

Home Blast Shelter

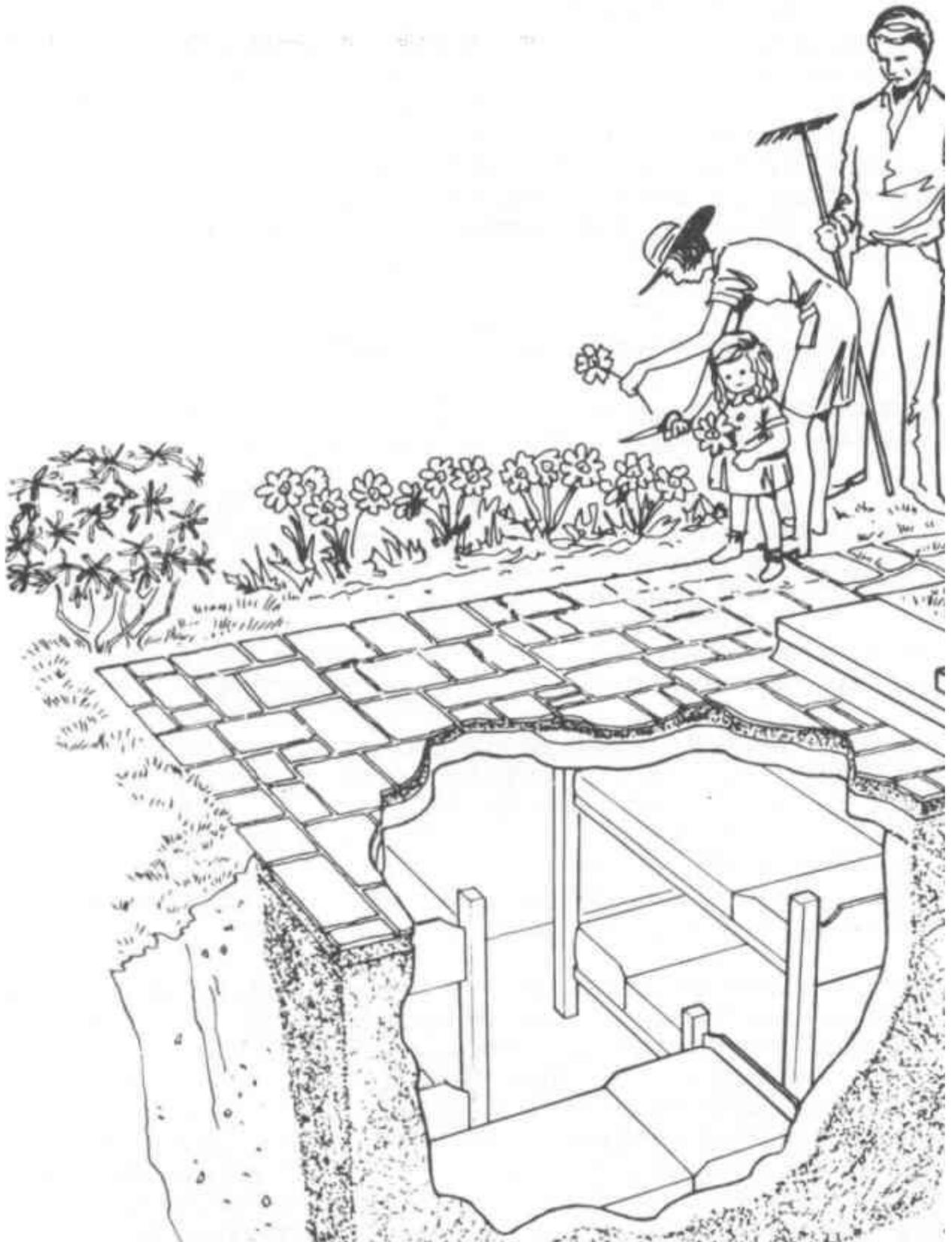
# Home Blast Shelter

H-12-3 / November 1983

(Supercedes H-12-3 dated July 1981)

Federal Emergency Management Agency

Home Blast Shelter





## GENERAL INFORMATION

This family blast shelter can be placed in the yard and will provide protection against thermal effects, fallout radiation, and blast effects from a nuclear weapon. It is designed to accommodate six adults. This shelter will also provide excellent protection against tornadoes. It has a protection factor far greater than 40 which is the minimum standard of protection from fallout radiation established by the Federal Emergency Management Agency for public shelters. It will withstand blast overpressures of up to 15 pounds per square inch (psi). If it is built as detailed, with the top near ground level, an outdoor patio can be constructed above the roof slab. The shelter is accessible by a hatch-door and wood stairway. Fresh air flow is provided by a hand-operated centrifugal blower and two ventilating pipes that extend above ground level.

The blast effect from a nuclear weapon is a wave of air, at high pressure, moving outward from the explosion. The moving air is strong enough and lasts long enough to destroy buildings out to a distance of several miles. Ordinary homes will be damaged or destroyed by the blast pressure if it exceeds two pounds per square inch. At 15 psi peak overpressure, homes will be reduced to rubble and there could be fires and smoldering debris.

People can be killed or injured by blast in three ways: First, the blast pressure acts directly on weaker parts of the body such as the lungs and eardrums; second, it hurls pieces of debris about at such speeds that they can kill or injure; and third, it can throw persons against solid objects. Protection from the effects of blast can be provided only by structures strong enough to resist the blast wave. Occupants of a shelter can be killed or severely injured if excessive blast pressures enter the shelter. A good blast shelter must have the opening sealed to keep out the blast wave, as well as smoke and toxic fumes.

The shelter has a wood main hatch cover, and a smaller wood access hatch cover, both of which are blast hardened to prevent the blast wave from entering. The main hatch cover weighs about 600 pounds and would be opened only when needed to move furniture and equipment in and out of the shelter. The main hatch cover is held in

place by load binders (two on each of the long sides). People enter and leave the shelter through the access hatch opening in the main hatch. The access hatch cover is hinged and weighs about 125 pounds. It also is held in place by load binders (one on each of the long sides).

The ventilation piping includes a gate valve and pipe cap on the air intake, and a pipe cap for the air exhaust, to prevent the blast wave from entering the ventilation system. During normal periods, the pipe caps on both the air intake and exhausts should be removed. This will permit

some natural ventilation and help keep the shelter dry. When the blast shelter is to be used for protection, both caps should be placed on the air intake and exhaust, and the gate valve closed to the blower, to prevent the blast wave and smoke from entering. As soon as the blast wave has passed over the shelter, the gate valve to the blower can be opened, the pipe cap of the air exhaust removed, and the blower started. If smoke contaminates the air around the air intake, it will be necessary to delay removal of the pipe caps, and blower operation. To prevent fallout particles being pulled into the shelter through the air intake, an optional air intake hood can be stored in the shelter and installed after the blast.

If the attack does not occur by the time the shelter has been occupied for about 2 hours, the ventilation system should be operated for about 15 minutes to provide fresh air in the shelter.

The ventilation system should then be closed again and this cycle repeated until either the blast wave has passed over the shelter (detected by a shaking movement) or the danger of attack has ended.

Before building the shelter, make certain that the design conforms to the local building code. Obtain a building permit, if required. If the shelter is to be built by a local contractor, engage a reliable firm that will do the work properly, offer protection from any liability or other claims arising from its construction, and will guarantee workmanship and materials for a period of at least one year.

## DRAWINGS

The drawings on pages 6, 7, and 8, show a plan view and three cross sections. With these drawings, a contractor can build the structure. Individuals who may not be able to read and understand the drawings and plan to construct their own shelter may

require outside assistance.

## GUIDE TO CONTRACTS AND SPECIFICATIONS

It is always advisable to have a written contract with your contractor, as well as technical specifications to supplement the drawing. A widely used and convenient contract form for

construction of this size is the AIA Document A 107, "Short Form for Small Construction Contracts (Stipulated Sum)," which is available from the American Institute of Architects, 1735

New York Ave., NW., Washington, D. C. 20006. It would be impractical to write a technical specification to suit every local condition. However, the following summary of generally accepted construction materials and practices should be a useful guide.

## EXCAVATION

The excavation should have side slopes gradual enough to prevent caving; or appropriate shoring should be provided. Materials used for backfill and embankment should have debris roots, and large stones removed before placement. The sub-grade for the floor slab should be level for ease in placing waterproofing membrane and to provide uniform bearing. The area over the roof should be sloped away at a minimum grade of 1 inch per 10 feet to provide good drainage.

## CONCRETE

For details of concrete construction, follow "Building Code Requirements for Reinforced Concrete" (ACI 318-71), which can be obtained from the American Concrete Institute, Detroit, Michigan 48219. Concrete shall have a minimum compressive strength of 3,000 psi, and all reinforcing steel shall be Grade 60.

## WATERPROOFING

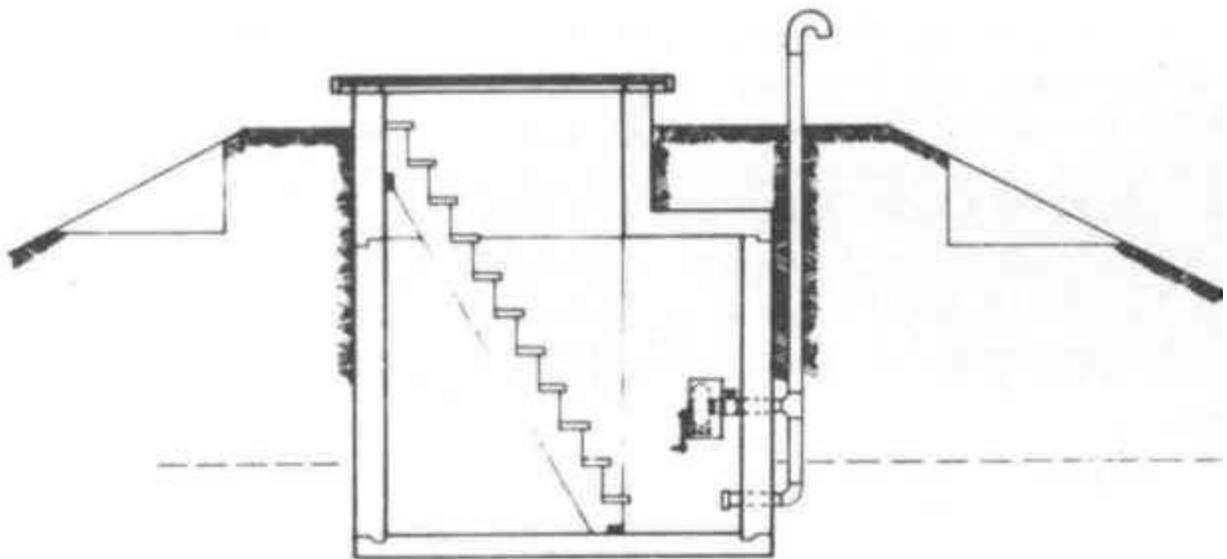
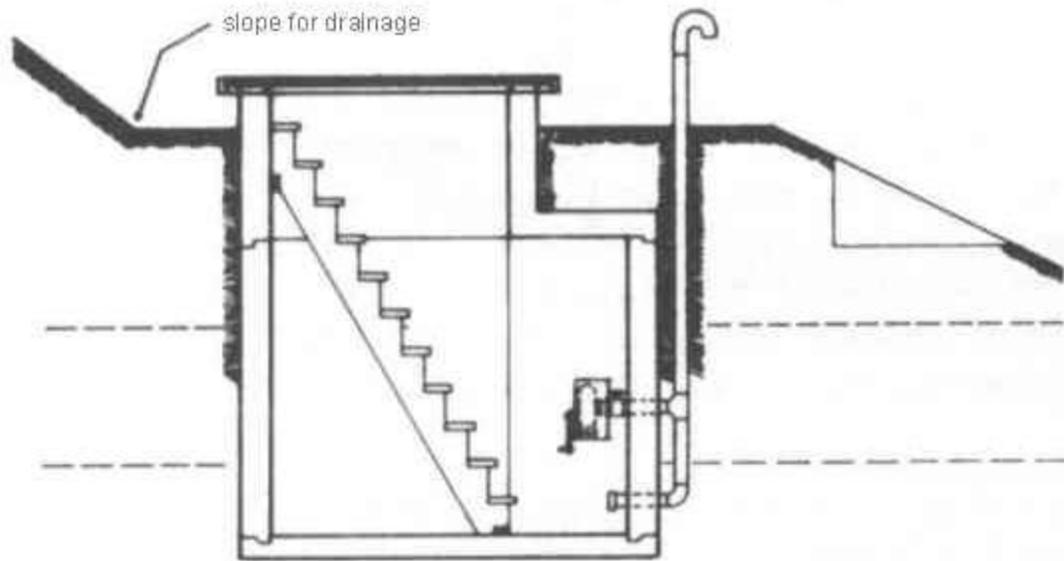
Waterproofing specifications may be obtained from the nearest FHA (Federal Housing

Administration) office; or those of a reputable manufacturer of waterproofing materials may be used. Special attention should be given to assure good waterproofing, and the contractor should guarantee it for a period of at least 5 years.

## VENTILATION

All pipe and fittings shall be galvanized. Suitable ventilating blowers and roof ventilators are available from many sources of supply. Fabrication details and installation requirements will differ. Blowers having geared, hand-crank drives can be obtained from commercial sources. The Optional air-intake hood can be obtained from commercial sources also.

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## MODIFICATIONS

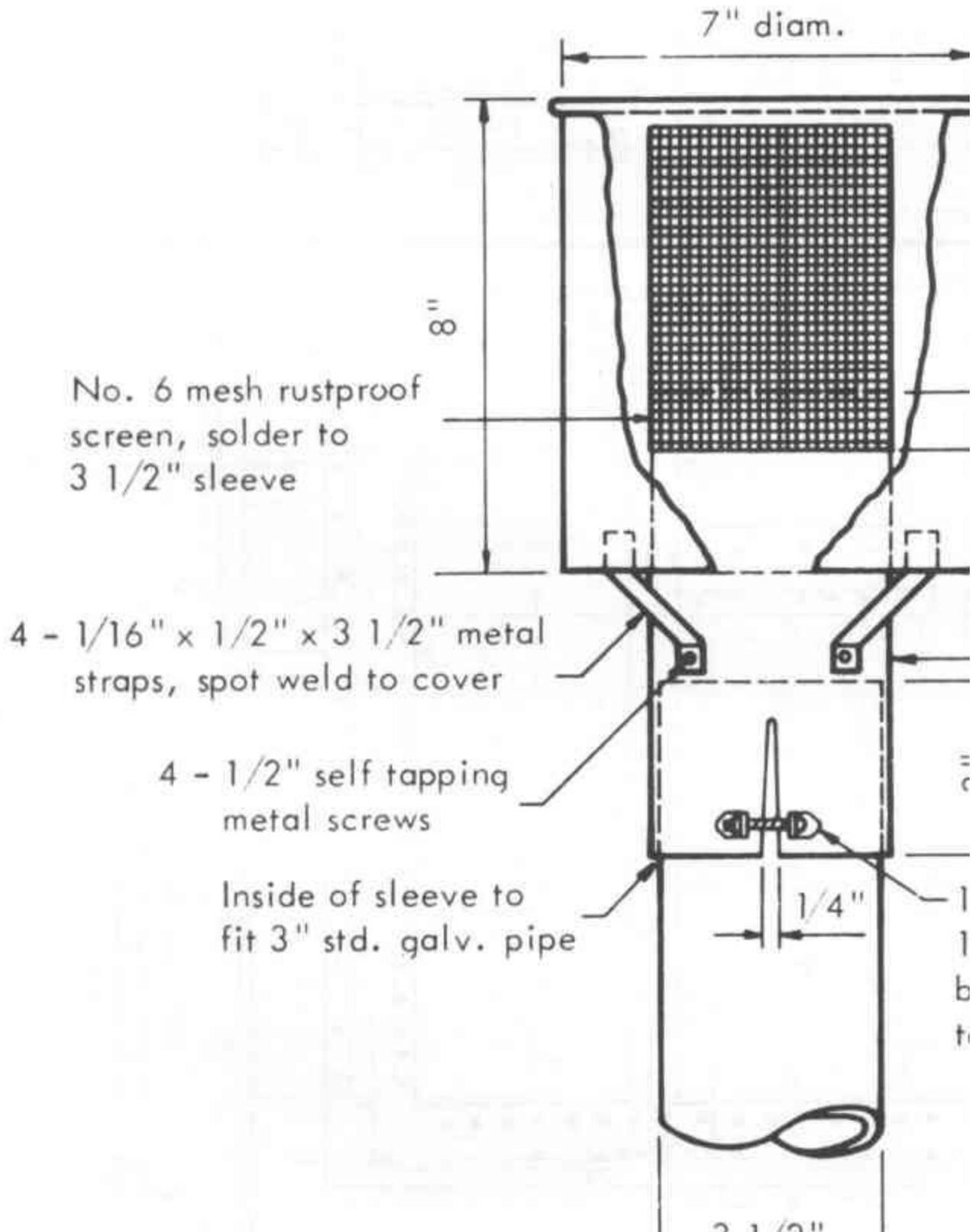
If the topography permits, the shelter can be built into a hillside or embankment. This modification can increase the protection factor further by the additional earth mound over the shelter. A maximum of 3 feet of earth cover is recommended. The minimum cover for the shelter is shown on the detailed drawings. On the downhill side, a maximum slope of 1 on 2 is recommended within 18 feet of the shelter. There are no restrictions on the slope on the uphill side.

The principal advantage of this shelter is that it can be erected with a minimum of excavation in locations where there is poor drainage or where the ground-water table is close to the surface. However, the exposure of the shelter above ground requires the addition of earth mounding around all sides. A maximum slope of 1 on 2 is recommended within 18 feet of the shelter.

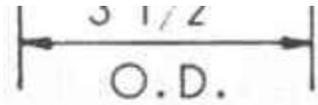
## OPTIONS

To accommodate more people, increase the shelter length 1'-3", for each additional shelter space. Do not increase the 10'-3" width without redesigning the roof slab for the longer span. Electrical service may be brought to the shelter from a separate circuit in the house. A branch circuit breaker should be installed inside the shelter. This is for use under normal times, since electric power may or may not be available during the shelter period.

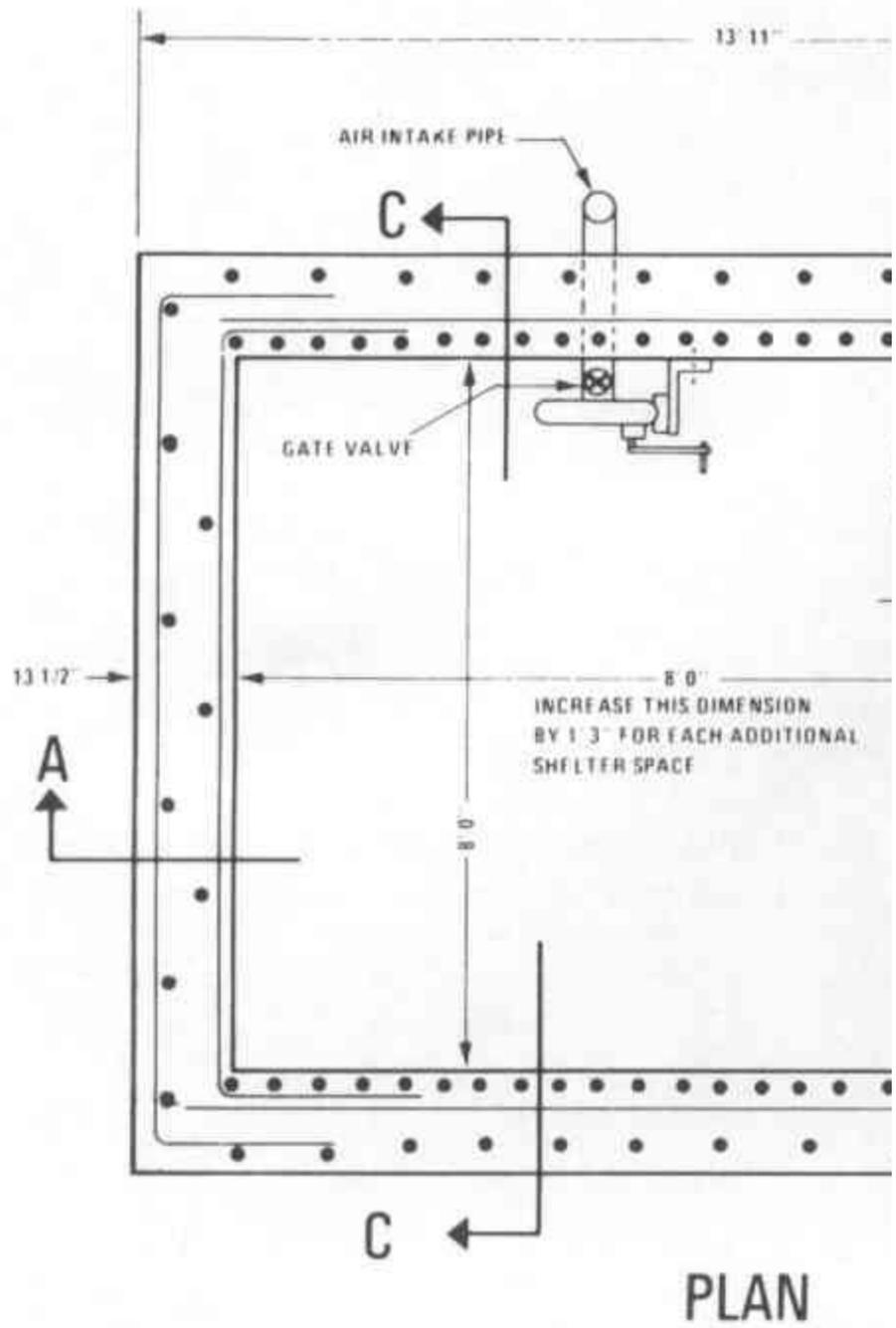
The optional air intake hood, shown below, can be installed after the blast wave has passed, by removing the gooseneck piping and slipping the air intake over the pipe and tightening the hood to the pipe.



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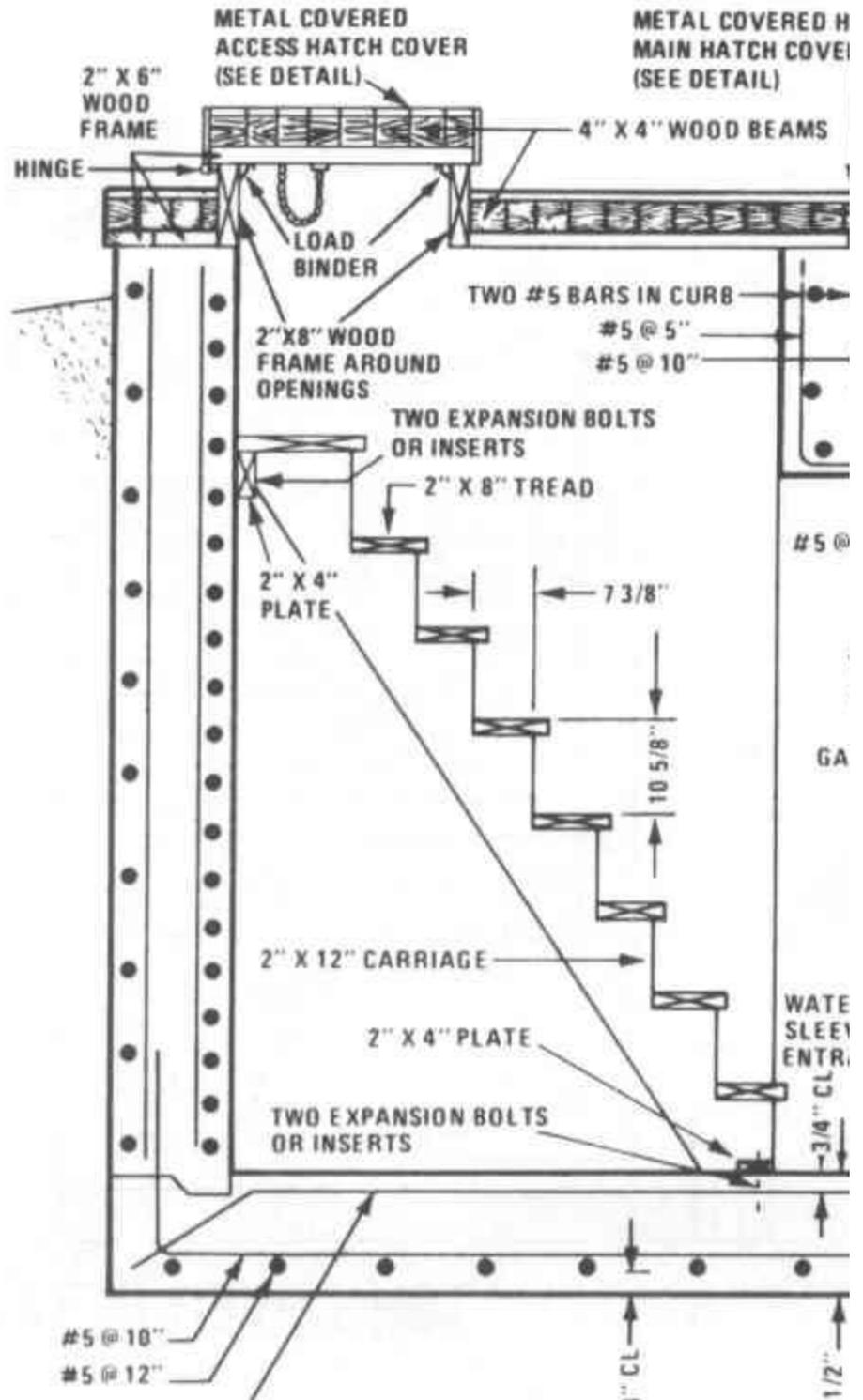
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AIR INTACK GOOSENECK

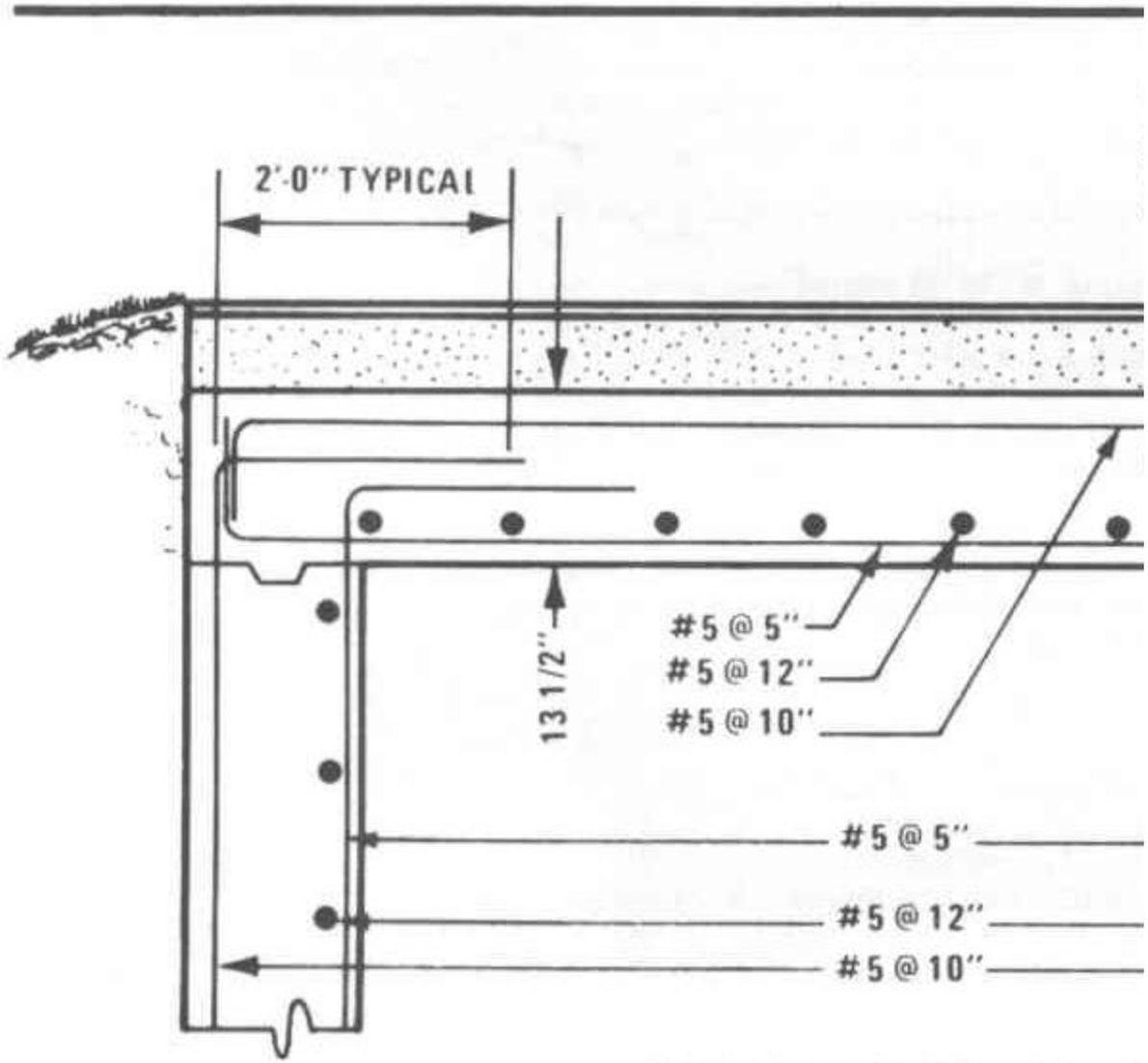


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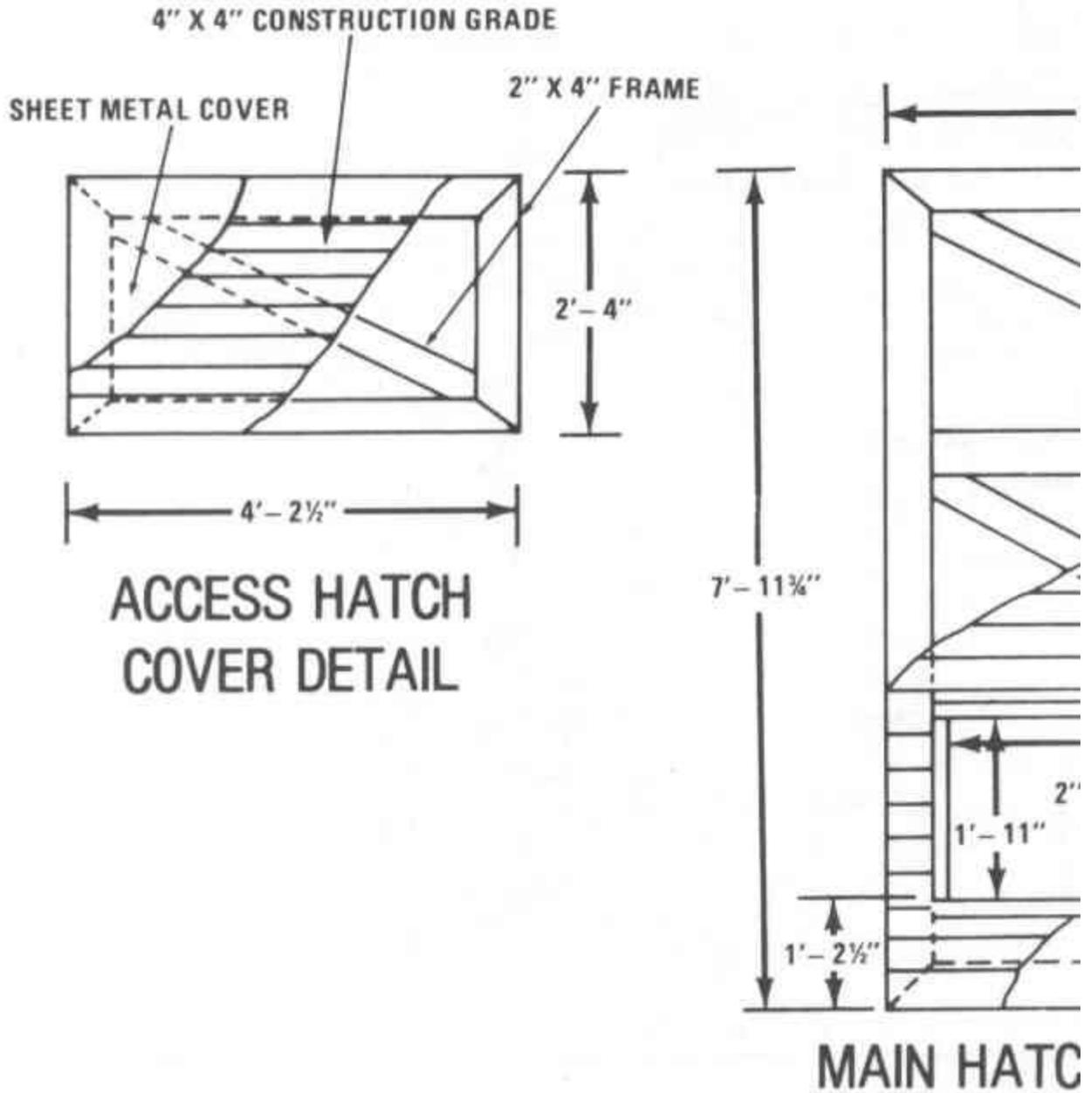


#5 @ 5"

# SECTION B-I



# SECTION C-C



NOTES:

Exterior walls, roof slabs, and under-floor slabs shall be waterproofed with a 3-ply membrane waterproofing system. This provides a continuous barrier which seals the

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entire area of surface to be protected. The membrane shall be protected from backfill and other construction damage.

Place flagstones or bricks on a sand bed when using the roof slab as a patio. Bevel all exposed corners of concrete 3/4" at 45 degrees.

Use construction grade 2 x 6's and 4 x 4's for the hatch cover. 2 x 4's standing on edge may be substituted for the 4 x 4's. Nail, bolt, or screw the 4 x 4's to the 2 x 6 frame. Cover the outside with galvanized sheet metal. Provide a smoke-tight seal all around the hatch cover (neoprene gasket, weatherstripping, etc.)

Cover opening in air intake and exhaust goosenecks with a No.6 mesh rustproof screen. An optional removable air intake hood can be made and stored in the shelter for use after the blast.

### Structural Design Data:

All reinforcing bars shown are No.5's, Grade 60

Concrete = 3,000 psi

Minimum soil bearing = 1,000 pounds per square foot (psi)

Lumber in hatch cover: Design bending stress 500 psi

### Distribution:

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State & Local Emergency Management Directors

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