



Wind Science & Engineering Research Center
Debris Impact Test Facility
P.O. Box 41023
Lubbock, Texas 79409-1023

Test Report

**INVESTIGATION OF
WIND PROJECTILE RESISTANCE
OF THE
SERIES 1-3 WALL PANELS**

Submitted to

Mr. Dutch Medford
Medford Enterprises, Inc.
2877 Aukul Street
St. Lihue, HI 96766-2084

Investigators

Ernst W. Kiesling, Ph.D., P.E.
Larry J. Tanner, P.E.

Date Submitted

January 13, 2012



TEXAS TECH UNIVERSITY



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Report No. 20120113A
Specimen No. Multiple
Test Date: Jan. 13, 2012

1.0 MANUFACTURER'S IDENTIFICATION

- 1.1 **NAME OF APPLICANT:** **Medford Enterprises, Inc.**
2877 Aukul St.
St. Lihue, HI 96766-2084
- 1.2 **CONTACT PERSON:** **Mr. Dutch Medford**
- 1.3 **TEST LAB CERTIFICATION:** Federal Emergency Management Agency (FEMA) and the ICC-500 Shelter Standard; ISO 17025 certified tests available.

2.0 TEST UNIT IDENTIFICATION

- 2.1 **PRODUCT TYPE:** Series 1-3- Wall Panels
- 2.2 **MODEL NUMBER:** A, B, & C
- 2.3 **CONFIGURATION:** Wall Panels
- 2.4 **SAMPLE SIZE:** 4-ft. x 4-ft.
- 2.5 **PANEL UNITS:** 4-ft. x 4-ft.
- 2.6 **DOOR ASSEMBLY:** N/A
- 2.7 **DRAWINGS:** See Appendix B for manufacturer's drawings

3.0 TEST UNIT DESCRIPTION

- 3.1 **ASSEMBLY CONSTRUCTION:**
Shelter wall panels were tested for stand-alone and retrofit shelters. Basic construction of both included double 4-in. x 2-in. x 14 gauge or 3 5/8-in. x 2 in. x 14 gauge studs spaced at 16-in. on center with 12 gauge sheet steel on the outside of the wall for the stand-alone and 12 gauge sheet steel on the inside of the wall for the retrofit shelter. Ceiling joists for both designs included 8-in. x 2-in. x 14 gauge steel members spaced at 16-in. on center. 12 gauge sheet steel would be located as per the wall construction for each shelter type.
- 3.1.1 **Series 1 Panel:** Composite, See Appendix B.
- 3.1.2 **Series 2 Panel:** Corner panel, see Appendix B.
- 3.1.3 **Series 3 Panel:** Backside of corner panel, retrofit design, see Appendix B.



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4.0 TEST RESULTS

4.1 SCOPE: Conduct Missile Impact Test on Above Ground Shelter Assembly

4.2 SUMMARY OF RESULTS:

Test Method	Test Conditions	Test Conclusion
Missile Impact Test FEMA 320 & ICC-500 – Tornado Protocol 4, FEMA Hurricane Protocol 3 & ICC-500 Hurricane Protocol 2, See Appendix A	15-lb. 2 x 4	All panels passed the 100 mph impacts

4.3 OUTDOOR WEATHER CONDITIONS:

Temperature	55 degrees
Wind	13 mph
Relative Humidity	74 %

4.4 MISSILE IMPACT TEST RESULTS:

Missile Type: 2 x 4

Missile Weight: 15 lb.

Missile Impact Speed: 100 mph (tornado)

Impact Tests

Spec. / Impact No.	Velocity (mph)	Location	Results
1 / 1	101	Impact over D1 panel center	1 1/8-in. of deformation; see photos, pages 5-7.
1 / 2	103	Impact top right over studs.	1/2-in. of deformation with secondary impact; see photos, pages 8&9.
1 / 3	100	Impact over grilled vent.	2-in. deformation with 4-in. splintering of plywood backup and loss of 8 screws, pages 10-12.



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1/4	102	Impact high center above interior vent.	1/2-in. deformation; see photos, pages 13-15.
1/5	124	Middle left stud space.	1 1/2-in.; see photos, pages 16&17.
2/1	100	Center of A1 panel.	1-in. deformation with some separation of ply at exterior corner; sheet steel was screwed at corner stud; see photos, pages 18-20.
3/1	101	Impact center of panel.	2 3/8-in. of deformation with 6 screws withdrawn; see photos, pages 21&22.



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5.0 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:

Impact tests were conducted on January 13, 2012 on three series of above ground shelter panels for stand-alone and retrofit tornado shelters for Medford Enterprises, Inc. All panels passed the tornado tests per the guidelines of FEMA 320/361 and ICC-500. Tornado tests were conducted for resistance to the Protocol 100 mph Tornado Missiles. The 100 mph impact relates to the 15 lb. missile being propelled by a 250 mph tornado.

All tests were conducted in accordance to the guidelines of FEMA 320/361 and ICC-500.

Engineer of Record
Larry J. Tanner, P.E.