

Appendix A.1

Door-Covered Trench Shelter

(See illustration at the end of Appendix A.1)

PROTECTION PROVIDED

Against fallout radiation: Protection Factor 250 (PF 250)—a person in the open outside this shelter would receive 250 times as much fallout radiation as he would if inside.

Against blast: Better protection than most homes, if built in very stable earth. Blast tests have indicated that this shelter would be undamaged up to at least the 5-psi overpressure range from large explosions. Without blast doors, the shelter's occupants could be injured at this overpressure range, although probably not fatally.

Against fire: Excellent, if sufficiently distant from fires producing carbon monoxide and toxic smoke.

WHERE PRACTICAL

In a situation where at least one hollow-core door per occupant is available. (A family evacuating in a pickup truck or large station wagon can carry enough doors, with doorknobs removed.)

In very stable earth, where neither the water table nor rock is less than 4½ ft below the surface.

FOR WHOM PRACTICAL

For a family or other group with two or more members able to work hard for most of 36 hours.

CAPACITY

The shelter illustrated is roofed with 3 doors and is the **minimum** length for 3 persons. (If you have additional doors, or boards and sticks at least 3 ft long, make the entryway trenches 3 or 4 ft longer than illustrated—if not pressed for time.)

For each additional person, add an additional door. (If more than about 7 persons are to be sheltered, build two or more separate shelters.)

BUILDING INSTRUCTIONS

1. Before beginning work, study the drawings and read **ALL** of the following instructions.
2. Divide the work; **CHECK OFF EACH STEP WHEN COMPLETED.**
3. By the time the shelter is finished, plan to have completed (1) a ventilating pump (a KAP 16 in. wide and 28 in. high), essential for this shelter except in cool weather, and (2) the storage of at least 15 gallons of water per occupant (see Appendix B and Chapter 8).
4. Start to assemble materials and tools that are listed for the illustrated 3-person shelter.

A. Essential Materials and Tools for a 3-Person Shelter

- Three hollow-core doors.
- A shovel (and a pick, if the earth is very hard).
- Two to three square yards per person of waterproof materials for rainproofing the roof. Use materials such as 4-mil polyethylene film, shower curtains, plastic tablecloths, plastic mattress covers, or canvas.
- Two pieces of plastic or tightly woven cloth (each about 6½ × 6½ ft) to make canopies over the two shelter openings. Also sticks and cords or strips of cloth to support

the canopies—as described in Fig. A of the introductory section of this appendix.

- Materials and tools for building a simple shelter-ventilating pump, a KAP 16 in. wide and 28 in. high. (See Appendix B.) Only in cold or continuously breezy, cool weather can tolerable temperatures and humidities be maintained in a crowded underground shelter without an air pump.
- Containers for storing adequate water. (See Chapter 8.)

B. Useful Materials and Tools

- Large cans, buckets, and/or pots with bail handles—in which to carry earth and later to store drinking water or human wastes.
 - Two pillowcases and one bedsheet per person—to make “sandbags” around shelter openings and to cover trench walls. (If available, large sheets of 4-mil polyethylene are better than bedsheets, because they keep earth walls damp and stable. They also help keep shelter occupants dry and clean and prevent earth from falling into their eyes.)
 - File, knife, pliers, hammer.
 - Measuring tape, yardstick, or ruler.
 - Expedient life-support items.
5. To save time and work, SHARPEN ALL TOOLS AND KEEP THEM SHARP.
 6. Wear gloves from the start—even tough hands can blister and become painful and infected after hours of digging.
 7. Check to be sure the earth is stable and firm enough so that a trench shelter with unshored (unsupported), vertical earth walls will be safe from cave-ins. (Interior doors are not strong enough to roof an earth-covered trench wider than 3 ft.)

As a test of the stability of earth, dig a small hole about 18 in. deep. Remove all loose earth from the bottom of the hole. Then make a “thumb test” by pushing your bare thumb into the undisturbed surface at the bottom of the hole. If you can push your thumb into the earth no farther than one inch, the earth should be suitable for this type of shelter. If the earth does

not pass the “thumb test,” move to another location and try the test again. Continue to relocate and repeat until suitable earth is found, or build a shored-trench or aboveground shelter.

8. Prepare to dig a vertical-walled trench 4½ ft deep and 3 ft wide. To determine the length of the trench, add together the widths of all the doors to be used for roofing it, then subtract 8 in. from the sum. (To avoid arithmetical errors, it is best to lay all the doors side by side on the ground.)
9. Clear any brush, grass, or weeds that are more than a few inches high from the area where the trench will be dug. Also clear the ground around all sides of the trench, to a distance of about 8 ft from the sides and ends of the trench.
10. Stake out a rectangular trench 36 in. wide, with its length as determined above. Also stake out the entrance at one end, as illustrated in Fig. A.1 at the end of Appendix A.1, and the ventilation trench and opening at the other.
11. Dig the main trench, the entryway trench, and the ventilation trench. Place the excavated earth along both lengthwise sides of the trench, starting at the outside edges of the cleared space. Be sure that no earth is piled closer than 3 ft to the sides of the trench.
12. To be sure that unstable, unsafe earth is not encountered at depths below 18 in., repeat the “thumb test” each time the trench is deepened an additional foot. If the earth does not pass the test, do not dig the trench any deeper; try another location.
13. To keep each trench its full width as it is dug, cut a stick 36 in. long and another 18 in. long; use **them repeatedly from the start** to check the widths of the main trench and the entry trenches. Keeping the trenches full width will save much work and time later.
14. Carefully level and smooth the ground to a distance of 2½ ft from the sides of the trench, so that the doors will lie flat on the ground up to the edges of the trench.
15. If plenty of sheets, bedspreads, plastic, and/or other materials are available, cover the trench walls with them. Wall coverings should stop one inch from the floor of the trench to prevent their being stepped on and pulled down. Plastic wall coverings keep some types of damp earth walls from drying out and crumbling.

16. To rainproof the shelter and to prevent the roofing doors from being dampened and weakened, use available waterproof materials as follows:
- a. If the earth is *dry*, the easiest and best way to make a rainproof roof is to place the doors directly on the ground, with each of the end doors overlapping an end of the main trench by 4 or 5 in. (Be sure again to level the ground surface as you place each door, so that each lies flat against the ground all the way to the edges of the trench.) Next, mound dry earth over the doors. First place a few inches of earth on the doors near their ends; then mound it about 12 in. deep above the centerline of the trench. Slope the earth to both sides so as to just cover the ends of the doors. Next, smooth off the earth mound, being careful to remove sharp stones that might puncture rainproof materials. Then place waterproof material over the smooth mound, making the "buried roof" shown in Fig. A.1. Finally, carefully mound an additional 12 to 15 in. of earth on top of the buried roof, again placing it first over the doors near their ends. The earth over the trench should be at least 2 ft thick, so that effective earth arching will support most of the weight of the earth covering and will provide considerable protection if struck by blast.
 - b. If the earth is *wet*, place the waterproof material directly on top of the doors, to keep them dry and strong. To make water run off this waterproof covering and to keep water from collecting on a horizontal surface and leaking through, slope the doors toward one side of the trench by first making one side of the trench about 3 in. higher than the other side. A way to raise one side—without increasing the distance the doors must span—is to place an earth-filled "roll" of bedsheets or other material along one edge of the trench. To keep the waterproof material used to cover the doors from sliding down the slope of the doors when earth is shoveled on, tuck the upper edge of the material under the higher ends of the doors. Finally, mound earth over the doors, first placing it near their ends. The mound should be at least 2 ft deep above the centerline of the roof and about 3 or 4 in. deep over both ends of the doors.
- If more waterproof material is available than is required to make a buried roof (or to cover the doors) and to make the illustrated canopies over the two shelter openings, use this excess material to cover the wet ground on which the doors are placed.
17. To be able to place an adequate thickness of shielding earth all the way to and around the entryway and ventilation hole, stack improvised "sandbags" around these two openings before placing the earth on the roof. Or use cloth or plastic material to make "rolls" of earth, as illustrated in the introductory section of Appendix A.
 18. Shovel earth around the rolls, sandbags, or other means used to raise the level of the earth around the two shelter openings. Slope this earth outward, and pack it, so that rainwater on the ground cannot run into the shelter.
 19. Dig small drainage ditches around the completed shelter, to lead runoff water away.
 20. To keep rain and/or sand-like fallout particles from falling into the shelter openings, build an open-sided canopy over each opening, as illustrated in Fig. A, shown in the introductory section of Appendix A.
 21. Install the air pump (a KAP) in the shelter opening into which air is already naturally moving.
 22. If the shelter has a KAP, protection against radiation can be increased by placing containers of water and of heavy foods, or bags of earth, so as to partially block the openings. This would still permit adequate air to be pumped through the shelter, except in very hot weather.
 23. For seats, place water and food containers, bedding, etc., along the side of the trench that is farther from the off-center entry trenches. If the trench floor is damp, covering it with a waterproof material, tree limbs, or brush will help.
 24. Fill all available water containers, including pits which have been dug and lined with plastic, then roofed with available materials. If possible, disinfect all water stored in expedient containers, using one scant teaspoon of a chlorine bleach, such as Clorox, for each 10 gallons of water. Even if only muddy water is available, store it. If

you do not have a disinfectant, it may be possible to boil water when needed.

25. As time and materials permit, continue to improve your chances of surviving by doing the

- following things if possible: (1) Make a home-made fallout meter, as described in Appendix C. (2) Make expedient lights.

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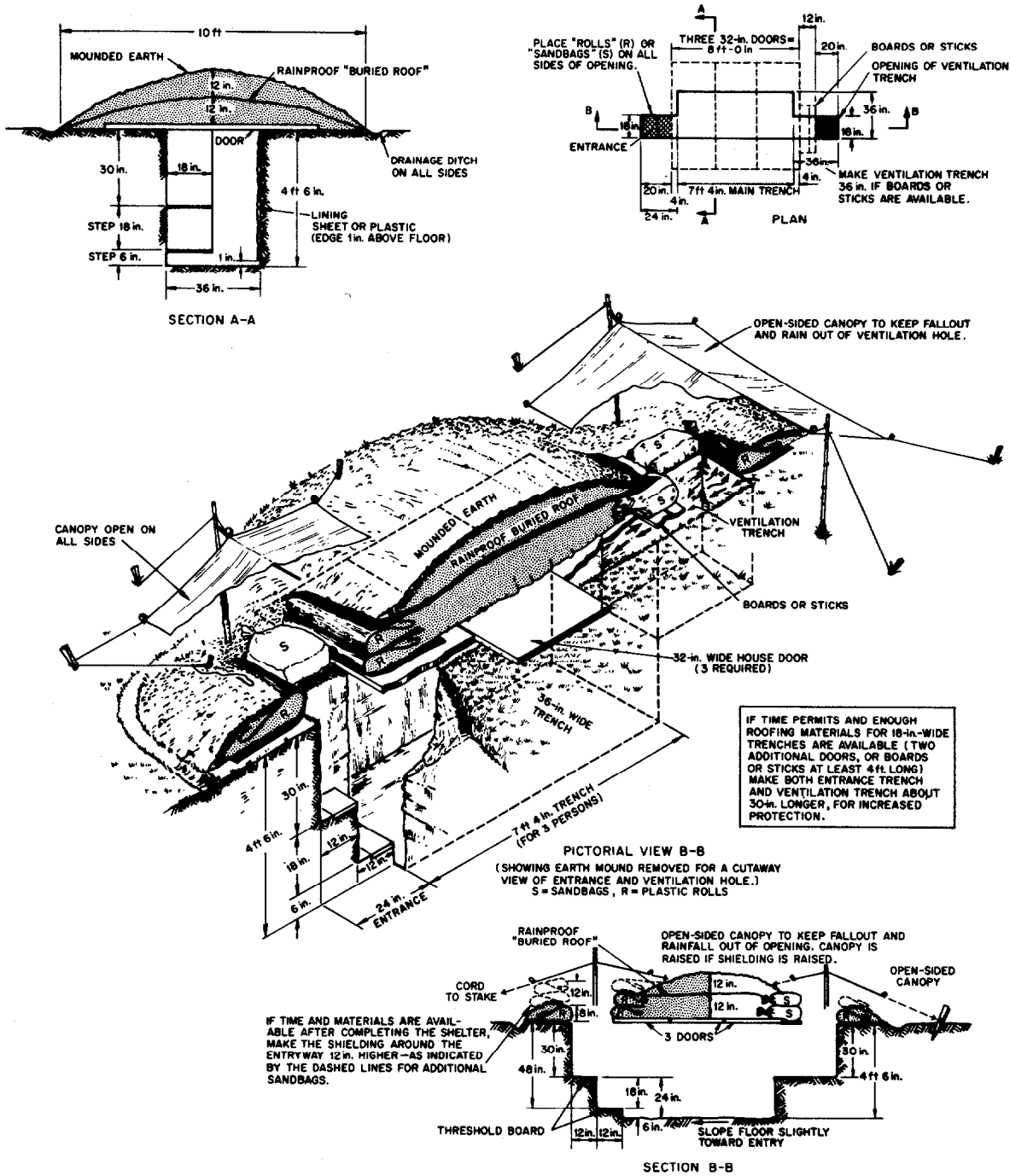


Fig. A.1. Door-Covered Trench Shelter.