ESP Wheelchair Accessible Safety Shelter Foundation Inspection / Anchoring

FEMA P-320-2014 Fourth Edition • ICC 500-2014 • FEMA P-361-2015 Third Edition

Concrete Foundation Inspection

The following concrete slab requirements and inspection criteria are based upon the engineering specifications specific to the ESP Safety Shelter. To maintain Near Absolute Protection any variations from these specific recommendations must be reviewed and approved by a structural engineer.

Minimum Slab Thickness must be an average 4 inches:

- To test for thickness drill several holes concentrated around area of installation; the drill bit selected must be able to drill a minimum of 4 1/2" deep.
  - Take a piece of stiff wire and bend a small "L" on the end. The "L" must be small enough to fit through the drilled hole and will be used to hook on the underside of the concrete.
  - Once the wire has been inserted into the hole, pull up on the wire so the "L" catches on the underside of the concrete and mark the wire at the top side of the concrete.
  - Remove the wire from the hole and measure the distance from the "L" hook to the mark on the wire to obtain the concrete thickness. This process will be repeated with each hole and the measurements noted.
- If there is any doubt that the average thickness is less than 4 inches, a plan should be put into place to cut out existing section of concrete and re-pour with proper reinforcement.
- Concrete should also extend beyond (overhang) the ESP Safety Shelter the minimum distance as described in the Installation Section of the Owner's Manual.

Minimum Concrete Reinforcement:

- No. 4 (1/2") rebar at a maximum spacing of 18" on center, in two perpendicular directions.

- If you are not sure if your concrete reinforcement meets this requirement, you should contact a contractor or building inspector for an inspection. They can evaluate your concrete with a GPR (ground penetrating radar). These devices can detect both ferrous and non-ferrous materials. They can also detect voids in concrete and thickness.

Concrete Compressive Strength and Surface Condition:

- The minimum standard for concrete strength is 2500 psi.
  - A good way to check the compressive strength of the foundation is with a rebound hammer. A rebound hammer will provide a reading on a scale that can be converted to PSI. It is recommended to take as many as 12 hits on the surface of the concrete in the area around installation site.
  - Another quick test to evaluate the concrete is to scrape the surface of the foundation with the edge of a small standard screwdriver. If the surface is easily scratched with deep grooves, your concrete may not meet the minimum requirements and should be evaluated by a professional and/or with a rebound hammer.
- A slab which contains numerous large cracks caused by settlement of the support of the supporting sub grade, prior extreme loading, or improper finishing or curing should not be considered adequate for shelter anchorage. Small cracks are acceptable, 1/32” or smaller. If these conditions occur, you should have your concrete evaluated by a professional.
- It is important to determine the location of any construction joints where the reinforcing may be discontinuous; this would make the slab inadequate for shelter anchorage. Sawn control joints are acceptable, provided reinforcing has not been cut. See **Minimum Concrete Reinforcement** above.

Anchor Bolt Installation and Inspection

The National Storm Shelter Association (NSSA) recommends following engineering specifications for anchor type, size, and capacity. The NSSA also recommends following manufacturers installation procedures.

ANCHOR INSPECTION – NSSA/International Code Council (ICC) 500, Section 106.3 and 3.1.

- Special inspections shall be provided for "anchors" post installed in hardened concrete, when used for anchorage of shelter components forming a part of the shelter enclosure (floor) or for anchorage of the shelter structure to foundations.
- NSSA/ICC 500, Section 106.3.1 requires a special inspection to verify the post installed anchor installation and capacity in accordance with Section 107.2.1, which should be the same as the recommendation by the design engineer. **Exception: For residential shelters, where the authority having jurisdiction verifies that the anchorage meets ICC 500 Section 107.2.1, the special inspection is permitted to be waived.**

INSTRUCTION TIPS FOR ANCHOR INSTALLATION

ANCHORS – EXPANSION / WEDGE TYPE

Selection:

- Your ESP Safety Shelter comes supplied with the approved anchors to properly install and secure your shelter. These anchors have been evaluated and verified to meet the necessary requirements and any deviation from these anchors should be reviewed by a professional engineer.

Drilling Anchor Holes:

- Anchor holes should be marked using the provided ESP Safety Shelter Drill Template before beginning the shelter assembly process. When placing the drill template, care should be taken to ensure holes are being drilled at least 4" to 6" from any edge of the concrete. For proper anchor fit and load requirements, the holes must be drilled with a 1/2" Carbide Concrete Drill Bit to a minimum depth of 2 3/4" and a maximum depth of 3". *Note: It is recommended to attach a piece of tape on the drill bit at the target depth to ensure the holes are being drilled properly. Care should be taken to ensure you do not drill "through" the concrete; this can allow moisture from the ground to enter the hole resulting in anchor failure. If the hole is drilled through the concrete, you should consult a professional in anchor installation for alternative solutions.

Installing Anchors:

- Before installing anchors, the dust needs to be removed from the drilled holes to ensure proper anchoring; this can be done by blowing them out with air or a vacuum. Set shelter in place as directed in the ESP Safety Shelter Assembly Instructions and verify anchor hole alignment. Start the anchor nut on the top of threaded anchor and then tap anchor in hole with a hammer to maximum depth. Hand tighten top nut and then using a torque wrench, torque the anchor bolts to 40 Foot Pounds to expand bottom wedge. Do not over tighten anchor. If the anchor begins to spin, the anchor will not work properly and you should consult a professional in anchor installation for alternate solutions.

Precautions:

- **Failure to follow the above recommended guidelines could result in an improper Safety Shelter installation. An improperly installed Safety Shelter will not provide the level of Safety and Security your ESP Safety Shelter was engineered and designed to provide.**