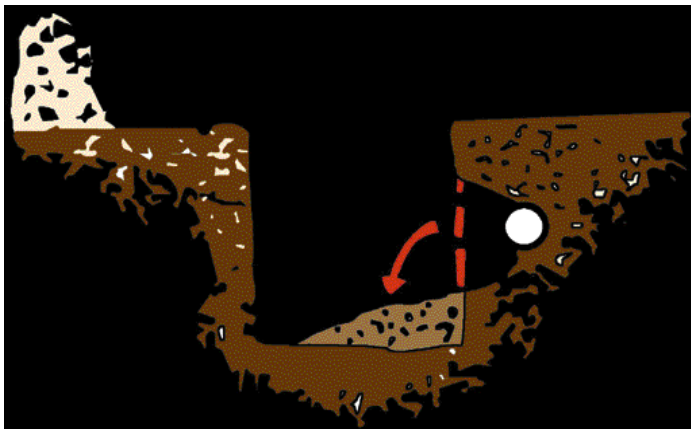


Trench Rescues

A First-in Engine or Truck Company (awaiting)

By Guy Brown



Shift change at 0700, you put your gear on the Engine or Truck Company, have a pass along with your relief to see what happened the shift before and what needs attention. Have some coffee around the kitchen table before the daily duties of the shift starts. Sounds like every town USA Fire Department. But today is different. A response comes in for a man trapped with no other information. Your Engine Company and Truck Company are the only available units to respond to the McGroarty Ranch off of Highway 71 in the Northern part of the County. Upon arrival you find a worker in a trench eight feet down trapped to his waist from the slough-in of a slip trench. The slip trench is eight feet deep by three and one half foot wide by twenty feet long.

What is a Trench? According to Federal OSHA 29 Code Federal Regulation Subpart P -1926.650 a trench is a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of the trench (measured at the bottom) is not greater than fifteen feet. After

fifteen feet it becomes an excavation under OSHA 29 Code Federal Regulation Subpart P Trenching & Excavations. In the case of the McGroarty Ranch incident a slip trench is a straight trench with no corners or bends. Usually a slip trench is utilized to place piping inline for great distances. This trench has been open for days and the sun has been drying out the moisture of the side walls increasing the lateral ground pressure. With the increased vibration of the trucks and earthmovers on the McGroarty ranch the worker was in the unshored slip trench and was subjected to a Slough-in collapse of the dry side walls (slough-in photo). The Slough-in collapse happens two feet from the top lip of the trench and can vary in the degree of collapse by how deep the trench is. As a general rule soil will weigh around one hundred pounds per cubic foot/1 tonne per cubic metre. Also take into consideration the soil typing and the type of collapse of the trench.

As a First-in Engine or Truck company the initial size-up must take a little more time than a routine structure fire size-up. Remember



you are on the McGroarty ranch by yourselves for sometime in the Northern part of the county. Being able to recognize and establish the incident command system is imperative in this situation. Operationally the Engine and Truck Company's manpower is light, three to four personnel on each apparatus depending on the department. Immediately call for an Urban Search and Rescue team and more engine companies to help with the stabilization of the trench incident. Setting up the Hot Zone which is the trench area, Warm Zone will be the area fifty to one hundred fifty feet away from the trench for the operational area and apparatus placement, and the Cold Zone where access control, staging, and medical staffing is located. During the incipient stages of the incident a few tactical operations can take place prior to the arrival of the Urban Search and Rescue team with the lumber jacks and mechanical shores. Every Truck

Company has at least two straight ground ladders and usually four by four inch cribbing for auto extrication. Since the fire service in general is an all-risk-hazard mitigator we have to think about what we have on our truck companies that we can use to mitigate the problem. We do not carry mechanical shores for a trench rescue but still have a duty to act to try to mitigate the problem of the trapped worker without exacerbating the incident. This is where we need to think what we can utilize as a rescuer on the truck company. Utilizing straight ground ladders as a shore is a good way to start an operation until the Urban Search and Rescue team arrives on scene.

Starting an operation
Trench Rescue classes all over the United States teach scene safety first and stabilizing the surrounding area. If available, find a competent informant and ask these simple questions.

SCUE

(ing USAR Team) View



'land bridge'

- What was the operation for the construction?
- How many people?
- How long have they been buried?
- How deep is the trench?
- Where are they buried?
- What materials are available?
- Are there exposure hazards?

The first operational tactic is to put a ladder into the trench approaching the trench from the end (ladder placement 2 photo). Approaching from the end of the trench the rescuer is able to look at the two side walls and the collapse of the trench to make a determination on how to mitigate the problem. If the trench is configured that the end of the trench is too far away from the victim a land bridge comprised of sturdy lumber or ladder can be placed near the victim and the first ladder will be placed against the land bridge. Since the Engine or Truck Companies do not carry sheets of plywood or two by eight or two by ten planks for edge protection, look

around the construction sight for lumber planks or engine back boards can be used to place along the trench lip as edge protection.

Ladder Construction

Between our engine and truck companies there are probably three straight ladders. One twelve or fourteen foot roof ladder and two twenty foot straight ladders. It makes no difference on the length of the straight ladder. The only thing that must be taken into consideration is the depth of the trench and can the ladders reach the bottom of the trench in a vertical configuration. The slip trench that the victim is trapped in is eight feet deep at the collapse site, so most fire service ladders that are carried on the engine and truck companies are adequate for this rescue. Place two straight ground ladders side by side with the butt or shoe of the ladder even with one another. Also needed from the truck company are eight pieces of four by four cribbing,

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ladder shores

a roll of duct tape, two sets of four by four or two by four wedges. From the butt end of the ladder measure up two feet and place one piece of cribbing across the rails of the two straight ladders, one for each ladder (ladder shores photo). Measure up from the cribbing four feet and repeat by spanning the rails with one four by four for each ladder. Use the duct tape to secure the

When access to the victim is made there is a two foot digging area that can be unearthed without another shore being put into place. Between the two cribbings is a four foot span to cover the safety zone established by OSHA and that will leave two feet from the lip to the first cribbing. Place the one ladder with the duct taped cribbing on the ladder against the trench wall trying



ladder shore placement

not line up is now a shelf to place the cribbing onto and will not be a structural member of the shore. After the shore is pressurized the piece of cribbing may be cut away and utilized in another position of the operation. Now that the ladders are vertical against the trench wall and the cribbing is lined up from one another a rescuer can start into the trench to complete the first

sides of the trench. Now that the cribbing is in place they are to be called whaler, and the ladder will be called an upright. When the rescuer is taking the measurement, he/she should subtract three inches from the measurement between the two whalers. These three inches is the needed space for the pressurizing wedges. If two by four wedges are to be used instead of four by four



ladder wall plate

cribbing to the ladder rails (ladder wall plate photo). The duct tape function is to hold the cribbing in place while it is in the vertical configuration and is not considered a structural part of the shore. OSHA states that no one will enter an unshored trench and if shoring is present, no one may travel more than four feet in any direction. This is the reason for the spacing on the ladder. From the bottom of the collapsed trench two feet was measured up to the piece of cribbing from the bottom of the ladder.

to keep the ladder as vertical as possible and the rails of the ladder against the wall of the trench (ladder shore placement photo). Place the second ground ladder on the opposite side of the trench with the cribbing facing inward and across from the first ladder in a vertical configuration, the cribbing should line up across from one another. If the cribbing does not line up across from the other, take another piece of cribbing and place it onto the cribbing that is attached to the ladder. The cribbing that did



ladder shore strut placement

shore. The rescuer will enter the trench climbing down the ladder with a lifeline attached to his waist. The rescuer may only enter the trench to his/her waist. Entry into the trench will be on the ladder that is at the end of the trench or a land bridge that was constructed. A measurement can be taken to place the first strut by leaning over and measuring the distance between each whaler (ladder shore strut placement photo). A strut is the structural member of the shore that provides lateral pressure against the

wedges, subtract one and one half inches. Every truck company in America has a chain saw for ventilation of a roof. Utilize the chain saw to cut the piece of cribbing to length to become a strut. Since the first shore is only two feet down from the lip of the trench, rescuers can lie down and help the rescuer on the ladder by holding the strut in place. The rescuer on the ladder then puts the wedges together and hand tightens the strut by pushing the wedges inward applying pressure against the

whaler and the strut. We are trying to get as much surface contact as we can between the ladder and the collapsed trench. If there is a gap between the rails of the ladder and the trench wall, wedges can be placed behind the rails of the ladder. This is called back shoring to fill the gap and provide as much surface contact as possible. After the back shoring has been placed take two small sledge hammers or regular hammers and tighten the wedges till they do not move anymore. This is usually done by the rescuer on the ladder.

Now that there is a shore in place by the letter of the law OSHA states we can proceed down into the trench four feet from the first shore. This is where we placed the first cribbing at the bottom of the ladder in the trench. The same rescuer that put the first shore in on the ladder climbs down to the second set of cribbing. The rescuer is down into the trench six feet but can not start digging for the victim until the second shore is complete. The rescuers on the lip looking down into the trench can not help as much with the placement of the second shore. The rescuer on the ladder repeats the measuring in-between the whalers for the size of the strut (Ladder Shore Lower Placement). Since the rescuer can not manage holding the strut in place and pressurizing the wedges all at the same time the rescuers on the lip will take a long pike pole and stab the four by four strut in the middle. The rescuer then holds the strut on the end of the pike pole in place lowering it to the bottom of the trench so the rescuer on the ladder can pressurize the wedges. After the second shore is pressurized the rescue can start. When the victim is trapped by the collapse they are still considered victims. When they are extricated and removed from the environment they will become patients. During the operation of removing the victim the rescuer should monitor the level of consciousness and if a peripheral arm is exposed the rescuer should start advanced life support to treat for crush/compartiment syndrome. Crush Syndrome is a metabolic phenomenon that occurs when a portion of the body like a leg has been crushed from the rest of the body for some time, creating a compartment that blood has been stopped from being delivered distally. Releasing the pressure of the collapsed trench on the distal body part lets blood flow back to the area that had created a

compartment. The heart will pump faster to fill that compartment again. This usually makes the victims blood pressure bottom out and heart rate go up because the heart is trying to compensate for the area that needs to be filled. To counteract this phenomenon, an US&R Medical Specialist is trained above the normal jurisdictional Paramedic level to recognize Crush Syndrome and relay

shovels. Usually a small hand shovel and buckets on a rope are used to remove the spoil of the trench to make access to the victim.

Other factors to consider when dealing with a trench rescue. Within the OSHA regulations trench and excavations has its own section. By the letter of the law a trench rescue also comes under the federal regulation of a confined space

rescue that takes place in a remote geographical area or an area that the Urban Search and Rescue will take awhile to respond to. When the Urban Search and Rescue team does arrive they will be in support of your operation and not there to "take over" the operation. The Urban Search and Rescue team is trained in trench rescue and should have the expertise to mitigate the problem with wood



ladder lower shore placement

their findings to the base hospital. Since the timing of the Urban Search and Rescue team is crucial the paramedic on scene should recognize this and relay their findings to the base hospital. The Urban Search and Rescue medical specialist will work with the on scene paramedic. For this crush syndrome Intravenous fluids and Sodium Bicarbonate are used to keep the blood pressure up and to counteract the acids in the blood that are building up on the opposite side of the crushed area. The rescuer should not on the other hand start any further treatment until the victim is extricated. The main goal is to get the victim out of the environment.

The rescuer can now come off of the ladder and can be joined by other rescuers in the trench. The rescuers that are working in the trench can move laterally four feet on either side of the ladder shore. If the rescuers need to move more than four feet on either side of the shore another shore must be placed. Digging should be done in a very methodical way without the use of mechanical

operation. OSHA defines a confined space as, a space large enough and so configured that an employee can bodily enter and perform assigned work; and has limited or restricted means for entry or exit; and is not designed for continuous employee occupancy. Federal Standard found in the Code of Federal Regulations CFR 1910.146.

Responding to the McGroarty ranch in the Northern part of your county can be a lonely place. With the tools on the engine and truck company in todays fire service we need to be an all risk, all hazard, mitigator and be comfortable in thinking what we have available to mitigate the problem at hand. After the rescue is complete and the demobilization of other resources, the ladders that were placed in the trench as uprights should be tested as the integrity of the ladder may have been compromised. This trench ladder shore has its place in your tool box of the way a rescue should be performed. This type of shoring is not your frontline defense but it is an excellent way of getting started on a

shores and/or mechanical shores. Trench collapses do not happen very often in your career but just like any other aspect of the fire service we should train to mitigate any risk that comes our way. Hopefully this type of Engine and Truck company operation will help you in the future.

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