

MCDONALD-MEHTA ENGINEERS
Specializing in Wind Engineering
Lubbock, Texas

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Dr. Ernst Kiesling
NSSA
P.O. Box 41023
Lubbock, TX 79409

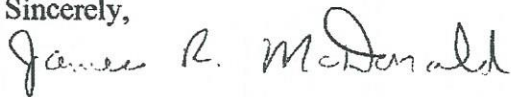
RE: Third-Party Evaluation of
Safe Shed Model 8x10

Dear Dr. Kiesling:

I have performed a third-party evaluation of Model 8x10 Safe Shed as manufactured by Safe Sheds, Inc. of Alma, Illinois. The residential tornado shelter is in compliance with all applicable provisions of the ICC/NSSA Design Standard (ICC-500) and FEMA 320. A copy of my evaluation report is enclosed.

If you have questions or need additional information, I will be pleased to discuss them with you or your representative.

Sincerely,



James R. McDonald, Ph.D., P.E.
Principal/Partner

Copy to Client

Introduction

This report presents results of a third-party evaluation of the Model 8x10 safe room manufactured by Safe Sheds, Inc., Alma, Illinois. The pre-cast, above ground, reinforced concrete shelter is transported to a site and anchored to a drilled pier foundation. The evaluation is based on 22 pages of design calculations by Patrick M. O'Toole and a company brochure that illustrates the main features of the construction. A letter from Kevin M. Finn, P.E. certifies that design construction and the door construction meet or exceed the FEMA 320 publication. A second letter certifies that the design meets the applicable requirements of the International Building Code and the National Electrical Code currently enforced in the State of Alabama. My evaluation is based on a peer review of the O'Toole calculations and checks for compliance with the prescriptive, performance and functionality requirements of the ICC/NSSA *Standard on the Design and Construction of Storm Shelters*, ICC-500, 2008. The evaluation leads to the conclusion that the above referenced Safe Shed meets or exceeds the applicable requirements of the ICC/NSSA Standard. The evaluation does not consider tornado missile impact criteria.

The Model 8x10 Safe Shed is rectangular in shape and has a gable roof with a 3:12 slope. The walls and roof are 4 in. thick and are reinforced with #4 rebar at 12 in. on center each way. The 6-in. thick floor slab has #4 bars at 24 in. on center each way. Bent bars connect the roof to wall and walls to floor slab. A 6-in. x 16-in. roof support beam spans in the 10-ft direction. The calculations include assessment of four 9-in. diameter drilled piers located at each corner of the shed. The piers resist sliding and overturning under the ultimate design loading.

The safe room evaluation includes the following:

1. Access, ventilation, lighting, environmental and fire safety requirements
2. Durability of shelter materials for intended installation conditions and environment
3. Stability, strength and serviceability of the structure
4. Connectivity and anchorages of roof, walls and foundation

The applicable dimensions and design criteria are documented in Table 1.

Evaluation

1. Access, ventilation, lighting, environmental and fire safety requirements

The 37-in. by 73-in. door provides adequate access into and out of the safe room. The hinges and latches have sufficient strength to resist tornado wind forces acting on the door.

With 3 ft² per occupant, the capacity of the shelter is 26. To be considered a residential shelter the number of occupants shall be ≤ 16 . Other community shelter requirements come into play with more than 16 occupants.

The 4 - 5-in. diameter protected vent openings in the walls are adequate for APC equalization and breathing air for 16 occupants. Since the total opening area of 79 in.² is less than 144 in.² the shelter can be treated as an enclosed building according to ASCE 7-2005.

The lighting and electrical system (if any) is certified by letter to meet code. Constructed of non-toxic and non-combustible materials, both environmental and fire safety requirements of the shelter are also met.

2. Durability of Shelter Materials for Intended Installation and Environmental Conditions

Reinforced concrete is a durable material that will not deteriorate with proper maintenance. Interior and exterior are covered with Portland cement stucco and painted. The NSSA criteria for all environmental conditions expected to be encountered are met.

3. Stability, Strength and Serviceability of Structure

The uplift, sliding and overturning of the shelter due to wind loads were independently checked and found to be in agreement with 250 mph design wind loads. The dead weight of the structure comes close to being adequate without additional anchorage. However, anchoring the shelter to the piers provides a very stable structure.

We reviewed the O'Toole calculations in detail and found them to be in accordance with standard concrete design practice. In addition, the calculations are very thorough in the design of walls, roof and foundation components. They also include the lintel over the door, the roof support beam and details of the door, hinges, latches and frame..

4. Connectivity and Anchorages of Roof, Walls and Foundation

The rebar in the walls, roof and floor are bent with adequate embedment to transfer loads at all intersections and corners. The loads from the shelter to the foundation piers are transferred through metal plates that are anchored in the piers and bolted to the floor slab. Connectivity and anchorage details meet both prescriptive and performance requirements.

Conclusion

The Safe Shed appears to indeed be safe. It is a very good design concept and that has been peer-reviewed by at least three registered engineers, including the writer. It meets all applicable criteria of the applicable standards. Missile impact resistance is evaluated by others.

Attachments:

1. McDonald-Mehta Engineering calculation sheets
2. Design wind pressures according to ASCE 7-2005
3. Patrick M. O'Toole calculations
4. Kevin M. Finn, P.E. and R.F Hansing, P.E. letter
5. Safe Shed Inc. brochure

Table 1. Dimensions and Details of Model 8x10 Safe Shed

Contact:	Don Guymon
Shelter Manufacturer:	Safe Sheds, Inc.
Nominal Outside Dimensions (ft):	8 x 10 x 7.2 eave height
Gable Roof:	3:12 slope
Floor Area (sq ft):	80
Volume (cu ft):	534
Wall Construction:	4-in. thick concrete with #4 rebar at 12 in. on center each way
Roof Construction:	Same as walls
Door Opening (ft):	3x6.08
Door:	3/16-n. steel plate with 8 steel stiffeners; 3 heavy duty latches and ball bearing hinges
Ventilating area for equalization of APC and air for breathing (in. ²):	77 (min.)
Vents	4 – 5-in. diameter missile-protected openings
Design Wind Speed:	250 mph, 3-second gust at 10 m Above ground in flat open terrain
Internal Pressure:	Vented; treat as enclosed building
Missile Impact:	Approved by others
Terrain Exposure:	C
Applicable Standards:	ICC/NSSA 500 ASCE 7-2005 AISC, 3 rd Ed., 2001 FEMA 320, 2 nd Ed.