

*Test Report*

**INVESTIGATION OF WIND PROJECTILE  
RESISTANCE OF STEELCRAFT  
MODEL B14 & MODEL L14 SHELTER DOORS**

*Submitted to*

**Mr. Kelly Hall  
Fiberglass Creations  
P.O. Box 2042  
Henderson, Texas 75653**

*Testing Performed by*

**The Wind Science and Engineering Research Center  
Texas Tech University  
Box 41023  
Lubbock, TX 79409-1023**

*Investigators*

**Ernst W. Kiesling, Ph.D., P.E.  
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*Date Submitted*

**March 26, 2001**

# TEXAS TECH UNIVERSITY

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March 24, 2001

Mr. Kelly Hall  
**Fiberglass Creations**  
P.O. Box 2042  
Henderson, TX 75653

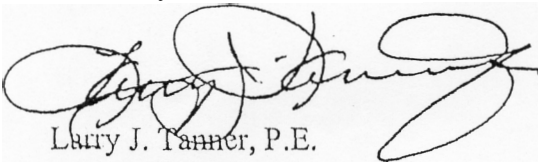
Re: Shelter Component Testing

-- Dear Mr. Hall:

On September 7, 2000 and January 22, 2001 tests were conducted on the "The Refuge" cellar door and locking mechanisms. The tests were consistent with FEMA 320 (Taking Shelter from the Storm) guidelines requiring the cellar door to resist a **15-lb.** 2x4 missile traveling vertically at 67 mphi. This missile speed relates to debris dropped by a 250 mph tornado.

Congratulations on your sheller door successfully passing the FEMA 320 tests.

Sincerely,



Larry J. Tanner, P.E.  
Research Associate

## **Investigation of the Door System for Use in “The Refuge” Below Ground Tornado Shelter**

### Overview of Project

Mr. Kelly Hall of Fiberglass Creations contacted the Wind Science and Engineering (**WISE**) Research Center at Texas Tech University to assess the ability of their door system to resist tornado forces and debris impacts. Tests were conducted on September 7, 2000 and January 22, 2001. The specifics about each test, results, and conclusions follow.

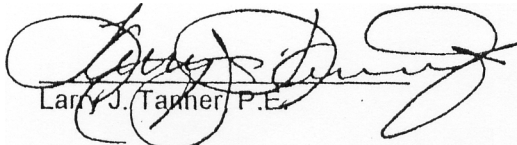
The missile criterion used for the tests was a 15-lb. 2x4-in. wood board traveling along the board's longitudinal axis, striking the panel perpendicular to the panel face. The tornado test criterion uses this missile traveling at 67-mph which corresponds to debris dropped vertically by a 250-mph ground-level wind and is the criterion used in designing for occupant protection. Additional factors of safety are inherent in the criterion since there is a very small probability that a missile will be traveling along its axis and will strike a wall perpendicular to its surface.

A pressure test was not conducted on the door system. The missile criterion used in the test is consistent with the guidelines of FEMA 320; "Taking Shelter from the Storm."

## Conclusions

*Within the bounds of reasonable engineering and technical certainty, and subject to change if additional information becomes available, the following is my professional opinion:*

The door assembly for The Refuge (underground shelter), manufactured by Fiberglass Creations, is capable of resisting the 15-lb. 2x4 traveling vertically at 67 mph, as required by FEMA 320. The additions of the clips to the pneumatic operator and the chain to the boomer latches will prevent disengagement upon impact. The relocation of the vent from the door to a piped from the rear of the shelter will prevent large debris from entering the shelter.



Larry J. Tanner, P.E.

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