety. Copies of the code suitable for posting and distribution (Figure 2-1 on page 2-3) can be obtained from the Office of Land Surveys:

http://www.dot.ca.gov/hq/row/landsurveys/SurveysManual/Surveys_Chapter_2_Figure_2_1.pdf

Replace with 11" x 17" *Caltrans Code of Safe Surveying Practices*

Replace with 11" x 17" *Caltrans Code of Safe Surveying Practices*

2.3 Safety Responsibilities

For a complete description of safety responsibilities see the *Caltrans Safety Manual* Chapter 1, “The Management Structure and Operating Details of the Caltrans Safety Program” and Chapter 12, “Personal Protective Equipment”.

2.3-1 Individual Responsibilities

Each employee is responsible to:

- Have a practical working knowledge of, and adhere to, the provisions of the *Code of Safe Surveying Practices* and this Chapter of the *Surveys Manual* and the *Caltrans Safety Manual*;
- Be alert for possible unsafe conditions and/or unsafe acts. Report unsafe conditions and/or acts to the supervisor or lead worker “in charge;”
- Use equipment properly and carefully, and follow all health and safety policies, procedures, and work practices, as directed by his/her supervisor, and ask for instructions or assistance if unable to understand the assigned task;
- Promptly report all incidents, accidents and personal injuries to their supervisor after rendering or finding aid for injured persons;
- Report to work mentally and physically capable to perform all assigned duties without jeopardizing the health and safety of themselves, other employees, or the public;
- Report for work properly dressed to protect themselves from exposure to conditions found on the work site. Garments that expose upper body parts (midriff and shoulders) and bare legs are prohibited. Employees shall wear appropriate footwear for the assigned task and work area.

Personal Protective Equipment

Each employee is furnished personal protective equipment which shall be consistently used. Specifications for personal protective equipment shall comply with all state and federal laws.

Hard Hat: Employees are responsible for wearing hard hats with chin straps during any work activity that may expose them to a head injury. The hard hat must be worn when working within any street or highway right of way or on a construction site.

Safety Vest: High visibility apparel (vest, shirt, or jacket) of fluorescent orange, or yellow-green color that meet the specifications of ANSI/ ISEA 107-2010 Class II or III must be worn whenever working within any highway right of way or on a construction site. Class III apparel is required for flaggers and all night work. Orange is the only approved color for vests or shirts when working on railroad rights of way. Class II vests are not acceptable in “small” or “extra-small” sizes. Class III (sleeved) garments may be worn in all sizes. Older ANSI/ISEA 107-2004 garments in good condition may be used until replaced by 2010 or later versions.

When conditions warrant the following personal protective equipment should be provided to employees:

- Safety glasses (see note below)
- Safety Goggles
- Dust masks
- Gloves
- Hearing protection
- Chaps
- Rainwear
- High visibility apparel

See the *Caltrans Safety Manual*, Chapter 12, “Personal Protective Equipment (PPE)” for details. http://www.dot.ca.gov/hq/opo/safety/safetymanual/Chap_12-2000.pdf

Note: Employees who wear prescription eye glasses and are assigned to work in field locations generally qualify for at least two pair of State-furnished prescription safety glasses annually. For complete details see Section 12.11 of the *Caltrans Safety Manual*.

2.3-2 Party Chief Responsibilities

A designated Party Chief, whether a supervisor or a lead worker, is responsible for the work methods and safety practices of the survey party. It is the Party Chief's responsibility to ensure that all safety rules and procedures are followed and that all work is performed safely. The Party Chief must ensure the use of the safest possible method for each operation. This responsibility may not be delegated.

The following summarize common responsibilities of the Party Chief:

- Ensure that a copy of the *Code of Safe Surveying Practices*, the *Caltrans Safety Manual*, and the *Caltrans Surveys Manual* is always available to employees.
- Give safety first priority in planning each survey. When first reporting to a new job site, it is the responsibility of the Party Chief to reconnoiter the entire site, taking note of all potential hazards such as power lines, steep inclines, hazardous traffic areas, abandoned mines, animals, or other safety concerns. This information will be discussed with the field crew as part of the tailgate safety meeting conducted for new job sites (see Section 2.4)
- Before starting work, inspect all traffic controls for conformance to Caltrans standards as stated in the *California Manual on Uniform Traffic Control Devices (MUTCD)* and Chapter 8 of the *Caltrans Maintenance Manual*. Continue to monitor conditions to ensure that controls are adequate for any change in conditions.
http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/ca_mutcd2010.htm
<http://www.dot.ca.gov/hq/maint/manual/maintman.htm>
- Cease work and notify the field supervisor immediately if any field conditions are such that safety is jeopardized.
- Train and provide lookouts whenever necessary.
- Train and provide flaggers whenever necessary.
- Utilize attenuator trucks or other protective vehicles whenever appropriate.
- When possible avoid assigning party members to independent tasks that isolate them from the other party personnel. Try to have each member working with a buddy. (This is especially important in high-hazard areas, such as along roads, and in remote desert and mountain areas.)
- Ensure that each subordinate possesses the required personal protective equipment and uses the equipment as required.
- Train new employees to safely perform required work tasks before assigning them to work independently.

- Ensure that tools are used and stored safely.
- Do not allow employees to work if they refuse to work safely. Refer the matter to your supervisor.
- Report all violent acts, threats of physical violence, verbal abuse, property damage, security hazards, and other inappropriate activities to the field supervisor or security guard.
- Conduct a tailgate safety meeting with party members at least once every ten working days, or as needed. See Section 2.4. Report and document all occupational injuries and illnesses.
- Designate a responsible person-in-charge when they are away from the workplace.

2.3-3 Field and Office Supervisor Responsibilities

Field and office supervisors may be first or second line supervisors. Field supervisors generally supervise more than one field party.

According to the *Caltrans Safety Manual*, “Supervisors are responsible to conduct Caltrans business in the safest possible manner consistent with Departmental policies, procedures, and work practices.” This includes:

- Enforce all health and safety laws, rules, and policies, and initiate corrective action for employees who violate health and safety laws, rules, and policies.
- Ensuring that all employees receive required first aid and defensive driving training, as well as any required specific training for hazardous tasks such as operating a chainsaw. For classes, refer to the training catalog published by the Division of Training.
- Ensuring that all employees receive Safety Training for special circumstances including construction surveys on superstructures.
- Ensuring that employee safety and health issues are discussed and assessed annually at the time of issuing the “Individual Development Plan/Performance and Appraisal Summary” report and when employee probationary reports are issued.
- Scheduling all required safety meetings. Supervisors should provide sample tailgate meeting topics and outlines to party chiefs and utilize regular staff meetings to disseminate information on accident prevention and on new safety policies and devices.
- Periodically inspecting field and office work sites to identify, document, and eliminate hazards that might cause injury or illness.

- Ensuring that each field crew have access to:
 - *Caltrans Surveys Manual*.
 - *Caltrans Safety Manual*.
 - *Caltrans Maintenance Manual*, Chapter 8, “Protection of Workers”
 - *California Manual on Uniform Traffic Control Devices*.

When assigning field crews to projects, field supervisors are responsible for:

- Approving work within six feet of moving traffic.
- Obtaining an approved traffic control plan, if necessary, and providing a copy to the party chief.
- Approving all surveys without traffic controls.

Supervisors are responsible to report and document occupational injuries and illnesses, and arrange for appropriate workers’ compensation benefits to employees who are injured or contract an illness arising out of their employment. For details on reports, see *Caltrans Safety Manual*, Chapter 10, “Reporting Personal Injuries and Illnesses.”

When assigning field crews to projects or sending office personal on field trips, consider:

- The experience of personnel in undertaking hazardous tasks.
- Possible health problems for specific employees (such as poison oak allergies).
- Traffic hazards (plan for any controls that are needed).
- Unusual hazards associated with the work.

Field/office supervisors are responsible for new employee orientation, as follows:

- Provide new employees a copy of the *Code of Safe Surveying Practices* and make available a copy of the *Caltrans Safety Manual* and the *Surveys Manual*. Require that new employees read each document.
- Show the employee Std. 621, Notice to State Employees, which includes a list of facilities that are approved for treating industrial injuries. Inform the employee that each office and survey party has a copy of the list.
- Ensure that the employees assigned to the field are scheduled for first aid training as soon as available or within the first three months of their assignment if possible, and at least once every two years thereafter.
- Describe hazards that are likely to be encountered in the employee’s first assignments and the protective measures to be used.

- Brief the employee on:
 - Medical care available throughout the State.
 - State Compensation Insurance Fund benefits.
 - The role of the District Accident Prevention Committee.
 - The supervisory accident investigation process and its purpose in preventing accidents.
 - Accident and injury reporting and their purposes.
 - The right to refuse to perform tasks that are dangerous or hazardous.
 - Responsibilities in case of personal and motor vehicle accidents.
 - The Employee Assistance Program.

2.4 Safety Meetings

Policy

Supervisors shall schedule, conduct, and document safety meetings with their employees to discuss occupational safety and health issues. Document all safety meetings with the Safety Meeting Report (Form [PM-S-0110](#)). For a complete guide to safety meetings see the *Caltrans Safety Manual*, Chapter 2.

Tailgate Safety Meetings for Field Personnel

At least once every ten working days, or as necessary for special circumstances, each Party Chief shall conduct a tailgate safety meeting. Special circumstances include: reporting to a new job site, a change in crew members, or a change in the work environment. The tailgate safety meeting should focus on safety considerations for the survey party's current assignment.

Office Personnel Safety Meetings

Meetings for office personnel to discuss safety or health concerns must be held at least once every three months.

2.5 Construction Surveying Operations

The Resident Engineer and the Structure Representative are responsible for safety on Caltrans construction sites. Notify the Resident Engineer that you will be working on the project and of any unsafe observed operations or conditions. Before beginning a construction survey, determine potential hazards that might arise from the natural environment, the public, and the contractor's operations. For project conditions not covered by the surveying manual, use the construction code of safe practices for the project. Plan the survey accordingly.

During the course of the work, observe the following safety guidelines:

- The Contractors traffic patterns, especially hauling operations, are governed by optimal production rather than typical rules of the road, don't assume anything.
- Be extremely cautious around heavy and fast-moving equipment, especially on haul roads and around equipment with limited driver visibility.
- Do not rely on the operator's visibility, judgment, or ability. Make eye contact with the operator and confirm it is safe before walking in front of or behind any piece of equipment.

- Use lookouts as conditions dictate. See Sections 2.6-2 “Lookouts” and 2.6-6, “Temporary Traffic Control.”
- Suspend survey operations when uncontrollable hazards develop. Resume work only when safe working conditions have been restored

2.6 Surveying Near Traffic

Working in, near, and around traffic is an inevitable part of transportation land surveying work. The SURVEY CREW (W21-6) sign should be used to warn of surveying crews working in or adjacent to the roadway. Field crews need to take the following precautions to ensure this work is performed as safely as possible.

2.6-1 General Procedures

Use the following general safety procedures when working in or around traffic:

Required “Free Space”: Maintain at least six feet of space between moving traffic and your work area. This includes work on shoulders as well as on the traveled way. Survey at the maximum space possible between moving traffic and your work area. Any surveying that requires working within six feet of moving traffic must be approved by the Field Supervisor or the Surveys Manager.

Face Traffic: Whenever feasible, each employee must face moving traffic at all times. If it is not possible to face traffic, a lookout should be used.

Move Deliberately: Do not make sudden movements that might confuse a motorist and cause an accident.

Signal Cautiously: Whenever feasible, use radio communication. Carefully and deliberately use surveying hand signals so they will not startle or confuse motorists or be mistaken for a flagger’s direction.

Avoid Interrupting Traffic Flow: Minimize crossing traffic lanes and never attempt to run across traffic lanes.

Physical Barriers: Whenever feasible, place a barrier vehicle or a shadow vehicle between moving traffic and workers. See Figure 2-2 and Section 17.17 of the *Caltrans Safety Manual* for additional information.

http://www.dot.ca.gov/hq/opo/safety/safetymanual/Chap_17_Jul2007_r111008.pdf

Distractions to Motorists: Minimize working near moving traffic, especially on high-speed roads, when the motorists' attention may be distracted by other ongoing activities, such as vehicular accidents, maintenance activities, and construction operations; or distracting objects on or along the highway. Do not work along streets or highways within 2000 feet of such activities or objects.

2.6-2 Lookouts

While working on foot on or near the traveled way, workers should normally be protected by barrier vehicles, guardrail, or other physical means. Where the absence of such physical protection exposes workers on foot to errant vehicles, a person shall be assigned as a lookout. A lookout is an employee whose only duty is to provide immediate warning to coworkers of vehicles or equipment that have become imminent hazards to their safety. The lookout shall not try in any way to direct traffic. A lookout is used only to warn of impending traffic hazards, not direct or control it.

When work occurs within any railroad right of way, railroad provided or approved lookout and permit to enter is required. See Section 2.9-2.

Lookouts are required when all of the following conditions exist:

- Work occurs on a roadway with a posted speed of 55 mph or more.
- Workers are without physical protection (barrier vehicle, k-rail, natural or man-made terrain features, etc.).
- Working on foot within 30 feet of moving traffic.

Lookouts should be considered whenever:

- Working without traffic controls on streets and highways.
- Working within 25 feet of the centerline of an actively-used railroad track outside of a railroad right of way.
- Where there are conflicting or multiple vehicular and equipment movements.
- In areas with restricted sight distances.

Lookouts must be in constant communication with the employee under their protection. If restricted sight distance or other factors preclude verbal communication, use a radio. Lookouts should be stationed where they can observe traffic sufficiently in advance of the workers to warn them of approaching danger by out of control vehicles. Use audible warning devices such as horns or whistles. In some cases, more than one lookout may be necessary. When it appears that a vehicle or some equipment has become a threat to

personnel, the lookout will immediately and repeatedly use the word “scramble,” or activate a warning device.

2.6-3 **Flaggers**

A flagger is a trained person who gives motorists, pedestrians, and cyclists exact instructions, enabling them to move through temporary traffic control zones safely. Flagger training is available to Caltrans staff through the Learning Management System (LMS). Flaggers should be carefully chosen because they are responsible for public safety and make the greatest number of public contacts of all highway workers. Because of their importance and responsibility, flaggers should be rotated and relieved periodically to maintain alertness.

Flaggers must be used any time two-way traffic must share the same lane because of work in the other lane. Generally, flaggers should not be used along freeways. See *Caltrans Standard Plan T13*.

Flaggers shall be trained in flagging procedures and use the proper equipment and ANSI/ISEA 107-2010 Class III safety garments outlined in the *California Manual on Uniform Traffic Control Devices*, Section 6, “Temporary Traffic Control”. A copy of the *California MUTCD* should be available to each survey party. For additional requirements for flaggers see the *Caltrans Safety Manual*, Section 12.11, “Warning Garments.”

2.6-4 **Protective Vehicles**

Protective vehicles can be especially important at sites, such as instrument set-ups, where surveyors might be located for an extended period of time. There are two types of protective vehicles:

Barrier Vehicle: A vehicle, usually unoccupied, which is parked between the oncoming traffic and a stationary work site.

Shadow Vehicle: A vehicle with an attenuator which follows a survey operation moving in the direction of traffic.

Position protective vehicles so they are effective barriers to the traffic. Keep a protective vehicle close enough to employees to give actual physical protection but not so close that it is a hazard to employees. To determine appropriate spacing between protective vehicles and personnel, see Figure 2-2 which provides data on “roll-ahead” for protective vehicles of various weights.

Impacting Vehicle		Shadow Vehicle (SV)		Speed of SV after Impact (mph)	Roll Ahead of SV (feet)
Weight (lbs.)	Speed (mph)	Weight (lbs.)	Speed (mph)		
2,250	55	6,000	0	15	15
		10,000	0	10	6
		24,000	0	5	1
		6,000	25	33	172
		10,000	25	30	54
		24,000	25	28	40
4,500	55	6,000	0	24	47
		10,000	0	17	20
		24,000	0	9	4
		6,000	25	38	120
		10,000	25	34	81
		24,000	25	30	50
10,000	55	6,000	0	34	150
		10,000	0	28	72
		24,000	0	16	18
		6,000	25	44	243
		10,000	25	40	152
		24,000	25	34	77
24,000	55	6,000	0	44	462
		10,000	0	39	244
		24,000	0	27	72
		6,000	25	49	572
		10,000	25	46	346
		24,000	25	40	152

6,000 pounds = Loaded 3/4-ton pickup
 10,000 pounds = Loaded 1-ton cargo truck
 24,000 pounds = Loaded 4 yard dump truck

Shadow Vehicles: Roll-ahead stopping distances are for worst case where the vehicles remain in contact after the collision and all braking is done by the shadow vehicle under ideal conditions (dry pavement, good tire tread, good brakes, brakes locked, etc.)

Figure 2-2
Shadow Vehicle Roll Ahead After Impact

2.6-5 Amber Warning Lights and Emergency Flashers

Caltrans' use of amber warning lights is regulated by the California Vehicle Code (CVC), section 25258. In addition to complying with the CVC, usage should be based in common sense and generally conform to the Caltrans warning light usage guide available on the Caltrans intranet:

<http://onramp.dot.ca.gov/hq/equipment/engineering/DevelopDeploy/WarningLights/UsageGuide.htm>

Use amber warning lights, emergency flashers, or both as needed:

- To alert traffic of workers on foot or operations near the traveled way.
- When moving into or out of traffic.
- When parked outside of a lane closure within 6 feet of traffic.

Do not use the amber lights when driving at normal highway speeds, when parked in an established lane closure, or when parked over 6 feet from traffic, unless circumstances warrant usage. Misuse and overuse of warning lights seriously reduces their effectiveness. When working during the hours of darkness, use the amber lights with discretion. Do not blind or distract traffic needlessly. At times, the vehicle's emergency flashers may be more effective.

2.6-6 Temporary Traffic Control

Temporary traffic controls are used to establish a “working area-of-protection” for employees. Methods of temporary traffic control include use of: a) portable warning/control devices, b) prescribed procedures (*see below*), and c) personnel such as flaggers and lookouts. Traffic movement should be disrupted as little as possible by traffic controls. Optimum safety can be achieved most effectively through controlling the activities of surveyors rather than restricting vehicular movements.

Procedures

- Do not undertake any form of temporary traffic control without consulting and following the directives of the *California MUTCD*, and Chapter 8 of the *Caltrans Maintenance Manual*.
- Lane closures should only be undertaken with the approval of the District Traffic Manager.

- Set-up and removal of lane and shoulder closures should generally be undertaken by Maintenance using the guidelines found in the *California MUTCD*, and Chapter 8 of the *Caltrans Maintenance Manual*.
- The protection of employees and the public shall be the primary consideration when temporary traffic control measures are used.
- All reasonable measures shall be used to avoid interference with vehicular movement. Lane and shoulder closures shall not be considered until other alternatives have been evaluated for employee protection.
- Minimize the time temporary control devices are used. Employee breaks should be scheduled so that temporary control devices are utilized for the entire period they are in place.
- The party chief is responsible for inspecting and monitoring traffic controls set by surveyors or others. If controls are inadequate or conditions change, surveying activities shall be halted until a safe condition is established.
- Except for special surveys or because of lack of reasonable daylight alternatives, surveys on or adjacent to roads shall be done only during full daylight hours.
- In general, limit the length of a work area to 0.5 mile. When the scope of the survey is longer than 0.5 mile, divide the survey into lengths of 0.5 mile or less. When using lane or shoulder closures, limit the total closure length to an area that can be surveyed during an uninterrupted period of work.

Planning

When planning a surveying project that requires temporary traffic controls, be sure to:

- Use standard traffic control layouts shown on Caltrans Standard Plans T10 through T17 or those shown in the *California MUTCD*.
- Use surveying methods that minimize exposure to traffic hazards.
- Consider factors that will affect traffic hazards and implement temporary traffic controls to minimize the hazards. Some factors to consider are:
 - Prevailing traffic speed.
 - Peak traffic hours.
 - Motorists' sight distances.
 - Effect of unusual survey activities on traffic.
 - Pavement conditions – wet, frosty, etc.
 - Special conditions and events, such as school hours and large public gatherings.

- Inform District Traffic Operations and obtain necessary approvals, if any survey activity is going to significantly affect the normal flow of traffic for 20 minutes or longer.
- Observe local district/region policies and procedures regarding traffic controls.
- Coordinate traffic control activities with Maintenance, Construction and CHP, as appropriate.
- Assign adequate personnel to survey parties to meet special safety needs, such as flaggers or lookouts.

2.6-7 Surveying Without Traffic Controls

Even when traffic is light, the closing of a lane or setting of other controls might be the most dangerous aspect of a survey. Under certain conditions some surveys can be undertaken safely without including the risk of establishing traffic control. Exposure and risk can be minimized without purposely affecting the flow of traffic. An example is determining elevations of edges and centerline of roadways. Short term surveying operations may be undertaken without traffic controls if all of the following conditions exist:

- Approval of the Surveys Field Supervisor or Surveys Manager.
- The traffic volume is light. This means that surveyors can walk from the shoulder to the site on the traveled way, perform their duties, and walk back to the shoulder without interfering with traffic.
- Sight distance in each direction is at least 550 feet. When 550 feet of site distance is not available, one or more lookouts may be posted to extend visual coverage.
- Vehicles can be parked completely off the traveled way.

If all of the above conditions are met, the survey can be undertaken without traffic controls using ALL of the following methods:

- One surveyor shall be used as a lookout. See Section 2.6-2, “Lookouts.”
- All surveyors shall be off the traveled way when traffic passes.
- Surveyors shall face traffic whenever possible.
- Surveyors have a planned escape route.

2.6-8 Yellow-Stripe Surveys

The term “yellow-stripe” survey is used to designate those surveys along the centerlines, or lane stripes, of conventional roads. A yellow-stripe survey without a lane closure must be approved by the Field Supervisor or Surveys Manager. A yellow-stripe survey with a lane closure must be recommended by the Field Supervisor and approved by the Surveys Manager after consultation with the District Traffic Manager.

Yellow-stripe surveys should only be undertaken after considering and rejecting all alternatives, including remote sensing. See Sections 12.7-2, “Pavement Elevation Surveys” and 12.7-3, “Pavement Elevation Survey Methods.”

Yellow-stripe surveys must be performed during off-peak hours. Traffic control procedures for yellow-stripe surveys are described in the *California MUTCD*. For surveys on high volume roads, see Standard Plans T10 through T13. See Section 2.6-7, “Surveying without Traffic Control,” to determine if conditions warrant a survey without traffic controls.

2.7 First Aid

First aid is defined in Section 2582.1 of the State Administrative Manual as follows:

“The assistance provided the sick or injured before medical help is available but only with the express purpose of controlling the loss of blood, sustaining breathing, and reducing the effects of shock. Suitably trained personnel are highly recommended. Medical diagnosis, treatment, and provision of medicines or drugs (aspirin included) are not appropriate.”

The following are basic requirements that must be met to ensure adequate response to a situation requiring the use of first aid. For more detail see Chapter 9 of the *Caltrans Safety Manual*.

- All surveys field personnel shall be trained in first aid during the first three months of their assignment and at least every two years thereafter.
- Each survey vehicle and office shall be equipped with a 16-unit first aid kit.
- Each survey vehicle and office shall have a readily available copy of a current *Red Cross First Aid Manual* or equivalent.

2.8 Environmental Hazards

2.8-1 Heat Hazards

- When working in hot conditions, ensure adequate potable water, a minimum of 1 quart per person per hour of scheduled work, is available at the start of each shift. It is allowable to begin the shift with smaller quantities of water if there is an effective procedure for replenishment during the shift as needed to allow employees to drink one quart or more per hour. Ice does not constitute water.
- When working in hot conditions, access for a period of no less than five minutes to an area with shade that is either open to the air or provided with ventilation or cooling shall be provided to employees suffering from heat illness or an employee believing a preventative recovery period is needed. Such access to shade shall be permitted at any time.

2.8-2 Animal Hazards

During the normal course of land surveying it is common to encounter animals. Try not to startle or surprise an animal. Avoid contact with animals as much as possible.

Precautions Concerning Snakes

The following precautions should be taken when working in rattlesnake habitat:

- Always assume snakes are active.
- Do not work alone in remote snake habitat.
- Avoid stepping over logs and large rocks into unseen areas. The safest policy is to walk around such obstacles. If this is not possible, first step on top of the object, then look at the back side of the obstacle before stepping down.
- Do not jump down from overhangs onto areas where snakes might be hidden from view.
- Never climb vertical or near vertical faces using unseen handholds above your head.
- Do not attempt to capture or kill snakes.
- When necessary to move low-lying logs, large rocks, and boards, use a pry bar, not your hands.
- Double your precautions at night, especially in warm weather.
- When possible, maintain radio contact with isolated employees.
- Know the location of the nearest medical facility where anti-venom is available and the quickest route there.

First Aid Treatment for Snake Bites

Symptoms indicating that venom has been injected are immediate severe pain, swelling, and discoloration. Look for the symptoms and follow these procedures:

- Identify the snake, but do not take the time to kill it. The fang marks, rattles, and marking and coloration of the snake should be sufficient for identification.
- Immobilize and reassure the victim. Keep the bite below the level of the heart, if possible.
- Thoroughly cleanse the wound with antiseptic.
- If possible, carry the victim to a vehicle, then drive him to a medical facility where anti-venom is available for injection.

Precautions Concerning Insects

Be alert for and avoid insect hives, hills, and nets. Some persons are highly allergic to insect stings. Symptoms of a severe allergic reaction (anaphylactic shock) are:

- Difficulty breathing.
- Swollen lips, throat, and tongue.
- Flushed, blotchy skin .
- Lowered level of responsiveness.

First Aid Treatment for Suspected Anaphylactic Shock.

It is recommended that employees who know they are susceptible to such reactions should inform supervisor and co-workers of their condition and the appropriate treatments

- Assist the victim with emergency medication, such as an Ana-Kit or EpiPen, if prescribed.
- Apply cold packs to minimize swelling.
- Immediately take the victim to a medical facility for treatment.

2.8-2 Plant Hazards.

During the normal course of land surveying it is common to encounter plants, some of which that can cause injury or allergic reaction. Learn how to identify these plants before going into the field, warn others on the crew when detected, and avoid contact as much as possible

Poison Oak

Medical authorities agree that avoidance is the best prevention for poison oak (*Toxicodendron diversilobum*) or *Rhus dermatitis*. Avoidance can be difficult because *Rhus*-sensitive people can react, often severely, from contact with implements, clothing, and other objects that have touched poison oak bush. Poison oak is not the only plant that triggers dermatitis.

Grease Wood

In desert areas, avoid contacting grease wood (or creosote bush) and encilia. Persons allergic to these plants have a reaction similar to that caused by poison oak. Precaution and treatment are the same as for poison oak.

Thorns and Nettles

Many native plants (cacti, wild berries, thistles) and ornamentals (roses, bougainvillea) have thorns that can give painful wounds. Always be careful when walking through thick brush where it's difficult to identify the next plant you will encounter.

Precautions Concerning Plant Hazards

The following precautions should be taken when working in areas with plant hazards:

- Keep highly allergic employees away from hazardous plants and tools and clothing that have been in contact with the plant during all seasons of the year.
- Adopt a survey plan which minimizes exposure.
- Be able to recognize the plant.
- Wear long sleeves and gloves to minimize contact with the plant. Close cuffs and collars by taping. Wear State-issued, disposable, paper coveralls or work suits of white or fluorescent orange for extra protection.
- Change clothes and wash boots each day after exposure. Use a strongly-alkaline laundry soap for cleaning work apparel. (Dry cleaning is the one safe method for cleaning the clothing of highly sensitive persons.)
- Clean "contaminated" tools with a commercial cleaning fluid or a very strong laundry soap. Use cleaning fluid out-of-doors.

- Wear neoprene or other waterproof gloves with cleaning agents.

First Aid Treatment after Exposure to Hazardous Plants

In severe exposure circumstances, seek immediate medical attention when hazardous plant exposure results in significant respiratory distress, an extensive rash that covers most of the body, or elevated heart rate for an extended period of time.

If the severity of the dermatitis warrants or if it persists, see a doctor who is approved for treatment of industrial injuries.

For incidental contact with a hazardous plant:

- Immediately after exposure, wash thoroughly with strong soap and warm water. Rinse thoroughly with clear water after washing.
- Apply bandages as needed. Application of rubbing alcohol may help remove plant oils, but will also remove protective lipid coatings from the skin, making a person more vulnerable to secondary exposure.
- Use medications which are made specifically for dermatitis.

2.9 Special Operations

During the course of their work, land surveyors can find themselves in any kind of terrain, weather, traffic or project condition. It is imperative to use caution and good judgment when encountering a field condition for the first time.

2.9-1 Night Operations

Hazards are amplified at night. Therefore, surveying shall not be done at night unless reasonable daylight alternatives are not satisfactory. Night surveys can disrupt traffic and arouse the curiosity of local residents. If this seems likely, notify local law enforcement agencies and the California Highway Patrol (CHP). Consider giving advance public notice through local news media. Public notices should be handled by the District Public Affairs Office.

When unavoidable, plan night surveys to:

- Make safety the number one priority.
- Allot extra time for all night operations.
- Make certain you have enough personnel, equipment, and supplies.
- Brief all party members.
- Issue of adequate reflective clothing and lumination equipment.

When surveying at night in mountainous areas:

- Use the “buddy” system.
- Use reflective flagging to guide personnel along safe roads and trails into work areas and to specific points.
- Provide radio communication for each work area.
- Double your precautions against snakebites in warm weather and fires in dry seasons.

For night surveys in traffic:

- Only consider night surveys as a last resort.
- Seek advice and assistance from the District Offices of Traffic and Maintenance.
- Consider use of CHP or other law enforcement agencies.
- Require all personnel to wear ANSI/ISEA -107-2010 Class III apparel.

2.9-2 Railroads

Railroad operations are not to be interrupted. Observe the following guidelines when working within an operating railroad right of way:

- Always have a written permit to enter railroad right of way. Permit arrangements must be handled well in advance of planned field work. Typically, the Field Senior or Surveys Office staff in coordination with the District or Region Railroad liaison secures the permit. Actual procedures may vary from District to District.
- Only personnel who have taken a safety / security course approved by the railroad are permitted to work within the railroad right of way.
- A railroad provided or approved lookout is required.
- Whenever possible, use reflectorless instruments or remote sensing equipment, such as laser scanning, to survey the railroad tracks.
- Orange is the only approved color for high visibility apparel within railroad right of way. Never wear red clothing within a railroad right of way.
- Although you have a lookout, always be alert around railroads. Railroad equipment may not be heard, especially on noisy work sites.
- All crewmembers must be familiar with the safety provisions of the permit to enter railroad right of way. Abide by the requirements and procedures.

Basic rules for working around a Railroad include the following:

- Do not crawl under stopped railroad cars or over couplings, and do not cross railroad tracks between closely-spaced cars. They might move at any time.
- Do not leave protruding stakes or any holes within 10 feet of the railroad tracks.
- Do not park vehicles within 10 feet of the railroad tracks.
- Do not chain or tape across railroad tracks.
- Do not leave instruments or other equipment unattended, on or near railroad tracks.

2.9-3 Water Operations

When surveying in or around bodies of water, use the following precautions:

- Wear a Coast Guard approved life jacket whenever working in a boat, in water over waist deep, or in swift water with treacherous footing.
- Always perform work with a buddy.
- Never wade barefoot.
- Use a tautly stretched lifeline as a handrail when wading if stream velocity is high or the streambed is rough or slippery.
- Schedule work on beaches during low tides.
- Do not walk on floating debris.

2.10 Special Work Activities

Power Lines

All work around overhead power lines shall be conducted in accordance with California Division of Occupational Safety and Health Title 8 Regulations, Chapter 4, Subchapter 5, Article 37, Section 2946 “Provisions for Preventing Accidents Due to Proximity to Overhead Power Lines”. <http://www.dir.ca.gov/Title8/2946.html>.

Regard all power lines as dangerous. Be particularly careful when using 25 foot rods. At no time shall any prism pole or other extendable rod be extended through a vegetation canopy without the employee knowing that the area above the canopy is free from hazards.

The Caltrans Safety Manual, Section 8.41, requires a minimum clearance of 3 feet at all times around low voltage power lines (less than 600 volts). This would be typical for residential service connections. The minimum clearance from high voltage power lines is six feet. See Section 2946, above, for all safe clearances near power lines.

Subsurface Installations

A subsurface installation, in the context of this Manual, means any underground utility, pipeline, conduit, duct, wire, or other structure. If survey activities will be conducted in an area that is known, or reasonably should be known, to contain subsurface installations, avoid setting survey monument pipes or stakes that could damage subsurface installations.

Radio Transmitters

Mobile radio transmissions can set off explosive charges. If you are near blasting operations, always check with the blasting supervisor before transmitting.

Tire Inflation Safety

Determine proper tire inflation pressure by reading the tire sidewall before inflating.

Don't air up tires that are more than 20% under inflated. Take the wheel to a qualified tire repair person for breakdown, inspection, repair if necessary, and re-inflation.

Inspect wheel before inflating; do not inflate tires with obviously damaged or bent wheels. If in doubt contact your supervisor.

Never place yourself in front of a tire or wheel during inflation. Position yourself to the side. Use a clamp-on chuck or extension hose with a remote valve.

Use caution when handling inflated tires and wheels. Do not allow others to stand nearby when dropping or rolling inflated tires from a truck bed or loading dock. Never use any tire as a jack stand or vehicle support.

Pressurized Spray Cans

Serious injuries and costly cleanup may result from improper handling of pressurized spray cans. Observe the following rules when using spray cans:

- Do not puncture or incinerate.
- Store at temperatures lower than 120° F.
- Do not carry in vehicle passenger compartments.
- Do not discard any spray can in a receptacle that is normally accessible to children.
- Always wear safety glasses with using spray cans.

Hazardous Materials

A hazardous material is any substance which is a physical or health hazard. Materials that are physical hazards include combustible liquids, compressed gases, and explosives. Materials that are health hazards are substances for which there is scientific evidence that acute or chronic health effects may occur in exposed employees. For specific Caltrans policy on handling hazardous materials see Chapter 16 of the *Caltrans Safety Manual*.

Hazardous Material Spills

When an employee encounters a spill or a quantity of an unknown material or substance on or near a highway, the employee should:

- During regular working hours call the Maintenance Region Manager, the Caltrans Communications Center, the CHP, or other emergency number including 9-1-1, depending on the severity of the incident
- Stay clear and “up wind” .
- Avoid contact with the unidentified material.
- Provide traffic control when qualified, equipped, and necessary.

If an unknown material is encountered on a job site, stop work and notify the supervisor. The supervisor shall request the District Hazardous Materials Coordinator to determine if the job site is safe before work is continued. If you believe that your personal safety may be in jeopardy, leave the immediate area.

Lead Contaminated Soils

Recent testing of soils along some urban freeways has revealed lead levels that are not hazardous. Even in the face of these tests, because lead enters the body through ingestion or inhalation, it is prudent to observe the following safe practices:

- Avoid working in dusty work conditions without a proper mask.
- Prevent soil ingestion by not eating, drinking, or smoking near work operations. Wash hands and face before eating, drinking or smoking. Clean hands, clothing, and shoes before entering vehicles or buildings. Store food and water so it will not be exposed to dust.