Project # U552933

Fee Paid $498.

Date 10/20/89

SAFETY & ACCIDENT PREVENTION

PROGRAM

GENERAL ENGINEERING CONTRACTOR:
HUNTER & FAHY CONSTRUCTION COMPANY, INC.
411 NORTH BUCHANAN CIRCLE #2
PACHECO, CA 94553

TABLE OF CONTENTS

SUPPLEMENTAL SECTION

EMERGENCY PHONE NUMBERS:

FOR MOST ALL AREAS THAT MINTER & FAHY CONSTRUCTION COMPANY WORKS, ESPECIALLY THE LOCAL BAY AREA, THE EMERGENCY POLICE, FIRE, AND AMBULANCE CAN BE REACHED BY DIALING:

911

ADDITIONAL PHONE NUMBERS:

OFFICE: 415-674-8800

SERVICE TRUCK: 415-860-0994

JOHN FAHY (HOME) : 415-372-9303

MATT MINTER (HOME) : 415-754-0623

January 1989

Employee List:

John F. Fahy Jr.
131 Clipper Lane
Martinez, CA 94553

Jerry Fahy
80 Monterey Avenue
San Anselmo, CA 94960

Steven Gotz
41 Mt Shasta Place
Clayton, CA 94517

Matthew W. Minter
2827 Lucena Way
Antioch, CA 94509

James L. Minter
2212 Tyler Court
Antioch, CA 94509

William Thweatt, Jr.
2819 B Florida Avenue
Stockton, CA 95205

Emergency Phone Numbers:

Office (24 hours).....415-674-8800
John F. Fahy, Jr.....415-372-9303
Matthew W. Minter.....415-754-0623
James 'Les' Minter.....415-757-1338

October 1989

Vehicle List

Number	Year	Make	License	Vehicle I.D.
#2	1964	Hopto, Warner & Swasey	2EKU607	3706
#3	1964	Hopto, Warner & Swasey	SFHO87	3723
#6	1968	Ford Dump Truck	1M87097	U85BU835105
#9	1975	GMC Service/Dump Truck	95398X	TCY3357512398
#12	1978	GMC Service Truck	1K43612	TCL348Z509498
#15	1987	Ford F350 Service Truck	3F22121	1FDJF37L8HKA46711
#18	1989	GMC Suburban (M)	2LXV148	1GKGV26K8KF505633
#21	1989	GMC Suburban (J)	2LXL654	1GKGV26K8KF505065
#24	1977	Strongboy Trailer	UB1641	2768

SECTION ONE

SECTION ONE

SAFETY PROGRAM

TO ALL EMPLOYEES:

This manual is hereby distributed as the Minter & Fahy Construction Company Safety Manual. Federal and State safety laws require that a safety manual be written, and used, to see that safe conditions prevail in all of our work areas.

It is company policy that safety always be of prime concern, especially when working on the jobsite. Accidents cost everyone, and benefit no one, with the exception of doctors, attorneys, and morticians.

Minter & Fahy Construction is involved in the removal and the installation of underground fuel tanks. There are several areas where safety problems are the most demanding on our company. They are: excavations, backfill, electrical tools, air compressors, heavy equipment operation, and exposure to hazardous materials. The best way to prevent accidents is to identify and eliminate the causes before they happen. This manual will be used to help identify the causes, and thus prevent accidents from happening at all.

Weekly tailgate meetings shall be carried out by the Safety Officer assigned to each particular job, whenever two or more employees are located on one jobsite. Notifications of the meetings and the topic covered shall be forwarded to the office on the log sheets at the back of this manual.

We are proud of our record and it will take your constant attention to hazards to continue keeping working conditions safe.

SAFE PRACTICE PROGRAM

GENERAL

1. All persons shall follow these rules, render every possible aid to safe operations, and report unsafe conditions or practices to the proper authorities.

2. The foreman shall insist that all employees observe all the safety rules.

3. All employees shall be given frequent accident prevention instructions, once a month at a general meeting, and each week at the jobsite tailgate meetings.

4. Anyone known to be under the influence of intoxicating liquor and/or drugs, will not be allowed on the jobsite, and will be subject to immediate release.

5. Horseplay will be absolutely prohibited on the jobsite.

6. Work shall be planned and supervised to forestall injuries in the handling of heavy materials and in working together with equipment.

7. Employees shall not enter manholes, underground vaults, tanks, open excavations, or other similar places that receive little ventilation.

8. Employees shall be alert to see that all guards and other protective devices are in proper places, and adjusted, and shall report any deficiencies to the foreman.

9. All injuries shall be reported promptly to an authorized person , so that arrangements can be made for first aid.

10. When lifting heavy objects, use the large muscles of the leg, instead of the smaller muscles of the back.

11. Gasoline shall not be used for cleaning purposes.

12. Heavy equipment shall only be operated by employees that have been instructed and trained for such operation.

USE OF TOOLS AND EQUIPMENT

1. Keep faces of hammers in good shape to avoid flying nails and bruised fingers.

2. Hold cold chisels in such a way so that the knuckles will be protected if the hammer misses the hand.

3. Do not use pipe wrenches as a substitute for other wrenches.

4. Files shall be equipped with handles.

5. Do not use a screwdriver for a chisel.

6. Keep hand saws sharp.

7. Do not push a wheelbarow with handles in the upright position.

8. Do not leave the cords of portable electrical tools where cars or trucks can run over them.

9. Do not lift or lower portable tools by means of the cord, use a rope.

10. Do not alter wrench size by the use of a handle extension or a "cheater".

11. All tools and equipment shall be maintained in good condition. Any tool or pice of equipment that is damaged shall be removed from service and tagged "Defective".

12. No burning, welding or other source of ignition shall be applied to any enclosed tank or vessel, even if there are some openings, until it has first been determined that no possibility of explosion exists, and authority for the work is obtained from the foreman or the superintendent. The fire department must be present for these type of operations.

HEAVY EQUIPMENT, MACHINERY, AND VEHICLES

1. Do not operate machinery or equipment without the proper permission, training, and instruction.

2. Machinery shall not be repaired or adjusted while in operation.

3. Do not work under vehicles supported by jacks or chain hoists, without proper blocking.

4. Air hoses should not be disconnected at any end until the hose has been bled.

5. All excavations should be inspected before backfilling operations begin, to insure that it is safe to do so.

6. Excavating equipment shall not be operated near tops of cuts, banks, and cliffs, if employees are working below.

7. Tractors, and heavy equipment shall not be operated where there is a possibility of overturning in dangerous areas like edges of deep fills, cut banks, and steep slopes.

8. At all times, during the operation of heavy equipment, proper protection, such as hard hats, gloves, and steel toed boots shall be worn.

SECTION TWO

SECTION TWO

HEALTH AND SAFETY CONSIDERATIONS

A. Health and Safety Officer

James "Les" Minter is designated as the Health and Safety Officer for this project. He will be responsible for planning, implementing, and auditing the health and safety program for this construction work. He will be on site at all times to insure that the job flows in a safe manner. Les will be conducting weekly fifteen minute safety meetings with all construction personnel. He also will conduct monthly safety meetings with a minimum of one per location in the event that the construction schedule does not require a full month at each location. The Project Inspector may wish to be present at these meetings, so he will be notified in advance. Log sheets for the weekly and the monthly safety meetings can be found in the list of attached plates at the end of this booklet. The Health and Safety Officer shall fill out the sheet for each meeting.

B. Hazardous Substance Description

Light and heavy petroleum hydrocarbons, including benzene, toluene, and xylene may be encountered during the normal course of excavation and removal of the existing underground tanks, the associated piping, and the surronding soil. These petroleum hydrocarbons will be in the form of gasoline and diesel fuel, withthe BTX (Benzene, Toluene, and Xylene) being the result of the breakdown of these fuels in soil and water. Soil and/or

water samples will be taken at the discretion of the inspecting health officer from the county and/or the environmental health inspector. Appropriate measures will be taken in the event that the soil and or water is found to be contaminated.

C. Chemical Distribution

Petroleum hydrocarbons in the form of gasoline and diesel fuel will have the greatest concentrations at locations adjacent to the tanks and the associated piping, becoming less with distances away from the tank and associated piping. Utmost care will be taken to capture all residual product from the tank and associated piping so that it does not enter the soil or ground water.

D. Chemical Hazards

Potential chemical hazards include skin and eye contact and inhalation or exposure to potentially toxic concentrations of chemical vapors. The identified toxic compounds that could exist at the site are listed below with descriptions of specific effects of each. The list includes the main toxic constituents of gasoline (benzene, toluene, xylene, and ethylbenzene).

1. Benzene
    a. Characteristics: Clear, colorless, highly flammable liquid with characteristic odor.
    b. High exposure levels may cause: Acute restlessness, convulsions, depression, respiratory failure, suspected carcinogen.
    c. Permissible exposure level in the air (PEL) for a time average over an eight hour period: 10ppm

2. Toluene

a. Charateristics: Refractive flammable liquid with benzene like odor.

b. High exposure levels may cause: Headache, nausea, eye irritation, mild macrocytic anemia, but is less toxic than benzene.

c. PEL for an 8 hour TWA: 200 ppm

3. Xylene

a. Characteristics: clear, mobile, flammable liquid

b. High exposure levels may cause: severe eye irritation skin irritation, narcosis.

c. PEL for an 8 hour TWA: 100 ppm

4. Ethylbenzene

a. Characteristics: colorless liquid, aromatic odor, highly flammable

b. High exposure levels may cause: skin, nose, and eye irritation, dizziness, ataxia, loss of conciousness and respiratory failure.

c. PEL for an 8 hour TWA: 100ppm

E. Physical Hazards

Other on site hazards may include physical injuries due to the proximity of workers to engine-driven heavy equipment and tools, Heavy equipment used during the excavation and removal ofthe underground tanks for this project include a Hopto, a rubber-tire mounted excavator, a backhoe, and a tractor. Only trained personnel will operate machines, tools, and equipment; all of which will be kept clean and in good repair. Safety

apparel required around the heavy equipment will include a hard hat. Perimeters of tank holes will be barricaded, flagged, taped, and or fenced. All work will be performed in accordance with OSHA guidelines.

All inspections will be coordinated with the Project Inspector with plenty of notice. Tank holes will not be vacated unless approved by the Project Inspector.

Noise Control: Work hours will be normal working hours of 8:00am to 4:00pm, unless otherwise approved by the Project Inspector. Noise will be kept at a minimum, as far as possible. Ear and eye protection will be provided during jackhammering, cutting, and excavation, where necessary. Explosives will not be permitted under any circumstances.

Job Clean Up: Site excavations will be cleaned on a daily basis so that all stockpiled material from the excavation is clearly marked and barricaded to reduce injury from rubble, dirt, and any unwanted material in walkways and thoroughfares.

SECTION THREE

SECTION THREE

WORK PLAN INSTRUCTIONS

A. Level of Protection

Regular daily surveys of the site and knowledge of the anticipated hazards will determine the level of protection and the proper safety procedures to be employed on a tank by tank basis. During use of heavy equipment and machinery, all construction personnel and site visitors must wear a hard hat. The workers coming into contact with the excavated materials will wear boots, gloves, and a hard hat.

All safety equipment and first aid kits can be found in the service truck which will be located at the site during the normal construction hours. Fire extinguishers and eye wash can also be found on this truck. All construction workers should become familiar with the location of all safety equipment on the jobsite. Construction workers should also be familiar with the location of the nearest phone (station or commercial) at each tank site. There is a phone available in the service truck on the jobsite.

B. Site Entry Procedures

The two general work areas are shown on the site plans at the end of this booklet. Access to each tank hole site will be controlled with barricades, flagging, and caution taping. All personnel entering the work zone of each tank removal will be qualified field personnel wearing the proper level of protection.

Site visitors will be required to wear hard hats which are available from the job superintendent. Eating, drinking, and especially smoking and any other practices which increase the probability of combustion or hand-to-mouth transfer will be prohibited in the work zone. Potable water will be available at the site.

C. Decontamination Procedures and Disposal

All disposable protective clothing will be put into plastic bags and disposed of in a garbage receptacle. Excavated soils will be stockpiled in designated areas until chemical analyses have been performed on the soil samples, or until the health inspector deems the material to be free of potential contamination hazard. The soil will be covered with plastic sheeting in the event that the health inspector suspects there to be a contamination hazard.

In the event of a medical emergency, the injured party will be taken through decontamination procedures, if possible. However, the procedures will be omitted when it may aggravate or cause harm to the injured party. A member of the work team will accompany the injured party to the medical facility to advise on matters concerning chemical exposure.

The Health and Safety officer will be notified if combustible gas vapor levels exceed ambient concentrations in the samples. Excavation will cease, equipment will be shut down, and personnel will withdraw from the area. The Health and Safety Officer will determine when personnel may return to the work area.

SECTION FOUR

SECTION FOUR

EMERGENCY MEDICAL CARE

In the event of an injury or suspected chemical exposure, the first responsibility of the Health and Safety Officer will be to prevent further injury. This objective will normally require an immediate end to work until the situation is rectified. The Health and Safety Officer may order an evacuation of the work party, as discussed in Section Three of this manual.

The Health and Safety Officer's primary responsibility in the event of an accident will be evacuation, first aid, and decontamination of injured team members. The Health and Safety Officer will determine safe evacuation areas and begin first aid.

Emergency numbers can be found in the Supplemental Section of this manual. When in doubt as to which number to call, dial 9-911 on the station phone, or 911 on the commercial phone.

Accident report forms can be found on the following pages. For any accident or injury, regardless of how minor, an accident report will be filled out and presented to the proper representatives of the OICC and the Contractor.

ACCIDENT REPORT SHEET

UNDERGROUND TANK REMOVAL PROJECT

CONTRACT NO.

DATE:

PERSON FILING REPORT:

LOCATION OF ACCIDENT:

NATURE OF ACCIDENT:

PERSON/PERSONS INVOLVED:

DESCRIPTION OF ACCIDENT:

REMEDIAL ACTION TAKEN:

SIGNATURE:

DATE:

ADDITIONAL COMMENTS:

Case or File No. .....

OMB No. 44R 1453

Supplementary Record of Occupational Injuries and Illnesses

EMPLOYER

1. Name _____
2. Mail address _____
   (No. and street) (City or town) (State)
3. Location, if different from mail address _____

INJURED OR ILL EMPLOYEE

4. Name _____ Social Security No. _____
   (First name) (Middle name) (Last name)
5. Home address _____
   (No. and street) (City or town) (State)
6. Age _____ 7. Sex: Male_____ Female_____ (Check one)
8. Occupation _____
   (Enter regular job title, *not* the specific activity he was performing at time of injury.)
9. Department _____
   (Enter name of department or division in which the injured person is regularly employed, even though he may have been temporarily working in another department at the time of injury.)

THE ACCIDENT OR EXPOSURE TO OCCUPATIONAL ILLNESS

10. Place of accident or exposure _____
    (No. and street) (City or town) (State)
    If accident or exposure occurred on employer's premises, give address of plant or establishment in which it occurred. Do not indicate department or division within the plant or establishment. If accident occurred outside employer's premises at an identifiable address, give that address. If it occurred on a public highway or at any other place which cannot be identified by number and street, please provide place references locating the place of injury as accurately as possible.
11. Was place of accident or exposure on employer's premises? _____ (Yes or No)
12. What was the employee doing when injured? _____
    (Be specific. If he was using tools or equipment or handling material, name them and tell what he was doing with them.)
13. How did the accident occur? _____
    (Describe fully the events which resulted in the injury or occupational illness. Tell what happened and how it happened. Name any objects or substances involved and tell how they were involved. Give full details on all factors which led or contributed to the accident. Use separate sheet for additional space.)

OCCUPATIONAL INJURY OR OCCUPATIONAL ILLNESS

14. Describe the injury or illness in detail and indicate the part of body affected. _____
    (e.g.: amputation of right index finger at second joint; fracture of ribs; lead poisoning; dermatitis of left hand, etc.)
15. Name the object or substance which directly injured the employee. (For example, the machine or thing he struck against or which struck him; the vapor or poison he inhaled or swallowed; the chemical or radiation which irritated his skin; or in cases of strains, hernias, etc., the thing he was lifting, pulling, etc.)
16. Date of injury or initial diagnosis of occupational illness _____
    (Date)
17. Did employee die? _____ (Yes or No)

OTHER

18. Name and address of physician _____
19. If hospitalized, name and address of hospital _____

Date of report _____ Prepared by _____
Official position _____

SECTION FIVE

SECTION FIVE

EMERGENCY PROCEDURES

A. Response to an Emergency

In case of an injury, the Health and Safety Officer will use the appropriate first aid kit and contact off-site medical help, if appropriate.

If medical evacuation is required, the escape route will be determined by the Health and Safety Officer and the Project Inspector depending on which tank site the work force is currently operating.

B. Emergency Contacts

Ambulance, Fire : Dial 9-911 or 911

Security : Dial 2555 or 646-2555

Poison Control : Dial 9-242-7631 or 242-7631

C. Acute Exposure Symptoms and First Aid

Exposure	Symptoms	First Aid
Skin	Dermatitis	Wash immediately with soap and water, contact outside help, if required
Eye	Irritated eyes	Flush eyes with water, contact ambulance
Inhalation	Vertigo, tremor	Move person to fresh air, cover source
Ingestion	Nausea, vomiting	Call Poison control

D. Contingency Plan

The following procedures will be used in case of an unpredictable event:

FIRE: Use fire extinguisher if localized and call the fire department if uncontrolled.

CHEMICAL EXPOSURE: Follow first aid treatment specified in previous section.

PHYSICAL INJURY: Provide first aid treatment and contact ambulance for evacuation to hospital, if appropriate.

SECTION SIX

PERMITS

Permits for excavations and or trenches five feet deep or more in which workers must enter can be obtained at our local office :

CAL OSHA

1465 ENEA CIRCLE

BUILDING E SUITE 900

CONCORD, CA 94520

415-676-5333

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH

DISTRICT OFFICES

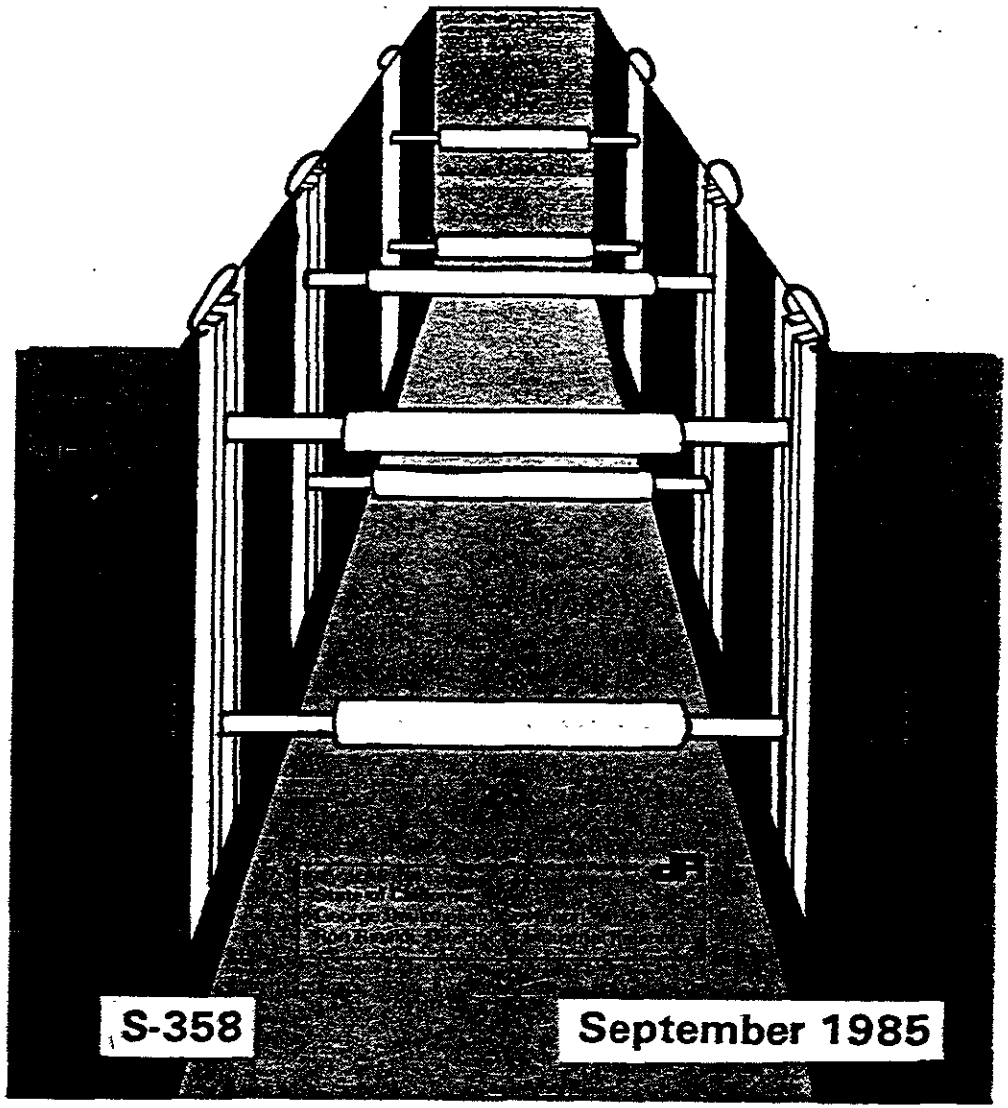
Bakersfield	4800 Stockdale Hwy.	93309	(805) 395-2718
Berkeley	1625 Shattuck Ave.	94709	(415) 540-3030
Concord	1465 Enea Circle	94520	(415) 676-5334
Covina	233 N. Second Ave.	91723	(818) 331-4875
Fresno	2550 Mariposa St.	93721	(209) 445-5302
Long Beach	245 W. Broadway	90802	(213) 590-5035
Los Angeles	3460 Wilshire Blvd.	90010	(213) 736-3041
Modesto	1800 Coffee Rd.	95355	(209) 576-6260
Redding	1421 Court St.	96001	(916) 225-2885
Sacramento	2422 Arden Way	95825	(916) 920-6123
San Bernardino	303 W. Third St.	92401	(714) 383-4321
San Diego	7807 Convoy Court	92111	(619) 237-7325
San Francisco	455 Golden Gate Ave.	94102	(415) 557-1677
San Jose	100 Paseo de San Antonio	95113	(408) 277-1260
San Mateo	1900 So. Norfolk St.	94403	(415) 572-9424
Santa Ana	28 Civic Center Plaza	92701	(714) 558-4141
Santa Fe Springs	14111 E. Freeway Dr.	90670	(213) 802-1711
Santa Rosa	50 "D" St.	95404	(707) 576-2388
Van Nuys	6150 Van Nuys Blvd.	91401	(818) 901-5403
Ventura	5720 Ralston St.	93003	(805) 654-4581
Vernon	2833 Leonis Blvd.	90058	(213) 589-5848

FIELD OFFICES

Chico	555 Rio Lindo Ave.	95926	(916) 345-7131
Eureka	619 Second Ave.	95501	(707) 442-6232
Salinas	21 W. Laurel Dr.	93906	(408) 443-3050
Santa Barbara	3704 State St.	93105	(805) 682-2578
Stockton	31 E. Channel St.	95202	(209) 948-7762
Ukiah	776 S. State St.	95482	(707) 462-8850

CAL OSHA

TRENCH and EXCAVATION SAFETY GUIDE



S-358

September 1985

CAL/OSHA Communications
525 Golden Gate Ave.
San Francisco, CA 94102

CONTENTS

TRENCH AND EXCAVATION SAFETY GUIDE

Each year workers are killed and disabled in excavation and trench cave-ins in California. Almost all of these accidents result from failure to shore or slope the trench or from inadequate shoring or sloping. This pamphlet provides guidelines based on CAL/OSHA standards for shoring, sloping, and benching. The number of cave-in accidents will be reduced if these guidelines and applicable CAL/OSHA standards are followed.

This is not a legal interpretation or a restatement of current CAL/OSHA regulations. Refer to Title 8, Sections 1503 and 1539-1547, for current regulations.

BEFORE YOU DIG

Obtain the required permit from the Division of Occupational Safety and Health (DOSH) before constructing trenches or excavations 5 feet deep or more into which a person is required to descend. Contact a DOSH District or Field office for information regarding the permit application procedure.

Determine whether any underground installations such as sewer, water, or fuel lines are likely to be encountered. You can get this information by calling the Underground Service Alert (USA): in Northern California (800) 642-2444 and in Southern California 1-(800) 422-4133.

With the exception of emergency repair work, give owners of underground facilities in the area at least 48 working hours advance notice before you begin excavation work.

SUPERVISION. All work in an excavation must be supervised by a qualified person.

HAZARDS

Remove trees, poles, boulders, and similar objects which may be hazardous to workers.

Do not allow work in or near the excavation until a qualified person has determined that no hazard to workers exists from possible moving ground.

Inspect excavations after rainstorms, thaws, or other events which may affect the stability of the soil and increase hazards before workers are allowed to enter the excavation.

Protect workers who enter excavations 5 feet deep or more with a system of shoring, sloping, benching, or equivalent alternative methods. When necessary, provide similar protection for workers in excavations less than 5 feet deep.

SPOIL. Dump excavated material far enough from the edge of the trench so that it does not fall back. When trenches are 5 feet deep or more, locate the spoil at least 2 feet from the edge Do not contain the spoil by any method which will disturb the soil already in place (such as driving stakes).

ACCESS. Provide a safe and convenient way for workers to enter and leave the excavation. In trenches 4 feet deep or more, provide a safe means of access within 25 feet of any work area in the excavation.

CROSSINGS. Install crossings with standard guardrails and toeboards when the excavation is more than 7½ feet deep.

UNDERMINING. Do not excavate beneath the level of the base of an adjacent foundation, retaining wall or other structure until a qualified person has determined that the earth work will not create a hazard to workers. Support undermined sidewalks so they will support anticipated loads.

If the excavation endangers the stability of adjoining structures, shore, brace, or underpin those structures.

RETAINING WALLS. Do not use an existing wall or structure as a retaining wall until it has been determined that it will safely support expected loads.

REMOTE WORK LOCATIONS. Provide barriers to prevent workers from falling into excavations.

Barricade or securely cover all wells, pits, shafts, and caissons.

Backfill temporary wells, pits, and shafts when the operation is completed.

WATER ACCUMULATION. Use diversion ditches, dikes, and other effective methods to prevent water from entering the excavation and to drain surrounding areas.

VIBRATIONS OR SUPERIMPOSED LOADS. Use additional bracing to strengthen shoring in excavations located near streets, railroads, or other sources of vibration and external loads. Take similar precautions when excavations are made in areas that have been previously filled.

SHORING, SLOPING, AND BENCHING SYSTEMS

Provide devices which allow the upper cross braces to be set in place from ground level. In deep trenches where additional braces are needed, workers should proceed downward, protected by cross braces already set in place. When removing shoring, use the reverse procedure.

STANDARD SHORING SYSTEM. Install shoring in accordance with Tables 1 and 2 on pages 15 and 16 and diagrams on pages 17 through 21, or according to plans prepared by a civil engineer registered in California.

Shoring must be composed of:

Solid wood sheeting or wood sheet-piling not less than 2 inches thick
Plywood at least 1⅛ inches thick
Wood uprights at least 2 inches by 8 inches
Wood braces and diagonal shores at least 4 inches by 4 inches and not subjected to compressive stress in excess of values given by the following formula:

$S = 1300 - (20L/D)$
Maximum Ratio $(L/D) = 50$
L—length, unsupported (in inches)
D—least side of the timber (in inches)
S—allowable stress (in pounds per square inch of cross section)

Wedge or cleat diagonal shores (struts) at the bulkhead end. If diagonal shores bear on the ground, they should not impose loads in excess of the test-determined soil-bearing values. (Allow for the horizontal component of force.)

Do not place diagonal shores at an angle greater than 45° from the horizontal.

Securely anchor tie rods when they are used to restrain the top of sheeting or other restraining systems.

Assume that there is full loading due to ground water when using tight sheeting or sheet piling (unless full loading is prevented by weep holes, drains, or other methods).

Provide additional stringers, ties, and bracing to allow temporary removal of individual supports.

Thickness of sheeting and spacing of shores:

Minimum Rough Thickness of Sheeting or Lagging	Maximum Spacing of Shores
2 inches	4 feet
3 inches	7 feet

TRENCH SHORING SYSTEMS. Do not slope a shored trench in excess of 15° from the vertical. Make uprights at least 2 inches in nominal thickness. Plywood panels at least ¾ inches thick may be installed behind the uprights to hold loose material not likely to impose heavy loads.

Extend uprights to the top of the trench and to within at least 2 feet of the bottom. If running soil is encountered, extend uprights to the bottom of the trench.

Cross braces—Always use at least two braces. Install one horizontal brace for each 4 foot zone or partial zone measuring 2 feet or more. Use metal screw-type trench jacks with a base on each end or timbers placed horizontally against the uprights or stringers. Hydraulic braces may also be used.

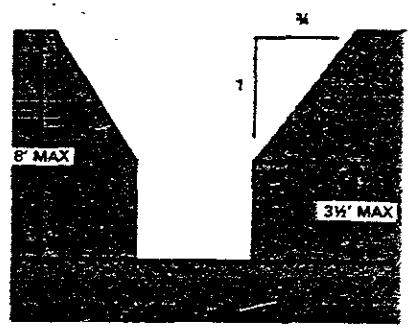
PROTECTIVE SHIELDS AND WELDING HUTS. Plans for protective shields and welding huts must be prepared by a civil engineer registered in California. Construct protective shields and welding huts out of steel or other material providing equivalent strength. They must provide protection equivalent to that afforded by adequate shoring.

BELL OR POT HOLES. Shore and brace bell and pot holes unless protective shields or welding huts are used.

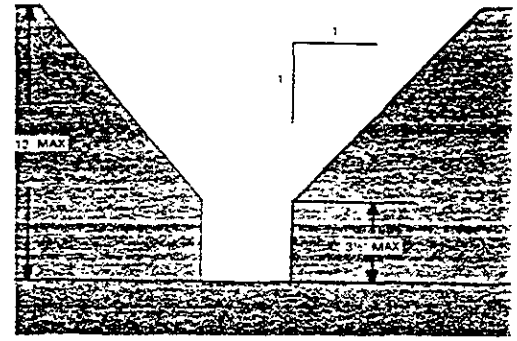
SLOPING OR BENCHING SYSTEMS. When sloping is used as a substitute for shoring, the slope should be at least ¾ horizontal to 1 vertical unless the instability of the soil requires a flatter slope.

Exceptions:

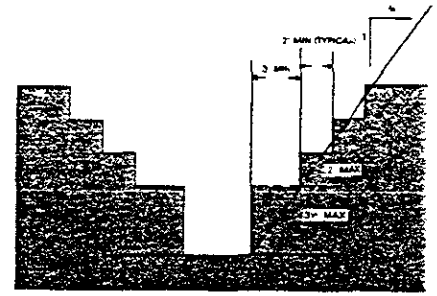
In hard, compact soil where the depth of the excavation or trench is 8 feet or less, make a vertical cut of 3½ feet with a slope of ¾ horizontal to 1 vertical.



In hard, compact soil where the depth of the excavation or trench is 12 feet or less, make a vertical cut of 3½ feet with a slope of 1 horizontal to 1 vertical.



When benching in hard, compact soil, use a slope ratio of ¾ horizontal to 1 vertical, or flatter.



SHAFTS

Retain all wells or shafts over 5 feet deep which workers are allowed to enter with lagging, spiling, or casing. Extend the lagging, spiling, or casing at least 1 foot above the ground, the full length of the shaft, and at least 5 feet into solid rock (if possible).

SMALL SHAFTS IN HARD, COMPACT SOIL. 2 inch cribbing can be used in square shafts not over 4 feet square. Cut half way through the width of the member and dovetail into position so that each member will act as a shore as well as lagging. Nail strips in the corner to prevent boards from dropping down.

SHAFTS IN OTHER THAN HARD, COMPACT SOIL. Use a system of lagging supported by braces and corner posts for square or rectangular shafts. In shafts 4 feet square or smaller, use 4 inch by 4 inch members at intervals of no more than 4 feet. Braces and corner posts in larger shafts should be correspondingly larger. The appropriate size should be determined by a registered civil engineer.

Completely lag round shafts with 2 inch material supported by adjustable rings of metal or timber at intervals of no more than 4 feet or case in a way which provides equivalent protection.

BELL EXCAVATIONS. Include the following to protect workers engaged in belling or enlarging the bottoms of shafts:

- Physical protection from potential ground movement or collapse
- Mechanical ventilation
- A line for instant rescue fastened to a shoulder harness and worn by each worker entering the shaft
- A hoist and platform for lifting and lowering workers in shafts over 50 feet deep
- Barriers to prevent materials from falling into the shaft

EARTHWORK AND EXCAVATING

Install a bench or other method of working if the height and the condition of the face pose a hazard to workers. When a bench method of operation is needed, construct a setback of at least ½ the height of the single face or bank for each section of the face or bank.

The maximum slope of the face depends on:

- The nature of the material being excavated
- The compaction of the material
- The height of the face
- The type and size of the equipment used at the face and the amount of protection this equipment affords the operator
- The safety of workers not protected by such equipment

Do not make the slope steeper than ¾ to 1 when the height of the excavation is greater than the bucket of the excavator or loader can reach and when the face is composed of loose or ravelling material.

Do not allow a slope steeper than ½ to 1 when the height of the excavation is greater than the bucket of the excavator or the loader can reach when the face is composed of material which will stand in place but which is not firmly cemented or consolidated.

OVERBURDEN

Do not allow a person under a face or bank where stripping or any other similar operation constitutes a hazard.

Use barriers, baffle boards, screens, or other devices to protect workers from material rolling or sliding down the slopes.

FACE INSPECTION AND CONTROL

Make daily inspections of faces, banks, and tops where workers are exposed to falling or rolling material, and correct any unsafe conditions. Do not allow anyone to work near an unsafe face.

Prohibit overhanging banks except:

- When material is moved by mechanical equipment with controls at a safe distance
- When the bank is undercut by a stream and the monitor is located a safe distance from the bank

When necessary, station a worker at the face who is instructed to give a warning when loose rock or other materials begin to fall. Provide this worker with the means of giving adequate warning to other workers. While the worker is assigned to this job, do not assign her/him to any other work.

Provide enough illumination for safe night work. Do not allow night work unless the working area is sufficiently illuminated so that movement of workers and equipment can be easily seen.

Keep workers away from dangerous areas that are not work areas by posting KEEP OUT signs or erecting barricades.

PROTECTION OF WORKERS AT THE FACE

Prohibit work above or below workers at the face if such work endangers their safety.

On top of the bank:

- Fence with guardrails or ropes.
- Use a railed platform.
- Have workers use safety belts and life lines.

Exceptions:

When the bank is less than 20 feet high
When the slope is flatter than ¾ to 1
When no work is being done within 10 feet of the edge

On the face:

Remove loose rock from over the working place.

Have workers use safety belts and life lines.
(Life lines used for scaling or inspection should be protected from excessive fraying or damage and made of a minimum of ⅞ inch wire core manila rope.)

Use portable staging.

Use a boatswains chair or skips especially designed for faces. (When using a boatswains chair, also use a safety belt and life line equipped with an effective descent control.)

Assign two or more workers cooperating with each other for drilling, blasting, or removing loose rock.

At the foot of the bank:

Remove loose rock from above the working place.

Maintain a ready exit to a place of safety.

Tables containing specifications for wood shoring and for shoring in running soils are printed in the Safety Orders. This table (1) and the table on the following page (2) cover the most common shoring materials and soil conditions.

TABLE 1

METAL-WOOD SHORING FOR HARD COMPACT SOIL

	UPRIGHTS		BRACES (STRUTS) AT 8' ON CENTERS				STRINGER
			ALUMINUM PIPE		STD. STEEL PIPE		
DEPTH (FEET)	HORIZ SPACING (FEET)	WOOD SIZE (INCHES)	MIN. ID (INCHES)	MAX EXCAV WIDTH (FEET)	MIN. ID (INCHES)	MAX EXCAV. WIDTH (FEET)	(WALER) (WOOD) SIZE
5	8	3×8	2½ (3½)	8 (10)	1½	3	
to	4	2×10	2½ (3½)	8 (14)	1½	3	4×4
7	2	2×8	2½ (3½)	8 (20)	1½	3	4×4
Over 7	8	4×10	2½ (3½)	6 (8)	2	6	
to	4	3×10	2½ (3½)	9 (11)	2½	12	6×8
10	2	3×8	2½ (3½)	12 (16)	3	15	6×8
Over 10	8	6×8	2½ (3½)	6 (7)	2 (2½)	8 (12)	
to	4	4×8	2½ (3½)	8 (10)	2 (2½)	10 (11)	8×8
12	2	3×8	2½ (3½)	10 (15)	2½ (3)	13 (15)	8×8
Over 12	8	6×8	2½ (3½)	5 (6)	2 (2½)	6 (10)	
to	4	4×10	2½ (3½)	7 (9)	2 (2½)	8 (12)	8×10
15	2	3×10	2½ (3½)	9 (13)	2½ (3)	13 (15)	8×10
Over 15	8	6×10	2½ (3½)	4 (5)	2½ (3)	8 (12)	
to	4	4×12	2½ (3½)	6 (8)	2½ (3)	10 (15)	6×12
20	2	3×12	2½ (3½)	8 (11)	2½ (3)	12 (15)	6×12
Over 20	See Section 1541(a)(6)						

- Metal pipe braces must be schedule 40, standard steel pipe or equivalent.
- Timber must be "selected lumber". See CSO 1504.
- Timber members of equivalent "section modulus" may be used for uprights and stringers shown in these tables.
- See page 17 for screw jack installation.
- Numbers in parentheses indicate maximum safe span for a specified diameter pipe.
- Tables may be modified by a civil engineer. See CSO 1541 (a) (6).
- Metal sheeting or other material equivalent to the strength of the wood members may be used.
- Place stringers to develop maximum strength (long side horizontal).

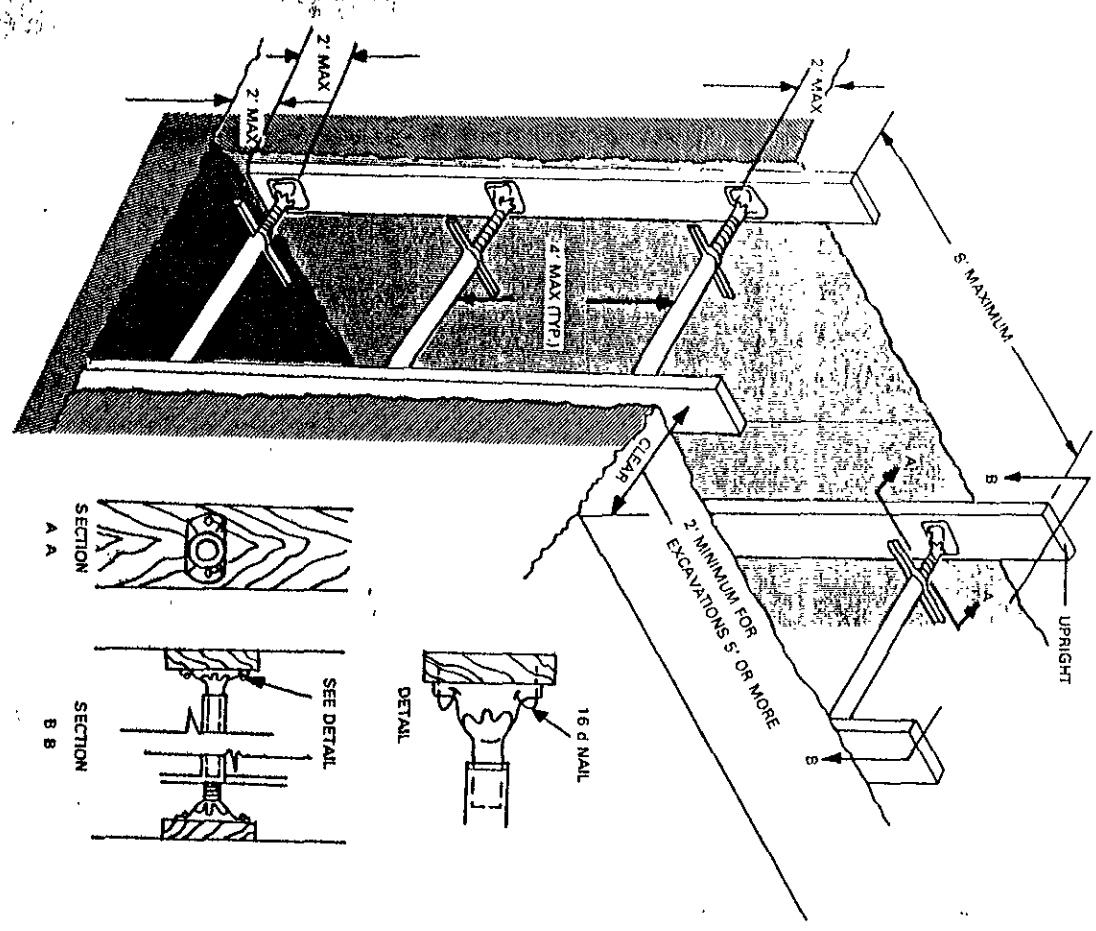
TABLE 2
HYDRAULIC SHORING, FOR HARD COMPACT SOIL

DEPTH (FEET)	UPRIGHTS: HORIZONTAL SPACING (FEET)	UPRIGHTS: SIZE ALUMINUM RAIL	STRINGERS (WALER): SIZE ALUMINUM RAIL	STRINGERS (WALER): VERTICAL SPACING (FEET)	BRACES (STRUTS): HYDRAULIC CYLINDERS	BRACES (STRUTS): HORIZ. SPACING (FEET)	MAX EXCV WIDTH (FEET)	
5 to 7	8	8" Wide Standard	6" Wide Standard	5	2" ID-2½" OD	8 cc	12	20
	*	***	***					**
Over 7 to 12	8	8" Wide Standard	6" Wide Standard	5	2" ID-2½" OD	8 cc	9	20
	*	***	***					**
Over 12 to 16	6	8" Wide Standard or HD	6" Wide Standard or 8" Wide HD	5	2" ID-2½ OD	6 cc	9	20
	*			5	2" ID-2½" OD			**
Over 16 to 20	6	8" Wide Standard or HD	6" Wide Standard or 8" Wide HD	4	2" or 3" ID or 2½" or 3½" OD	4 cc	9	20
	*			4				**

Over 20 See Section 1541(a)(6)

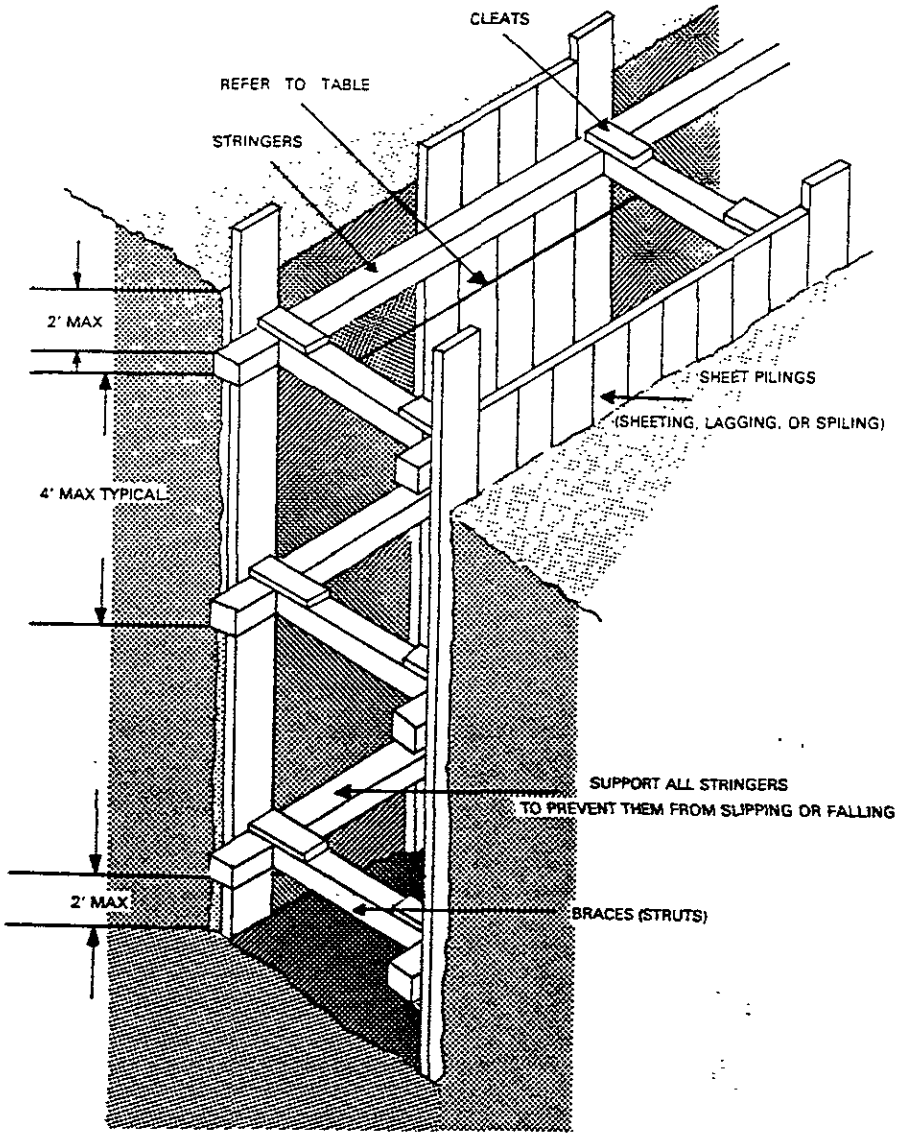
* Plywood may be used behind uprights.
** Use a 3½ × 3½ × 3/16" steel oversleeve to Std. 2" ID. No steel oversleeve required on 3" ID.
*** See Hydraulic Shoring Association Manual for strength of rails.

- If wooden members are used, refer to Tables 1 or 3 in GISO 1541.
- Tables may be modified by a civil engineer. See GISO 1541 (a) (6)

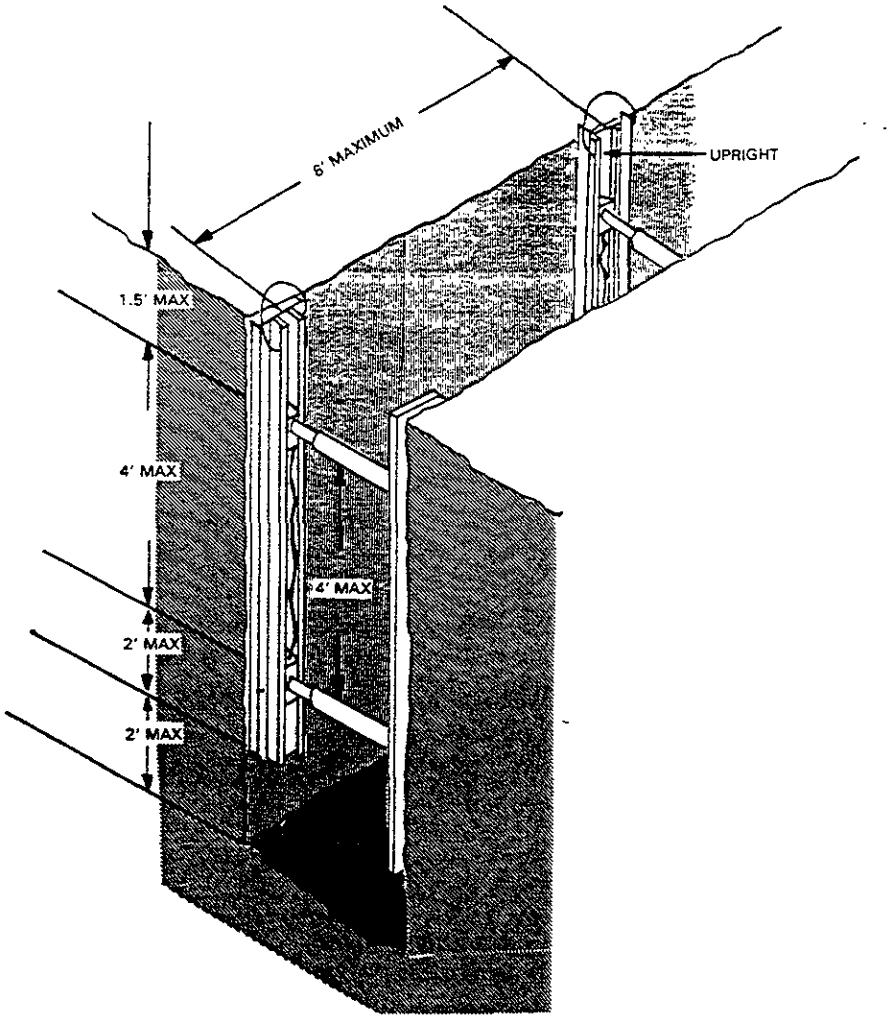


MINIMUM SHORING REQUIREMENT IN HARD COMPACT SOIL

CLOSE SHEETING METHOD IN RUNNING SOIL



MINIMUM SHORING REQUIREMENT IN HARD COMPACT SOIL—HYDRAULIC



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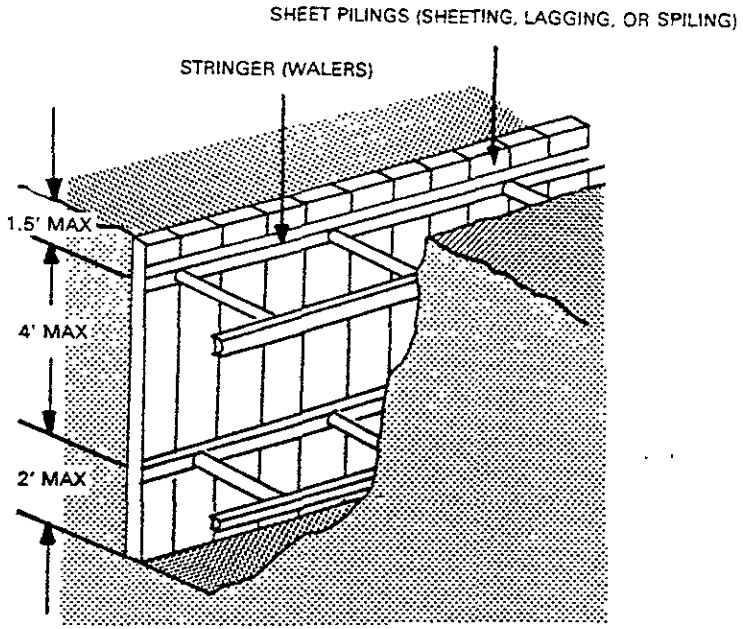
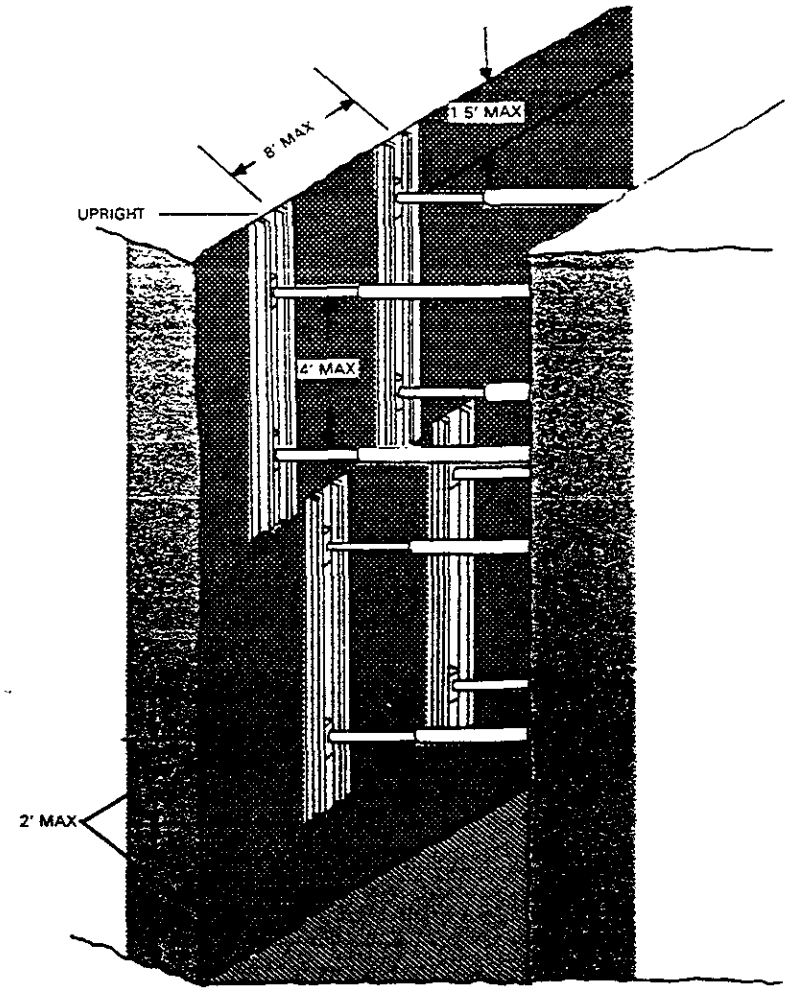


TYPICAL INSTALLATION IN HARD COMPACT SOIL— HYDRAULIC



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