

PROTECTION FROM WINDBORNE DEBRIS
TESTING IS IMPORTANT !

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Mayflower, AR door failure



Brought new awareness to importance of appropriate door selection

Mayflower a "Perfect Storm" Situation

- Installation of an inadequate, untested door
- Inward swinging, away from the stops
- Debris impact at critical location
 - Unusual missile though not thought to be extraordinary
- Occupants in contact with door or close to it

Consequences:

- One occupant killed, apparently from head injuries
- Second occupant injured with broken bones, lacerations

NSSA/TTU
Door performance demonstration

- Phase 1. Perform forensic analysis on failed Mayflower door


Completed

Findings

3' wide x 6'-8" high x 1-3/4" thick
 18 gage steel skin; 16 gage edge channel 1-11/16" x 5/8"
 Lapped, projection-welded edges, 3" o.c. top and bottom, 5" o.c. on edges
 8" concrete masonry walls; 18 gage wrap-around frame

- Three Residential Grade dead bolts and a latch set


Good quality hollow-core steel door, but not suitable for tornado safe room application



NSSA/TTU
Door performance demonstration

- Phase 2. Perform demonstration tests; document successful and failed performances under
 - Pressure , Debris Impact

Completed series of tests



- Journal publication in preparation
- Videos planned for NSSA websites

NSSA/TTU
Door performance demonstration

- Phase 3. Show ways to improve performance of inadequate doors, already installed

No conclusive results

- Perforation can be averted by adding to thickness
- Preliminary research using cross bars was not successful

More research into alternative improvements is needed
 Public funding required

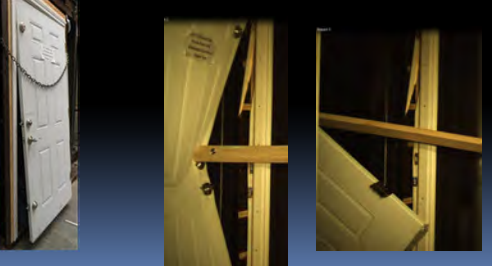
Demonstration door testing project

- Demonstrated failure modes
 - Perforation
 - Structural
 - Bending
 - Folding
 - Hardware
 - Latches
 - Hinges

Modes of failure

- Metal Clad Wood Frame door
- Residential Grade 1 hardware

Failed pressure test Impact knocked entire door out of frame



Modes of failure


- Metal clad Wood 6 Panel Hurricane Impact Resistant Door
- Residential Grade 1 hardware

Failed pressure test
Perforation of each of 3 impacts

Demo 3

18 gage metal door open cell Styrofoam Core;
Heavy Duty Hinge Reinforcement;
Residential Grade 1 hardware

- Passed pressure test
- Impacts destroyed top 2 locks and folded top corner



Mitigation attempt

16 gage Hollow Metal door, 16 gage hollow metal frame,
Styrofoam Core with 3 deadbolts and 1 latch, commercial
grade 2 hardware
3 crossbars

Passed pressure test
Top crossbar ejected and top corner folded



Successful Demonstration

- 14 gage HM Door & frame with vertically stiffened core,
reinforced frame, strike boxes, lock boxes; Commercial
grade 1 locks; HD hinges

Door passed pressure and debris impacts



Guidance available

- Consult FEMA Fact Sheet
- Purchase only doors that can be shown to be tested or that bear a 'tested' label
- See list of tested doors
 - UL Laboratories
 - Texas Tech Debris Impact Facility
 - Comprehensive listing forthcoming

"There is no substitute for a tested tornado safe room door."



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