SECTION 03320

PRE-CAST CONCRETE VAULT/TORNADO SHELTER

PART I - GENERAL

1.01 SUMMARY

Contractor to furnish pre-cast, preassembled and transportable steel reinforced concrete vault/tornado shelter. The vault is to be placed and attached to a cast in place foundation. The precast vault to be as manufactured by Lonestar Prestress Mfg., Inc. (LPMI), Houston, Texas or approved equal.

1.02 CODES, STANDARDS AND REFERENCES

A. FEMA 320, "Taking Shelter From the Storm: Building a Safe Room Inside Your House". Federal Emergency Management Agency.

B. "National Performance Criteria for Tornado Shelters", Federal Emergency Management Agency.

C. "Association Standard for the Design, Construction and Performance of Storm Shelters", National Storm Shelter Association.

D. ACI-318-99, "Building Code Requirements for Structural Concrete". American Concrete Institute.

E. NFPA 220-99, "Standard on Types of Building Construction", National Fire Protection Association.

F. NFPA 232-00, "Standard for the Protection of Records", National Fire Protection Association.

G. ASCE 7-98, "Minimum Design Loads for Buildings and Other Structures". American Society of Civil Engineers.

H. 1997 Uniform Building Code (UBC), International Conference of Building Officials.

I. PCI Design Handbook, Fifth Edition, Precast/Prestressed Concrete Institute.

J. ASTM, American Society for Testing and Materials:

C150 - Standard Spec. for Type I and Type II – Low Alkali Portland Cement.

C33 - Standard Spec. for Concrete Aggregates.

A36 - Standard Spec. for Carbon Structural Steel.

A615 - Standard Spec. for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

A307 – Standard Spec. for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

1.02 CODES, STANDARDS AND REFERENCES, Continued

K. UL 752, "Standard for Safety for Bullet-Resisting Equipment", Underwriters Laboratories Inc.

L. UL 555, “Fire Dampers”, Underwriters Laboratories Inc.

1.03 QUALITY ASSURANCE

A. UL-752 test method Level 4 for bullet resistance certified by an independent structural engineer.

Building fabricator must have a minimum of 5 years experience manufacturing pre-cast concrete buildings.

C. No alternate building designs to the pre-engineered LPMI vault will be allowed unless pre-approved by the owner ten days prior to the bid date.

1.04 DESIGN REQUIREMENTS

A. Dimensions:

Exterior: 6’-0” x 7’-8” x 8’-10” (exclusive of vent housing)

Interior: 5’-0” x 6’-8” x 8’-0”

B. Design Loads:

1. Standard Live Roof Load - 60 PSF

2. Standard Floor Load - 150 PSF

Standard Wind Loading – 250 MPH (per ASCE 7-98)

a. Importance Factor = 1.0

b. Exposure C

Windborne Missile Impact: Roof and walls of the vault/tornado shelter shall be designed to resist the loads from windborne missile impacts as specified in the FEMA publication, “National Performance Criteria for Tornado Shelters”.

Fire Rating: The vault/tornado shelter shall have a minimum 3-hour fire rating and shall be at a minimum a Type I-332 construction per NFPA 220.

Roof: The pre-cast roof panel shall be flat and have a 6” constant minimum thickness. The roof panel shall be reinforced with grade 60 deformed reinforcing bars conforming to ASTM A615. Perimeter edges of the roof panel shall be flush with the walls of the vault. All penetrations in the roof panel shall be constructed and protected from missile impact as prescribed in FEMA 320.

All ventilation ports shall pass through the roof and shall be equipped with dynamic fire dampers conforming to the requirements of UL 555.

1.04 DESIGN REQUIREMENTS, Continued

Walls: The pre-cast wall panels shall have a 6” minimum thickness. Wall panels shall be reinforced with grade 60 deformed reinforcing bars conforming to ASTM A615.

All walls shall have a 3/8” x 3/8” sealant reveal cast at the top, bottom and side edges on the exterior face.

Floor: The pre-cast floor panel shall have a 4” minimum thickness. The floor panel shall be reinforced with

grade 60 deformed reinforcing bars conforming to ASTM A615.

G. All wall-to-wall, floor-to-wall and roof-to-wall connections shall be of a bolted angle and bolted plate type. Connections shall be designed in accordance with Chapter 6, Section 6.5.9 “Connection Angles”, of the PCI Design Handbook. Welded connections shall not be allowed.

H. All walls shall be bullet resistant and be able to achieve a UL-572 Level 4 rating.

1.05 SUBMITTALS

Submit three (3) copies of the submittal information.

Building engineering calculations that are designed and sealed by a professional engineer licensed in the state of manufacture.

Shop drawings containing as a minimum the following information:

1. Elevations of the building as well as plans of the roof and floor. The drawings shall contain critical dimensions required to fully describe the structure. The drawings shall provide a proportionally accurate representation of the structure.

2. Individual panel drawings showing locations of openings and any other pertinent information.

3. Connection details and pertinent dimensions.

4. Required 28-day concrete strength.

An engineer licensed in the state of manufacture shall review the shop drawings. The drawings shall have an attached cover sheet bearing the signature and seal of the professional engineer stating the professional engineer has reviewed the drawings.

Product data information sheets including but not limited to:

Vault doors and doorframes.

Fire caulk.

Fire dampers.

1.05 SUBMITTALS, Contiued

F. UL 752, Level 4 test results for bullet resistance.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Concrete:

Steel-reinforced, 6000 PSI minimum 28-day compressive strength.

Cement used in the manufacture of the concrete shall be Low Alkali Type I/II Portland Cement conforming to the requirements of ASTM C150 with total alkalis not to exceed 0.6%.

Coarse aggregate to be crushed limestone with a maximum size per ASTM C33 of ¾".

Vault Door: Schwab No. 7832-4 Vault Door (UL Class 350-4 hour). Door color will be gray unless specified otherwise.

Reinforcing Steel: ASTM A615, grade 60 deformed bars.

Lifting Hardware: lifting hardware to be permanently cast into the concrete shall be hot dipped galvanized.

Appearance Grade Caulking: SIKAFLEX-IA elastic sealant or equal.

Fire Caulking: Fire caulk to have a minimum 3 hour fire rating and shall be one of the following:

1. Metacaulk 1000 by RectorSeal.
2. Flamesafe FS 1900 by Grace Construction Products.
3. FS-One by Hilti.

Fire Dampers: Fire dampers shall be dynamic type and conform to UL 555. The dampers shall have a 3 hour rating and be supplied by one of the following manufacturers:

1. Nailor Industries, Inc.
2. Greenheck.
3. Air Balance Inc.

Connection Angles: L3x3x3/8, ASTM A36, Galvanized.

Connection Bolts: 1/2" diameter coil bolts, Type A307, Galvanized.

Cast-in Anchors: Steel coil type.

2.02 FABRICATION

A. Concrete fabrication procedure to conform to ACI 318.

B. Panel Connections: All panels shall be securely fastened together with 3/8" thick stainless steel brackets fabricated from an L3x3x3/8 hot rolled structural shapes and plates. All fasteners to be 1/2" diameter galvanized steel coil bolts. Cast-in anchors used for panel connections to be stainless steel coil type. All inserts for corner connections must be secured directly to form before casting panels. Floating of connection inserts will not be allowed.

C. Reinforcing steel, anchors, inserts, plates, angles and other cast-in items are to be embedded and located as shown on shop drawings.

D. All blockouts for openings in the concrete panels shall be located as shown on shop drawings and secured directly to the form prior to casting. Floating of blockouts will not be allowed.

E. Tolerances:

Maximum out-of –square: 1/4 in. /10 ft., non-cumulative.

Maximum misalignment of anchors, inserts and openings: 1/4 in.

F. Caulking: Fire caulk shall be applied to the outer and inner edge of all wall-to-wall, wall-to-floor and wall-

to-roof joints to a minimum depth of ½". Following the application and set of the fire caulk, an appearance grade caulk shall be place over the joint on the interior and exterior of the building. Exterior caulk joints shall have a 3/8" x 3/8" square caulking reveal so that sides of joints are parallel for correct appearance grade caulk adhesion. The back of the joint shall be taped with bond breaking tape to ensure adhesion of caulk to parallel sides of the joint and not the back.

2.04 FINISHES

Building Exterior: Smooth steel trowel finish on all exterior panel surfaces.

Building Interior: Smooth steel form finish on all interior panel surfaces.

PART 3 - EXECUTION

3.01 SITE PREPARATION REQUIREMENTS

The precast vault/tornado shelter shall be place on a reinforced concrete cast in place foundation. The cast in place foundation shall have a 12"x30"continuous grade beam under the vault walls which is inclusive of a 4 inch cast in place slab thickness. The concrete for the foundation shall have a minimum 28-day strength of 3000 psi and deformed bar reinforcing shall conform to ASTM A615. Size and quantity of reinforcement shall be as shown on contract plans.

The vault/tornado shelter shall be attached to the cast in place foundation using galvanized connection angles (ASTM A36) bolted to the building with galvanized coil bolts (ASTM A307). The connection angle in turn shall be attached to the cast in place foundation with galvanized drill in type expansion anchors.

3.03 ACCESS

Contractor must provide level unobstructed area large enough for crane and tractor-trailer to park adjacent to the cast-in-place slab. Crane must be able to place outriggers within 5'-0" of edge of slab and truck and crane must be able to get side-by-side under their own power. No overhead lines shall obstruct the path of the crane during the process of placing the building.