



# Trench Rescue Technician (2021)

## Course Plan

### Course Details

**CTS Guide:** Trench Rescue (2021)

**Description:** This course provides the skills and knowledge needed for the trench rescue technician to work safely and efficiently in a trench rescue environment. This hands-on training program includes trench and excavation regulations, soil characteristics, trench configurations and hazards, rescue team preparation, incident response, initial on-scene and pre-entry operations, shoring systems and components, shoring system installation, victim rescue and recovery, and incident termination. This course incorporates awareness, operations, and technician training based on NFPA 1006 (2021).

**Designed For:** Personnel preparing to pursue technical rescue certification (pending) and all emergency personnel with responsibility for trench rescue operations

**Prerequisites:** Structural Collapse Specialist 1 **or** Rescue Systems 1  
Confined Space Rescue: Awareness

**Standard:** Attend and participate in all course sections  
Successful completion of all skills identified on the Training Record.

**Hours (Total):** 24 hours  
(5.75 lecture / 18.25 application)

**Maximum Class Size:** 24

**Instructor Level:** SFT Registered Trench Rescue Technician Instructor

**Instructor/Student Ratio:** 1:24 (lecture)  
1:8 (application)

**Restrictions:** See Equipment, Facilities, and Personnel requirements

**SFT Designation:** FSTEP

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## Required Resources

### Instructor Resources

To teach this course, instructors need:

- *Trench Rescue Technician Manual* (CMC Rescue, Inc., current edition)
- 29 CFR § 1926.650-652
- CCR Title 8 § 1504 and 1539-1543
- NFPA 1006: Standard for Technical Rescue Personnel Professional Qualifications (physical or digital access to current edition)
- NFPA 1670: Standard on Operations and Training for Technical Search and Rescue Incidents (physical or digital access to current edition)
- AHJ policies and procedures
- Manufacturer videos, manuals, and directions for equipment use
- Personal protective equipment (minimum requirements: helmet and eye, hearing, respiratory, hand, and foot protection determined by AHJ)

### Online Instructor Resources

The following instructor resources are available online at

<https://osfm.fire.ca.gov/divisions/state-fire-training/fstep-curriculum/>

- None

### Student Resources

To participate in this course, students need:

- Any textbook(s) selected by the instructor (recommended)
- Personal protective equipment (minimum requirements: helmet and eye, hearing, respiratory, hand, and foot protection determined by AHJ)

### Facilities, Equipment, and Personnel

#### Facilities

The following facilities are required to deliver this course:

- Standard learning environment or facility, which may include:
  - Writing board or paper easel chart
  - Markers, erasers
  - Amplification devices
  - Projector and screen
  - Laptop or tablet with presentation or other viewing software
  - Internet access with appropriate broadband capabilities
- A Trench Rescue Training Site with the NFPA 1006 required facilities, structures, work areas, materials, props, tools, and equipment of adequate size, type, and quantity to fully and safely support the cognitive and psychomotor training required to deliver the Trench Rescue curriculum

### Equipment

Student safety is of paramount importance when conducting the type of high-risk training associated with this Trench Rescue course. The equipment listed below is the minimum for the delivery of this course. The student is responsible for providing all personal protective equipment and ensuring that it meets AHJ and site requirements.

The following equipment is required to deliver this course:

Per 12-Person Module	Equipment
14	Plywood 4' x 8' x 3/4"*
14	2" x 12" x 10' (8' is okay, 10' preferred)*
10	2" x 4" x 8'*
14	4" x 4" x 8'*
4	4" x 4" x 12' (walers)*
4	4" x 4" x 14' (walers)*
1	6" x 6" x 12' (walers)*
12 pair	18" x 4" x 4" wedges*
Optional	14 ply Artic birch 4' x 8' x 3/4" (e.g., FinnForm)*
1	Wood pallet for cutting station
30 lbs.	Nails, 16D duplex
1	Hydraulic shores with extensions and appropriate equipment
2	Pneumatic shores with appropriate equipment
1	Trench air cushions with appropriate equipment
As needed	SCBA cylinders
4	Ellis post screw jacks; 4" x 4"
4	NFPA General Use rescue rope, appropriate lengths
6	Utility line, 25'
4	Webbing, 1" x 20'
1	Patient packaging device
1	Circular saw with appropriate equipment to operate
1	Palm nailer with appropriate equipment
1	Chain saw with appropriate equipment
As needed	Power source with appropriate equipment
4	Crow bars
2	Shovels; round point, long handle
2	Shovels; square point, long handle
2	Shovels; round point, short D handle or military type folding
2	Grubbing tools
1	Pike pole, 10' - 12'

## Trench Rescue Technician

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4	Bucket (canvas or plastic with wire or rope handle)
6	Framing hammers
3	Single jack (short handled 3-4 lb. sledgehammer)
6	Tape measure, 25'
1	Speed square
6	Carpenter pencils
As needed	Sandbags
1	Duct tape
1	Salvage cover
4	Ladders, straight or roof
4	Ladder belts or escape belts with carabiners
1	Ventilation fan with appropriate equipment to operate
1	Atmospheric monitor with appropriate equipment
1	Manikin (mannequin)
1	Excavation equipment with operator
As needed	Trench Rescue Tactical Worksheets
3	Daily Trench Inspection Worksheets
2	Trench Rescue Site Safety Officer Worksheets
1	Incident Action Plan
* Depending on AHJ, lumber lengths may be longer	

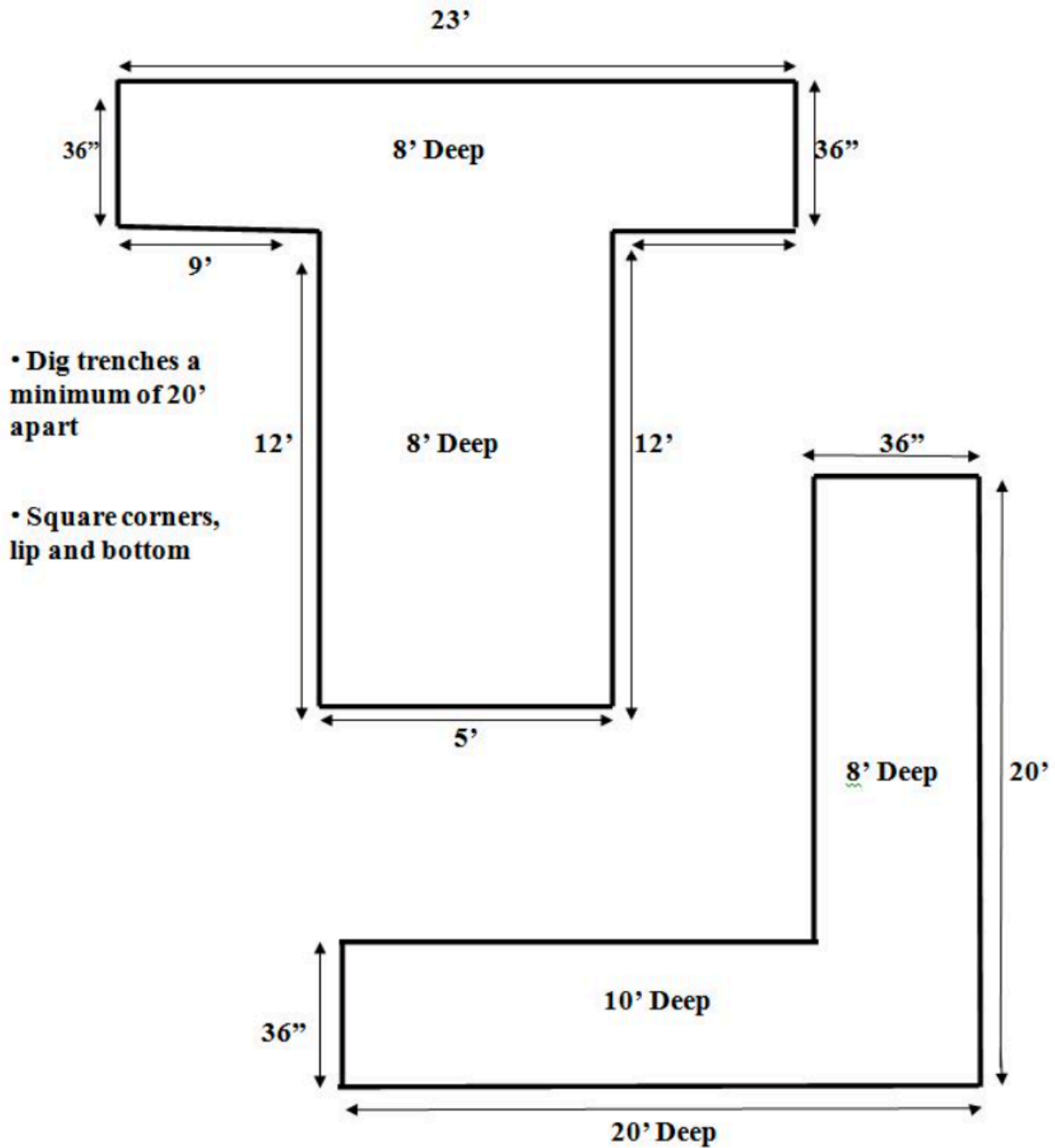
### Training Props

The following training props are required to deliver this course:

- One "L" trench and one "T" trench excavated according to the trench diagram
  - "L" Trench: Both legs of the trench to be 36" wide; each leg to be 20' long; one leg 8' deep; and one leg 10' deep
  - "T" Trench: Top of the "T" to be 36" wide, 23' long and 8' deep; upright portion of the "T" to be 12' long, 60" wide and 8' deep
  - Trenches must be in suitable soil for training with no extreme hazards
  - Trenches will be collapsed with manikins for each scenario

The provider or agency assumes all responsibility, liability, and maintenance for the engineering design, strength, stability, and adequacy of all props, including anchor points and tie offs. The provider or agency further assumes all responsibility, liability, and maintenance for all tools, equipment, and supplies used at the site for the delivery of a Trench Rescue class. This includes, but is not limited to, ladders, ropes, rescue hardware, and software.

**Required Trench Rescue Technician Trench Props**



**Personnel**

The following personnel are required to deliver this course:

- Any instructor counted toward student ratios must be an SFT Registered Trench Rescue Technician Instructor.

## Time Table

Segment	Lecture	Application	Unit Total
<b>Unit 1: Introduction</b>			
Topic 1-1: Orientation and Administration	0.5	0.0	
<b>Unit 1 Totals</b>	<b>0.5</b>	<b>0.0</b>	<b>0.5</b>
<b>Unit 2: Background</b>			
Topic 2-1: Introduction to Trench Rescue	0.25	0.0	
Topic 2-2: Standards and Regulations	0.25	0.0	
<b>Unit 2 Totals</b>	<b>0.5</b>	<b>0.0</b>	<b>0.5</b>
<b>Unit 3: Soil and Trench Considerations</b>			
Topic 3-1: Soil Characteristics	0.25	0.0	
Topic 3-2: Trench Types and Terminology	0.25	0.0	
Topic 3-3: Trench Collapse Patterns	0.25	0.0	
<b>Unit 3 Totals</b>	<b>0.75</b>	<b>0.0</b>	<b>0.75</b>
<b>Unit 4: Emergency Response</b>			
Topic 4-1: Rescue Team Preparation	0.25	0.75	
Topic 4-2: Incident Response	0.25	0.0	
Topic 4-3: Interviewing Witnesses	0.25	0.0	
Topic 4-4: Conducting Size Up	0.25	0.0	
Topic 4-5: Recognizing the Need for Technical Rescue Resources	0.25	0.0	
Topic 4-6: Identifying Hazards and Implementing a Hazard Control Plan	0.25	0.0	
Topic 4-7: Coordinating Heavy Equipment	0.25	0.0	
Topic 4-8: Supporting an Operations or Technician-Level Incident	0.25	0.0	
Topic 4-9: Pre-Entry Operations	0.25	0.0	
<b>Unit 4 Totals</b>	<b>2.25</b>	<b>0.75</b>	<b>3.0</b>
<b>Unit 5: Protective Systems</b>			
Topic 5-1: Protective Systems	0.25	0.0	
Topic 5-2: Shoring Systems and Components	0.25	0.0	
Topic 5-3: Installing Trench Shoring Systems	0.25	16.0	
Topic 5-4: Supporting an Intersecting Trench as a Member of a Team	0.25	0.0	
<b>Unit 5 Totals</b>	<b>1.0</b>	<b>16.0</b>	<b>17.0</b>
<b>Unit 6: Rescue, Recovery, and Termination</b>			
Topic 6-1: Non-Entry Rescue or Victim Self-Rescue	0.25	0.0	
Topic 6-2: Victim Rescue and Recovery	0.25	1.0	
Topic 6-3: Incident Termination	0.25	0.5	
<b>Unit 6 Totals</b>	<b>0.75</b>	<b>1.5</b>	<b>2.25</b>

<b>Formative Assessments</b>			
Determined by AHJ or educational institution	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
<b>Summative Assessment</b>			
Determined by AHJ or educational institution	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
<b>Course Totals</b>	<b>5.75</b>	<b>18.25</b>	<b>24.0</b>

### Time Table Key

1. The Time Table documents the amount of time required to deliver the content included in the course plan.
2. Time is documented using the quarter system: 15 min. = .25 / 30 min. = .50 / 45 min. = .75 / 60 min. = 1.0.
3. The Course Totals do not reflect time for lunch (1 hour) or breaks (10 minutes per each 50 minutes of instruction or assessment). It is the instructor’s responsibility to add this time based on the course delivery schedule.
4. Application (activities, skills exercises, and formative testing) time will vary depending on the number of students enrolled. The Application time documented is based on the maximum class size identified in the Course Details section.

The following is a breakdown of what a program might look like if there were fewer students. These estimates may need to be adjusted based on student abilities.

- 40 – 50 Students = 260 hours
- 30 – 40 Students = 180 hours
- 20 – 30 Students = 120 hours
- 1 – 20 Students = 60 hours

5. Summative Assessments are determined and scheduled by the authority having jurisdiction. These are not the written or psychomotor State Fire Training certification exams. These are in-class assessments to evaluate student progress and calculate course grades.



## Unit 1: Introduction

### Topic 1-1: Orientation and Administration

#### Terminal Learning Objective

At the end of this topic, a student will be able to identify facility and classroom requirements and identify course objectives, events, requirements, assignments, activities, skills exercises, resources, evaluation methods, and participation requirements in the course syllabus.

#### Enabling Learning Objectives

1. Identify facility requirements
  - Restroom locations
  - Food locations
  - Smoking locations
  - Emergency procedures
2. Identify classroom requirements
  - Start and end times
  - Breaks
  - Electronic device policies
  - Special needs and accommodations
  - Other requirements as applicable
3. Review course syllabus
  - Course objectives
  - Calendar of events
  - Course requirements
  - Student evaluation process
  - Assignments
  - Activities
  - Required student resources
  - Class participation requirements

#### Discussion Questions

1. Determined by instructor

#### Application

1. Have students complete all required registration forms.

## Unit 2: Background

### Topic 2-1: Introduction to Trench Rescue

#### Terminal Learning Objective

At the end of this topic a student, given case studies and current events, will be able to apply historical knowledge to trench rescue operations to reduce victim and rescuer injuries and fatalities.

#### Enabling Learning Objectives

1. Understand fatality and injury statistics from case histories and recent trench rescue incidents

#### Discussion Questions

1. Why is it important to have historical knowledge of trench rescue incidents?
2. How can an understanding of past trench rescue failures and successes impact future operations?

#### Application

1. Determined by instructor

#### Instructor Resources

1. Potential courses for case studies and statistics include [NIOSH](#), [Cal/OSHA](#), [U.S. Department of Labor](#), [U.S. Bureau of Labor Statistics](#), and [Firehouse](#).

**CTS Guide Reference:** None

## Topic 2-2: Standards and Regulations

### Terminal Learning Objective

At the end of this topic a student, given OSHA and Cal/OSHA standards and AHJ policies and procedures, will be able to carry out trench rescue operations in accordance with federal, state, and local standards, regulations, policies, and procedures.

### Enabling Learning Objectives

1. Identify federal standard for trenching and excavations
  - 29 CFR § 1926.650-652
2. Describe California standard for trenching and excavations
  - CCR Title 8 § 1504
  - CCR Title 8 § 1539-1543
3. Identify other regulations that may impact trenching operations
  - CCR Title 8 § 1669 § 1675 (fall protection)
  - CCR Title 8 § 5144 (respiratory protection)
  - CCR Title 8 § 3314 (lockout/tagout)
  - CCR Title 8 § 341 (permit requirements)
  - CCR Title 8 § 5156, § 5157, §5158 (confined space)
  - CCR Title 8 § 3203 (injury and illness prevention program)
  - CCR Title 8 § 5194 (hazard communication)
  - AHJ policies and procedures
4. Identify consequences related to regulatory non-compliance
  - Personal liability
  - Potential for criminal prosecution
  - Fines
  - Injury
  - Death

### Discussion Questions

1. Does your AHJ have trench rescue policies and procedures? What are they?
2. What safety regulations and standards apply to trench rescue incidents?
3. Where can you find specific state trench rescue standards?

### Application

1. Determined by instructor

### Instructor Notes

1. All regulations that apply to active trench rescue incidents also apply to trench rescue training exercises.

**CTS Guide Reference:** CTS 1-8

## Unit 3: Soil and Trench Considerations

### Topic 3-1: Soil Characteristics

#### Terminal Learning Objective

At the end of this topic a student, given soil and mechanical testing tools, will be able to describe soil characteristics that will impact trench stability and rescue operation decisions.

#### Enabling Learning Objectives

1. Describe soil types, characteristics, and concerns
  - Stable rock
  - Type A
  - Type B
  - Type C
    - C-60
    - C-80
2. Describe how to conduct soil testing to determine soil type
  - Visual testing
  - Manual testing
    - Plasticity test
    - Dry strength
    - Thumb penetration
    - Drying test
  - Mechanical testing
    - Penetrometer
    - Shear vane
3. Describe forces associated with soil
  - Vertical force
  - Horizontal force
4. Describe soil strength
  - Soil friction
  - Cohesion
  - Moisture content
  - Unconfined compression strength
5. Conduct soil tests

#### Discussion Questions

1. What are different methods for determining soil type?
2. What types of soil are present in your AHJ?
3. What can alter soil strength?
4. How does soil type impact operational decisions?
5. Why do we operate as if most rescue operations are Type C soil?

#### Application

1. Students will practice this skill on the drill ground and must perform it once for evaluation.

**Instructor Notes**

1. ELO 1: See CCR Title 8 § 1541.1 Appendix A.

**CTS Guide Reference:** CTS 2-1

## **Topic 3-2: Trench Types and Terminology**

### **Terminal Learning Objective**

At the end of this topic a student, given trench types and terminology, will be able to recognize types of trenches and excavations during a trench rescue incident.

### **Enabling Learning Objectives**

1. Define
  - Trench
  - Excavation
2. Describe trench types
  - Straight
  - L
  - T
  - X
  - Box
  - Bell piers
  - Shaft
3. Describe trench terminology
  - Wall (belly)
  - Lip
  - Floor
  - Toe
  - Head
  - Spoil pile
  - Inside corner
  - Outside corner

### **Discussion Questions**

1. What is the difference between a trench and an excavation?

### **Application**

1. Determined by instructor

### **Instructor Notes**

1. None

**CTS Guide Reference:** CTS 3-5

## Topic 3-3: Trench Collapse Patterns

### Terminal Learning Objective

At the end of this topic a student, given a trench rescue incident, will be able to describe trench collapse patterns and failure factors that will impact trench stability and rescue operation decisions.

### Enabling Learning Objectives

1. Identify trench collapse points
  - Lip
  - Belly
  - Toe
2. Describe collapse patterns
  - Spoil pile slide
  - Shear
  - Slough
  - Wedge
  - Rotational
3. Describe factors that lead to trench failure
  - Water
  - Environmental conditions
  - Soil type
  - Disturbed soil
  - Gravity
  - Surcharged load
  - Vibration
4. Describe signs of impending collapse
  - Visible cracks
  - Visible bulging
  - Water
  - Undercut or blown out walls
  - Noises

### Discussion Questions

1. What are some different types of trench collapse patterns?
2. What factors can lead to trench failure?
3. How do surcharged loads impact trench stability?
4. How does vibration impact trench stability?
5. How does the collapse pattern or cause of failure impact rescue operations?

### Application

1. Determined by instructor

### Instructor Notes

1. None

**CTS Guide Reference:** CTS 1-3 / 2-2 / 2-3 / 2-4 / 2-5 / 3-1 / 3-2 / 3-3 / 3-4 / 3-5 / 3-6 / 3-7 / 3-11

## Unit 4: Emergency Response

### Topic 4-1: Rescue Team Preparation

#### Terminal Learning Objective

At the end of this topic a student, given AHJ policies and procedures, best practices, personal protective equipment, and tools, will be able to prepare a team for trench rescue operations so that ongoing training is implemented; key positions are filled by qualified members; scene safety, discipline, and accountability are practiced; and personal protective equipment, tools, and equipment are selected, used, and cared for in accordance with AHJ policies and procedures and best practices.

#### Enabling Learning Objectives

1. Describe the importance of trench rescue training
  - Initial training
  - Recurrent training
  - Scenario-based training
  - Agency/regional training
  - NFPA 1006
  - NFPA 1670
2. Describe how to assemble an effective rescue team
  - Fill key positions with most qualified members
3. Describe the importance of scene safety, discipline, and accountability
4. Describe how to select and use personal protective equipment
  - Helmet
  - Eye protection
  - Hearing protection
  - Respiratory protection
  - Hand protection
  - Foot protection
  - Determined by AHJ
5. Describe how to select and use tools and equipment
6. Select and use personal protective equipment
7. Select and use tools and equipment

#### Discussion Questions

1. What personal protective equipment does your AHJ require for trench rescue?
2. What is your AHJ's trench rescue training policy?
3. Who is responsible for scene safety and accountability?

#### Application

1. Create an opportunity for students to select and use tools and equipment before operating them on the drill ground.

#### Instructor Notes

1. ELO 5: Students should know when to select and how to use the tools listed in the course Equipment list.



2. Most instructors have extra (surgical type) masks on hand.

**CTS Guide Reference:** CTS 1-7 / 2-2 / 2-5 / 3-1 / 3-2 / 3-3

## **Topic 4-2: Incident Response**

### **Terminal Learning Objective**

At the end of this topic a student, given a trench rescue incident, will be able to outline trench rescue considerations when responding to a given trench rescue incident.

### **Enabling Learning Objectives**

1. Describe factors to consider when responding to a trench rescue incident
  - Incident location
  - Time of day
  - Weather conditions
  - Incident access
  - Appropriate resources
2. Identify types of trench incidents common to the AHJ

### **Discussion Questions**

1. What factors should you consider en route to a trench rescue incident?
2. How do weather conditions impact trench rescue operations?
3. What resources are available in your AHJ for technical rescue?

### **Application**

1. Determined by instructor

### **Instructor Notes**

1. None

**CTS Guide Reference:** None

## Topic 4-3: Interviewing Witnesses

### Terminal Learning Objective

At the end of this topic a student, given a trench rescue incident, will be able to interview a witness or “competent person” so that potential for rapid, non-entry rescue or victim self-rescue is recognized.

### Enabling Learning Objectives

1. Describe the need to secure “competent person” or witness
  - Get immediate critical information to initiate operations
2. Identify questions to ask in an initial interview
  - What type of work was being performed?
  - What happened?
  - How many victims are there?
  - Where are victims located?
  - How long have victims been down there/buried?
  - Are there any known hazards?
  - What was the initial trench depth?
  - How long has the trench been there?
  - Is there a “competent person” on site?
3. Identify effective interview techniques
  - Don’t assign blame
  - Use a calm voice
  - Use neutral body language
  - Maintain communication and accountability with witnesses
  - Document information
4. Understand how to identify the “competent person”
  - Individual responsible for job site
  - Should be able to give overview of work being done and incident underway
5. Identify visual evidence of victim involvement, number, and location
  - Personal objects (coffee cups, tools, lunch box, etc.)
  - Fresh collapse
  - Open trench
  - Visible body parts
6. Use interview techniques

### Discussion Questions

1. What questions should you ask in an initial interview?
2. How will you use the information from the initial interview?
3. How can you gather information beyond an initial interview or when there are no witnesses?

### Application

1. Students will practice this skill on the drill ground and must perform it once for evaluation.

**Instructor Notes**

1. Many initial incident activities happen simultaneously. The remaining topics in this Unit can be addressed in any order to fit the audience or course delivery needs.

**CTS Guide Reference:** CTS 1-1

## Topic 4-4: Conducting Size Up

### Terminal Learning Objective

At the end of this topic a student, given background information and applicable reference materials, will be able to size up a trench rescue incident so that the scope of the rescue is determined, the number of victims is identified, the last reported location of all the victims is established, witnesses and reporting parties are identified and interviewed, resource needs are assessed, primary search parameters are identified, and information required to develop an initial incident action plan is obtained.

### Enabling Learning Objectives

1. Describe the importance of size up at a trench rescue incident
  - Serves as the foundation for operational decision making and risk assessment
  - Identifies availability, capability, and limitations of resources
  - Enables risk/benefit analysis methods and practices
2. Identify components to evaluate during size up
  - Witnesses or responsible party
  - Rescue vs. recovery
  - Trench configuration
  - Type of work occurring in trench
  - Type of emergency
    - Medical emergency in a trench
    - Trapped victim (collapse or failure)
  - Protection systems already in place
  - Known hazards
3. Describe basic search criteria for trench rescue incidents
4. Identify elements of a trench rescue incident action plan and related information
5. Describe the relationship of size-up to the incident management system
6. Identify information gathering techniques and how that information is used in the size-up process
7. Identify types of reference materials and their uses
  - Tabulated data sheets
  - *Emergency Response Guidebook* (DOT)
8. Gather information
  - Use interview techniques
  - Use information-gathering sources
  - Read technical rescue reference materials
9. Relay information

### Discussion Questions

1. What information do you need to gather during size up at a trench rescue incident?
2. What response plans and resources are available in your AHJ?

### Application

1. Students will practice this skill on the drill ground and must perform it once for evaluation.

**Instructor Notes**

1. Many initial incident activities happen simultaneously. The topics in this Unit can be addressed in any order to fit the audience or course delivery needs.

**CTS Guide Reference:** CTS 1-4

## **Topic 4-5: Recognizing the Need for Technical Rescue Resources**

### **Terminal Learning Objective**

At the end of this topic a student, given AHJ guidelines, will be able to recognize the need for technical rescue resources at an operations or technician-level incident so that the need for additional resources is identified, the response system is initiated, the scene is secured and rendered safe until additional resources arrive, and awareness-level personnel are incorporated into the operational plan.

### **Enabling Learning Objectives**

1. Describe trench rescue operational protocols
2. Identify components of a Trench Rescue Tactical Worksheet
  - Determined by AHJ
  - Identify types of resources available
    - AHJ and community resource lists and agreements
  - Identify resources needed
    - Incident operations
    - Incident support
3. Apply operational protocols
4. Select and use a tactical worksheet
5. Request support and resources

### **Discussion Questions**

1. What is the difference between operational resources and support resources?
2. Does your AHJ use a tactical worksheet for trench rescue operations? What should it include?

### **Application**

1. Students will practice this skill on the drill ground and must perform it once for evaluation.

### **Instructor Notes**

1. None

**CTS Guide Reference:** CTS 1-5 / 1-6

## **Topic 4-6: Identifying Hazards and Implementing a Hazard Control Plan**

### **Terminal Learning Objective**

At the end of this topic a student, given a trench collapse incident, a trench rescue tool cache and equipment, personal protective equipment, scene control barriers, a hazard control plan, and available specialized resources, will be able to identify incident hazards to victims and rescuers in and around a trench environment and implement a hazard control plan so that the scene is secured; hazards are identified and controlled; an approach path to the trench is identified; resource application fits operational requirements; risks to rescuers, bystanders, and victims are minimized; and rescue time constraints are taken into account.

### **Enabling Learning Objectives**

1. Describe how to secure a scene and control access
2. Describe tactics for approaching the trench while minimizing the likelihood of collapse
3. Describe types and nature of surface and below grade trench hazards
  - Spoil in
  - Shear in
  - Slough in
  - Lip in
  - Shoring failure
  - Superimposed weight
  - Water
  - Vibration
  - Soil conditions
  - Hazardous materials
  - Utilities
  - Atmospheric contamination hazards
  - Environmental hazards
  - Fall hazards (people and objects)
  - Traffic
4. Describe conditions with implications for secondary collapse and victim survivability
5. Describe hazard isolation/control methods, equipment, and implementation
6. Describe criteria for a safe zone within the trench
7. Describe methods of bridging and weight distribution
8. Describe emergency procedures
9. Establish safe zones (surface and below grade)
10. Place scene control barriers
11. Identify incident hazards
12. Communicate high-risk areas to other responders
13. Employ hazard control plan to protect personnel inside and outside of trench
14. Select and deploy tools or materials
15. Operate control and mitigation equipment

### **Discussion Questions**

1. What materials can you use for edge protection?
2. What are some examples of superimposed weight?



3. How can surface factors or conditions impact or create hazards within the trench?

**Application**

1. Students will practice this skill on the drill ground and must perform it once for evaluation.

**Instructor Notes**

1. None

**CTS Guide Reference:** CTS 1-3 / 1-5 / 2-2

## **Topic 4-7: Coordinating Heavy Equipment**

### **Terminal Learning Objective**

At the end of this topic a student, given personal protective equipment, means of communication, equipment, an operator, and an assignment, will be able to coordinate the use of heavy equipment so that operator capabilities and limitations for task are evaluated, common communications are maintained, equipment usage supports the operational objectives, and hazards are avoided.

### **Enabling Learning Objectives**

1. Describe types of heavy equipment
2. Describe capabilities, application, and hazards of heavy equipment and rigging
3. Describe how to confirm operator training
4. Describe types and methods of communication
  - Hand signals
  - Radio
  - Sound devices
  - Interpretive dance
5. Use communication methods
6. Recognize hazards
7. Assess operator for skill and calm demeanor
8. Assess heavy equipment for precision of movement and maintenance
9. Monitor rescuer and victim safety

### **Discussion Questions**

1. What type of heavy equipment might be available at a trench rescue incident?
2. How can you communicate with a heavy equipment operator?
3. Who qualifies to operate heavy equipment?

### **Application**

1. Students will practice this skill on the drill ground and must perform it once for evaluation.

### **Instructor Notes**

1. None

**CTS Guide Reference:** CTS 3-10

## **Topic 4-8: Supporting an Operations or Technician-Level Incident**

### **Terminal Learning Objective**

At the end of this topic a student, given an incident, an assignment, an incident action plan, and resources from the tool cache, will be able to support an operations or technician-level incident so that the assignment is carried out, progress is reported to command, environmental concerns are managed, personnel rehabilitation is facilitated, and the incident action plan is supported.

### **Enabling Learning Objectives**

1. Describe non-entry support activities
  - Ventilation group
    - Monitor and ventilate personnel
  - Extrication group
    - Prepare for extrication methods and tactics
  - EMS group
    - Plan for ongoing patient care, transfer, and transport in coordination with the incident commander and receiving hospital
  - Support group
    - Handle lighting, power, and environmental management
    - Conduct site security
    - Documentation
  - Cut station
    - Construct and fabricate shoring materials
    - Transport materials
  - Other duties as assigned
2. Apply operational protocols
3. Function within an incident management system
4. Follow and implement an incident action plan
5. Report the task progress status to a supervisor or incident command

### **Discussion Questions**

1. How can you support an operation in a non-entry capacity?

### **Application**

1. Students will practice this skill on the drill ground and must perform it once for evaluation.

### **Instructor Notes**

1. None

**CTS Guide Reference:** CTS 1-7

## **Topic 4-9: Pre-Entry Operations**

### **Terminal Learning Objective**

At the end of this topic a student, given a trench rescue incident and a trench rescue tool cache, will be able to safely perform in and around a given trench rescue incident so that a site safety officer is assigned, edge protection and ladders are placed, spoil is cleared, trench air is monitored and ventilated, hazards are identified and marked, and a pre-entry briefing is conducted.

### **Enabling Learning Objectives**

1. Describe pre-entry operations essential to safely perform in and around a trench rescue incident
  - Assign site safety officer
  - Place edge protection around trench
  - Place ladders
  - Clear the spoil
  - Perform atmospheric monitoring
  - Begin ventilation (if applicable)
  - Identify and mark hazards
  - Conduct pre-entry briefing

### **Discussion Questions**

1. Who should you assign as the safety officer?
2. What is the minimum distance from the lip to relocate the spoil?
3. What topics should you include in a pre-entry briefing?

### **Application**

1. Determined by instructor

### **Instructor Notes**

1. None

**CTS Guide Reference:** None

## Unit 5: Protective Systems

### Topic 5-1: Protective Systems

#### Terminal Learning Objective

At the end of this topic a student, given a trench rescue incident, will be able to identify types of protective systems used in trench rescue operations.

#### Enabling Learning Objectives

1. Describe when a protective system is required
2. Identify protective techniques or systems used in trench rescue operations
  - Sloping
  - Benching
  - Trench shields and boxes
  - Shoring
    - Timber
    - Mechanical (hydraulic, pneumatic, screw jacks)

#### Discussion Questions

1. When is a protective system required?
2. What are the benefits of trench shields or boxes?
3. What are the advantages and disadvantages of timber and mechanical shores?
4. What protective systems are used in your AHJ?

#### Application

1. Determined by instructor

#### Instructor Notes

1. None

**CTS Guide Reference:** CTS 2-3 / 2-4 / 3-1 / 3-2 / 3-3 / 3-4 / 3-6 / 3-7

## Topic 5-2: Shoring Systems and Components

### Terminal Learning Objective

At the end of this topic a student, given a trench collapse incident and a trench rescue tool cache, will be able to develop a shoring plan for a non-intersecting trench no more than 8 ft (2.4 m) deep, an intersecting trench, and a trench more than 8 ft (2.4 m) deep so that the methods of potential collapse are recognized, the mechanisms of entrapment are identified, areas of the trench that are blown out or undercut are addressed, related tabulated data is consulted, the weights and hazards associated with the soils are considered, and location of the victim and projected path for removal are incorporated.

### Enabling Learning Objectives

1. Describe a shoring system and components
  - Sheeting and panels
  - Shores
    - Upright shore
    - Waler shore
    - End shore
  - Nail patterns and positive connections
2. Describe how to place shoring systems
3. Identify how many shoring systems to use
4. Describe how stabilization tactics impact extrication and victim safety
5. Describe criteria for a safe zone within the trench
6. Describe how to interpret tabulated data
7. Describe how to develop a shoring plan for:
  - A non-intersecting trench no more than 8 ft (2.4 m) deep
  - An intersecting trench
  - A trench more than 8 ft (2.4 m) deep
8. Develop shoring plans

### Discussion Questions

1. What are the two primary variables included in a tabulated data sheet?
2. What is a \_\_\_\_\_ shore and when would you use it?
3. How does your shoring strategy impact victim extrication and safety?
4. How many times did your instructor say “tabulated data” during this course?

### Application

1. Students will practice this skill on the drill ground and must perform it once for evaluation.

### Instructor Notes

1. None

**CTS Guide Reference:** CTS 2-3 / 2-4 / 3-1 / 3-2 / 3-3 / 3-4 / 3-6 / 3-7

## Topic 5-3: Installing Trench Shoring Systems

### Terminal Learning Objective

At the end of this topic a student, given a trench collapse incident, trench shoring plan, and a trench rescue tool cache, will be able to implement a trench shoring plan for a non-intersecting trench no more than 8 ft (2.4 m) deep, an intersecting trench, and a trench more than 8 ft (2.4 m) deep so that the victim is protected from additional collapse, the trench walls are supported, prior areas of collapse are addressed, shoring team members work from protected areas, and shoring systems are installed so they perform their intended function.

### Enabling Learning Objectives

1. Describe how to set-up a cutting station
  - Location
  - Materials
  - Equipment
2. Describe how to install a shoring system for
  - A non-intersecting trench no more than 8 ft (2.4 m) deep
  - An intersecting trench
  - A trench more than 8 ft (2.4 m) deep
    - Install supplemental sheeting and shoring for each 2 ft (0.61 m) of depth dug below an existing approved shoring system
3. Describe how to use backfill
4. Describe how to use spot shoring techniques to support soil without incorporating uprights or panels as part of the shoring plan
5. Describe emergency procedures
6. Set up and use a cutting station
7. Pre-brief team
  - Shoring strategies
  - Victim releasee
  - Projected removal pathway
8. Build shores
  - Upright shore
  - Waler shore
  - End shore
9. Install shoring systems
  - In a trench 8 ft (2.4 m) deep
  - In an intersecting trench
  - In a trench more than 8 ft (2.4 m) deep
10. Establish safe zones
11. Anticipate extrication logistics

### Discussion Questions

1. What is a safe zone within a shored trench?
2. What are some potential issues you may encounter when shoring an intersecting trench?

3. What is the vertical strut spacing requirement in an 8 ft trench?

**Application**

1. Students will practice this skill on the drill ground and must build each type of shore and install a system in each type of trench once for evaluation.

**Instructor Notes**

1. None

**CTS Guide Reference:** CTS 2-3 / 2-4 / 3-1 / 3-2 / 3-3 / 3-4 / 3-6 / 3-7



## **Topic 5-4: Supporting an Intersecting Trench as a Member of a Team**

### **Terminal Learning Objective**

At the end of this topic a student, given size-up information and an action plan, a trench tool cache, and an assignment, will be able to support an intersecting trench as a member of a team so that strategies to minimize the further movement of soil are implemented effectively; trench walls, lip, and spoil pile are monitored continuously; rescue entry team(s) in the trench remains in a safe zone; any slough-in and wall shears are mitigated; emergency procedures and warning systems are established and understood by participating personnel; incident-specific personal protective equipment is utilized; physical hazards are identified and managed; victim protection is maximized; victim extrication methods are considered; and a rapid intervention team is staged.

### **Enabling Learning Objectives**

1. Describe how to support an intersecting trench as a member of a team
  - Implement strategies to minimize further soil movement
  - Continuously monitor trench walls, lip, and spoil pile
  - Ensure rescue entry team(s) in trench remain in a safe zone
  - Mitigate slough-in and wall shears
  - Establish emergency procedures and warning systems and communicate to participating personnel
  - Utilize incident-specific personal protective equipment
  - Identify and manage physical hazards
  - Maximize victim protection
  - Consider victim extrication methods
  - Stage a rapid intervention team (if appropriate)
2. Support an intersecting trench operation

### **Discussion Questions**

1. What ongoing support activities take place after a shoring system is installed?
2. What communication methods can you use to warn about potential danger?

### **Application**

1. Students will practice this skill on the drill ground and must perform it once for evaluation.

### **Instructor Notes**

1. None

**CTS Guide Reference:** CTS 3-5

## Unit 6: Rescue, Recovery, and Termination

### Topic 6-1: Non-Entry Rescue or Victim Self-Rescue

#### Terminal Learning Objective

At the end of this topic a student, given a trench collapse incident, tools used for self-rescue, and a rescue area and general area made safe, will be able to facilitate a non-entry rescue or victim self-rescue so that the non-entry and self-rescue tactics can be initiated.

#### Enabling Learning Objectives

1. Describe criteria for rapid, non-entry rescues
  - Victim with ability to assist with own rescue
2. Describe the need to brief rescuers
  - Assign roles
  - Understand tactics/operation
3. Identify non-entry rescue and self-rescue tactics
  - Establish communication with victim
  - Place edge protection in immediate area
  - Mitigate hazards (as needed)
  - Deploy equipment needed for rescue (ladder, rope, basket, etc.)
4. Implement non-entry rescue and self-rescue tactics
5. Select and deploy tools used to facilitate non-entry and self-rescue
6. Reduce imposed loads at or near the lip of the trench

#### Discussion Questions

1. What are some advantages to conducting a non-entry rescue?
2. How do you identify when a non-entry rescue is possible?
3. What safety precautions are important for a non-entry rescue?

#### Application

1. Determined by instructor

#### Instructor Notes

1. None

**CTS Guide Reference:** CTS 1-2

## Topic 6-2: Victim Rescue and Recovery

### Terminal Learning Objective

At the end of this topic a student, given a trench collapse incident, personal protective equipment, a trench tool cache, specialized equipment, a basic first aid kit, and victim packaging resources, will be able to remove a victim from a trench so that hazards to rescue personnel and victims are minimized; loads are stabilized or lifted; basic life functions are supported as required; the victim is evaluated for signs of compartment syndrome; techniques are used to enhance patient survivability; techniques do not compromise the integrity of the existing trench shoring system; methods and packaging devices selected are compatible with intended routes of transfer; universal precautions are employed to protect personnel from blood-borne pathogens; and extraction times meet time constraints for medical management.

### Enabling Learning Objectives

1. Describe how to search for a victim in a trench
2. Describe types of victim entrapment
  - Soil
  - Bricks, sidewalks, etc.
  - Pipes, utilities, etc.
  - Equipment
3. Describe how to construct load stabilization systems
  - Types
  - Applications
  - Limitations
  - Load calculations
  - Safety considerations
4. Describe how to lift a load
  - Applications of levers
  - Classes of levers
  - Principles of leverage, gravity, and load balance
  - Resistance force
  - Mechanics and types of load stabilization
  - Mechanics of load lifting
  - Application of pneumatic, hydraulic, mechanical, and manual lifting tools
  - Load weight calculations
  - Safety protocols
5. Describe how to release a victim from entrapment
  - Type of entrapment
  - Available extrication options (risk/benefit assessment)
  - Extent of injury
  - Time constraints
6. Describe how to manage care for a compromised victim
  - Medical care

- Crush injuries
  - Compartment syndrome
  - Advanced life support
  - Psychological care
7. Describe how to package a victim for removal
    - Medical protocols
    - Available medical resources
    - Universal precautions protocol
  8. Describe how to remove a victim
    - Transfer methods
      - Rope rescue systems
      - Ladder slide
      - High-point anchor options
    - Time needed to execute
  9. Select, construct, and apply stabilization systems
    - Evaluate system's structural integrity
    - Determine stability
    - Calculate loads
    - Operate levers
  10. Release a victim from soil entrapment
  11. Complete risk/benefit assessments for selected methods of rescue and time constraints
  12. Provide basic medical care and immobilization techniques
  13. Package a victim
  14. Remove a packaged victim

**Discussion Questions**

1. How does the shoring system impact victim removal?
2. What are your AHJ's policies, procedures, or protocols for addressing crush injuries and/or compartment syndrome?
3. What materials or objects can trap a victim in a trench?

**Application**

1. Students will practice this skill on the drill ground and must perform it once for evaluation.

**Instructor Notes**

1. None

**CTS Guide Reference:** CTS 2-5 / 2-6 / 3-8 / 3-9 / 3-11

## Topic 6-3: Incident Termination

### Terminal Learning Objective

At the end of this topic a student, given an incident scenario, assigned resources, and site safety data, will be able to terminate a trench rescue operation so that rescuer risk and site safety are managed; support systems are disassembled; scene security is maintained; custody is transferred to a responsible party; personnel and resources are returned to a state of readiness; record-keeping and documentation occur; and post-event analysis is conducted.

### Enabling Learning Objectives

1. Describe how to disassemble support systems
  - Shoring removal protocols
  - Equipment use and placement
  - Maintain safe zone
  - Personnel accountability
  - Emergency procedures
  - Manufacturer's recommended care and maintenance procedures
  - Briefing protocols
2. Describe how to terminate trench operations
  - Manage rescuer risk and site safety
  - Manage logistics and resource management
  - Maintain scene security
  - Transfer custody to a responsible party
  - Return personnel and resources to a state of readiness
  - Complete record-keeping, notifications, and documentation
  - Conduct incident debriefing
3. Identify the techniques to keep the scene safe upon leaving the area
4. Describe the overall goals of critical incident stress debriefing
5. Remove equipment and protective systems
6. Recognize hazards
7. Use trench safety protocols
8. Use site control equipment and methods
9. Clean and service equipment
10. Use asset and personnel tracking systems
11. Complete notification and documentation
12. Perform an incident debriefing

### Discussion Questions

1. What is the proper procedure for removing shores?
2. Why do you need to keep incident notifications and documentation?
3. When are you required to notify OSHA?
4. What should be included in an incident debriefing?

### Application

1. Students will practice this skill on the drill ground and must perform it once for evaluation.

**Instructor Notes**

1. Many catastrophic events occur during the end or termination stages of an incident when personnel are fatigued, and resources are in transition from active event participation to a return to service. Emphasize the importance of safety and situational awareness throughout this topic.

**CTS Guide Reference:** CTS 2-7 / 2-8

## How to Read a Course Plan

A course plan identifies the details, logistics, resources, and training and education content for an individual course. Whenever possible, course content is directly tied to a national or state standard. SFT uses the course plan as the training and education standard for an individual course. Individuals at fire agencies, academies, and community colleges use course plans to obtain their institution's consent to offer courses and provide credit for their completion. Instructors use course plans to develop syllabi and lesson plans for course delivery.

### Course Details

The Course Details segment identifies the logistical information required for planning, scheduling, and delivering a course.

### Required Resources

The Required Resources segment identifies the resources, equipment, facilities, and personnel required to deliver the course.

### Unit

Each Unit represents a collection of aligned topics. Unit 1 is the same for all SFT courses. An instructor is not required to repeat Unit 1 when teaching multiple courses within a single instructional period or academy.

### Topics

Each Topic documents a single Terminal Learning Objective and the instructional activities that support it.

### Terminal Learning Objective

A Terminal Learning Objective (TLO) states the instructor's expectations of student performance at the end of a specific lesson or unit. Each TLO includes a task (what the student must be able to do), a condition (the setting and supplies needed), and a standard (how well or to whose specifications the task must be performed). TLOs target the performance required when students are evaluated, not what they will do as part of the course.

### Enabling Learning Objectives

The Enabling Learning Objectives (ELO) specify a detailed sequence of student activities that make up the instructional content of a lesson plan. ELOs cover the cognitive, affective, and psychomotor skills students must master to complete the TLO.

### Discussion Questions

The Discussion Questions are designed to guide students into a topic or to enhance their understanding of a topic. Instructors may add to or adjust the questions to suit their students.

**Application**

The Application segment documents experiences that enable students to apply lecture content through cognitive and psychomotor activities, skills exercises, and formative testing. Application experiences included in the course plan are required. Instructors may add additional application experiences to suit their student population if time permits.

**Instructor Notes**

The Instructor Notes segment documents suggestions and resources to enhance an instructor's ability to teach a specific topic.

**CTS Guide Reference**

The CTS Guide Reference segment documents the standard(s) from the corresponding Certification Training Standard Guide upon which each topic within the course is based. This segment is eliminated if the course is not based on a standard.

**Skill Sheet**

The Skill Sheet segment documents the skill sheet that tests the content contained within the topic. This segment is eliminated if the course does not have skill sheets.