

FEMA Extreme Wind Safe Room Guidelines



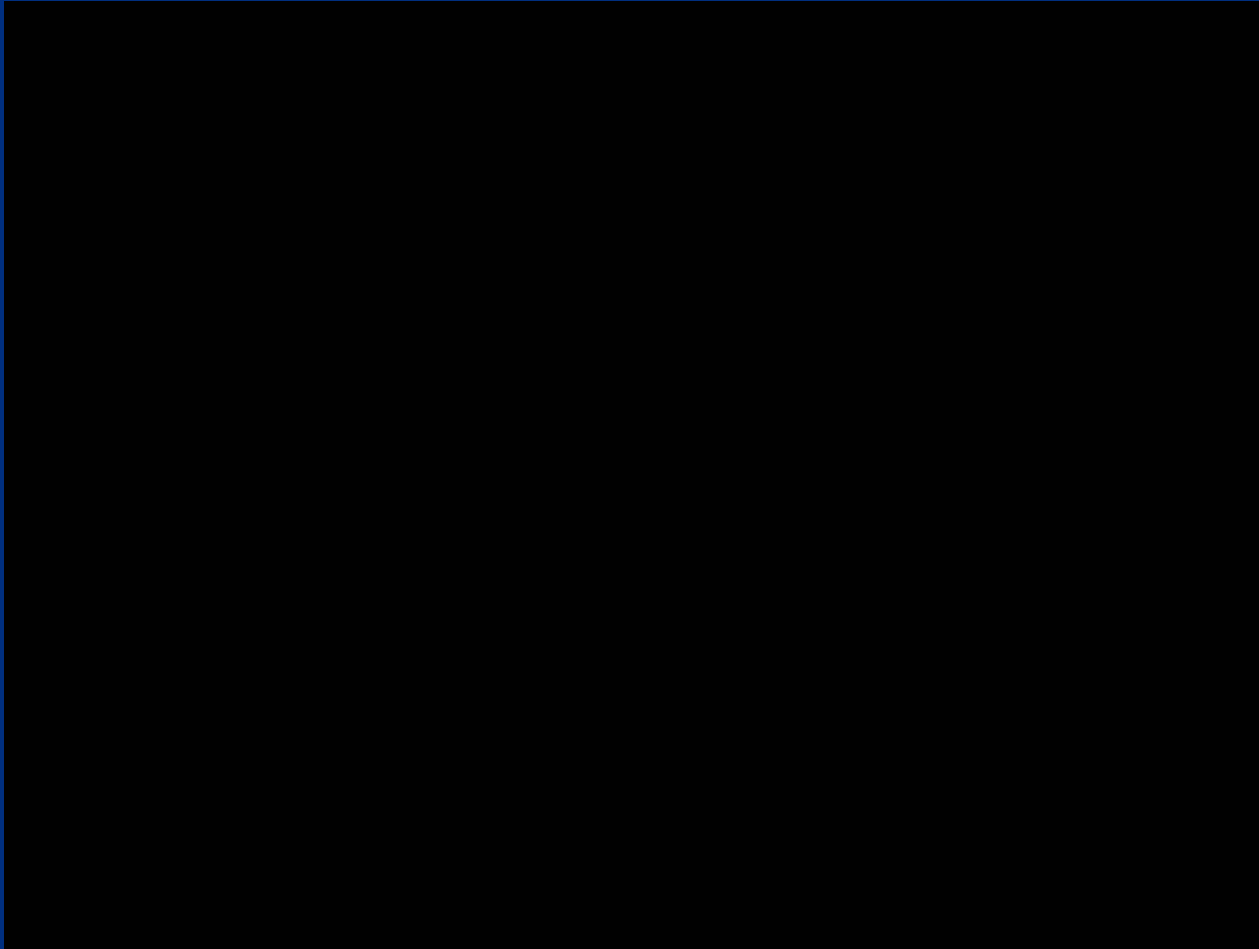
Presenter:

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Safe Rooms Save Lives



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Presentation Topics

- Background and purpose of FEMA Safe Room Guidance and Publications
- Highlights of FEMA Safe Room Publications
 - FEMA 320 Residential (3rd Edition)
 - FEMA 361 Community (2nd Edition)



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Levels of Protection – The Need for Community Safe Rooms



- Enterprise, AL
- March 2007
- 8 killed while taking refuge from a tornado
- No shelter in the school



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Levels of Protection – The Need for Community Safe Rooms

- Arcadia, FL
- Hurricane Charley, 2004
- 1,000+ people evacuated during storm



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Successes from the February 2008 Tornado Outbreak

- Lake County, TN
 - Laura Kendall School Safe Room
 - HMGP Project based on 2003 event
 - Used several times
 - 125+ people in the safe room during Feb event
- Macon County, TN
 - Color Me Cute Nursery School/Day Care Safe Room (aka. The Rain Forest Room)



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Shelter vs. Safe Room

- What is a Tornado Shelter? A Hurricane Shelter?
 - ***A hardened structure that provides life-safety protection from an extreme-wind event?***
 - A place where people go after their home has been destroyed (a recovery shelter)?
 - A place where people evacuate to in order to be protected from storm surge and high winds?
 - A place of last resort providing only limited protection from the effects of an extreme-wind event?
 - A building staffed by the American Red Cross or FEMA that “must provide protection from an extreme-wind event”?



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Shelter vs. Safe Room

- Previously FEMA defined the protected areas by use:
 - Residential and in-residence applications were called **safe rooms**
 - Community and other non-residential applications were called **community shelters**
- New terminology in updated publications: A **safe room** may be a building, or portion thereof, providing near-absolute protection via its structural system and exterior wall and roof systems which provide life-safety protection from wind events such as tornadoes or hurricanes



Benefits for Updating the FEMA Safe Room Publications



- Utilize lessons learned from
 - Actual events
 - Grants program implementation
- Incorporate research and study
- Incorporate new private sector standard
- Incorporate updated codes, standards, and costs
- Maintain state of the art
- Refined criteria benefits the user (greater flexibility and certain aspects less stringent than before)



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Goal of the FEMA Safe Room Publications 320 and 361

- FEMA Safe Room Publications provide guidance and criteria so that the design and construction of safe rooms will result in buildings or portions of buildings that provide **near-absolute protection** for occupants from wind and debris associated with tornadoes and hurricanes.

We must answer the question: *“What is your performance expectation of a safe room or shelter?”*



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Near-Absolute Protection

- From FEMA 361, Chapter 1, Page 1-2
“*Near-absolute protection* means that, based on our current knowledge of tornadoes and hurricanes, the occupants of a safe room built according to this guidance will have a very high probability of being protected from injury or death..... to date a wind event exceeding the maximum design criteria in this publication has not been observed.”



FEMA Safe Room Design Criteria

- The FEMA 320 and FEMA 361 publications specify prescriptive solutions and design criteria* respectively for:
 - Tornado and Hurricane Residential Safe Rooms
 - Tornado and Hurricane Community Safe Rooms
- Encourages multi-hazard approach

* Design criteria include structural and non-structural design parameters as well as operational and emergency management recommendations



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Highlights of the Content and Updates to the 3rd Edition of FEMA 320

- Present prescriptive solutions for residential and small, community safe rooms
- Designs meet or exceed all tornado and hurricane hazard design criteria
 - For near-absolute protection from FEMA 361
 - Set forth in the ICC-500 Storm Shelter Standard



Taking Shelter From the Storm:

Building a Safe Room For Your Home or Small Business

Includes Construction Plans and Cost Estimates

FEMA 320, Third Edition / August 2008



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FEMA 320 Safe Rooms

- Tornado and hurricane protection for residential and small, community use (<16 people)
- Typically small rooms (8'x8'x8'), many designs up to (14'x14'x8')
- Geared to owners, developers, and contractors
- Ready-to-use construction drawings
 - Reinforced masonry
 - Reinforced concrete
 - Metal sheathed wood framed
 - Insulated Concrete Forms (ICF)



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New for FEMA 320

- **Small, community application when occupancy is limited to 16 persons or less**
- Design criteria essentially unchanged, but safe room sizes expanded
- Improved presentation to better address and understand hurricane risk, not just the tornado risk
- Expanded guidance on preparing for disasters
- A new “Consumer Guide” section
- Revised estimated safe room costs



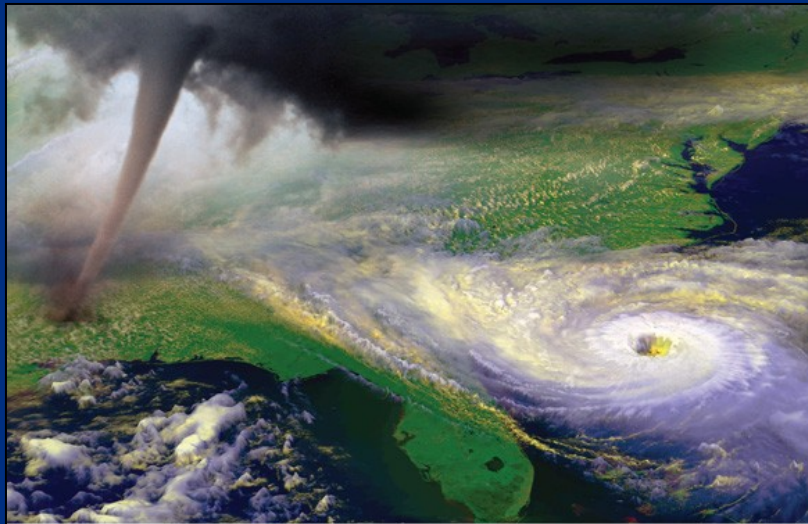
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FEMA 320 – Design Criteria

- Safe Room Wind Design Criteria
 - Design Wind Speed = **250 mph, 3-second gust** (max for all hazards)
 - Exposure C, Partially Enclosed
 - Debris impact resistance: 15-lb 2x4 at 100-mph
- All walls, roofs, and surfaces comply with pressure and debris impact criteria
- Cannot be sited in Special Flood Hazard Areas (with flood depths of 3 ft or more), in a floodway, on a barrier island, or in an area subject to storm surge (up to Category 5)



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Design and Construction Guidance for Community Safe Rooms

FEMA 361, Second Edition / August 2008



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Highlights of the Content and Updates to the 2nd Edition of FEMA 361

- Presents the criteria for the design and construction of safe rooms providing near-absolute protection
 - Is specific to identified hazard or the highest of multiple-hazards
 - Meets or exceeds all tornado and hurricane hazard design requirements set forth in the ICC-500

NOAA National Severe Weather Workshop – March 2009

FEMA 361 Community Safe Rooms

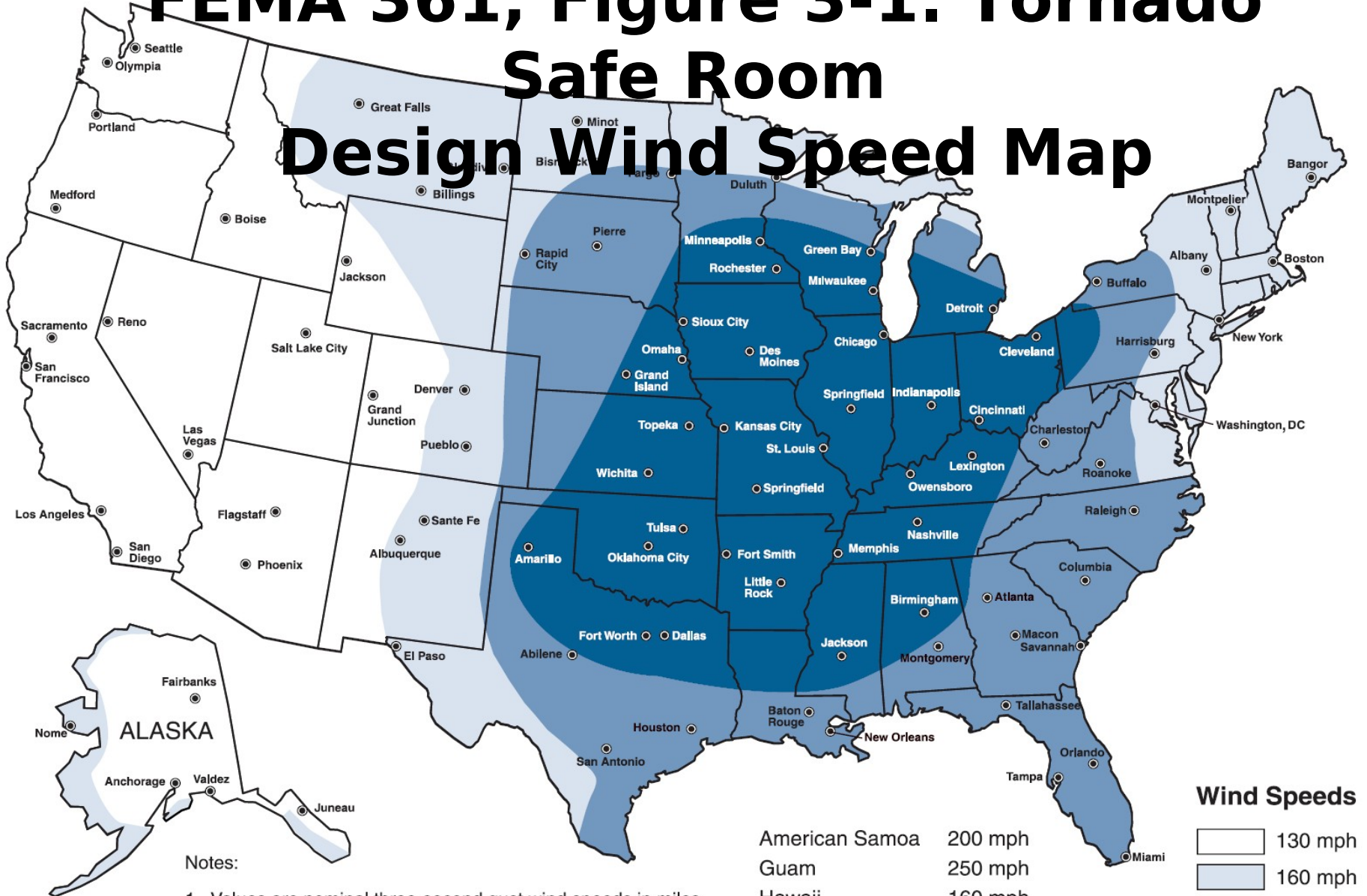
- Expands FEMA 320 for larger safe rooms housing greater numbers of people
- Geared to architects, engineers, and building officials
- Stresses design guidance - construction drawings / prescriptive solutions not included
- Contains guidance and includes information on:
 - Risk assessments
 - Design criteria checklists
 - Structural design and performance criteria
 - Wall, window, and door systems
 - Existing facility evaluations
 - Emergency management aspects



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FEMA 361, Figure 3-1. Tornado

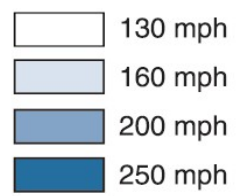
Safe Room Design Wind Speed Map



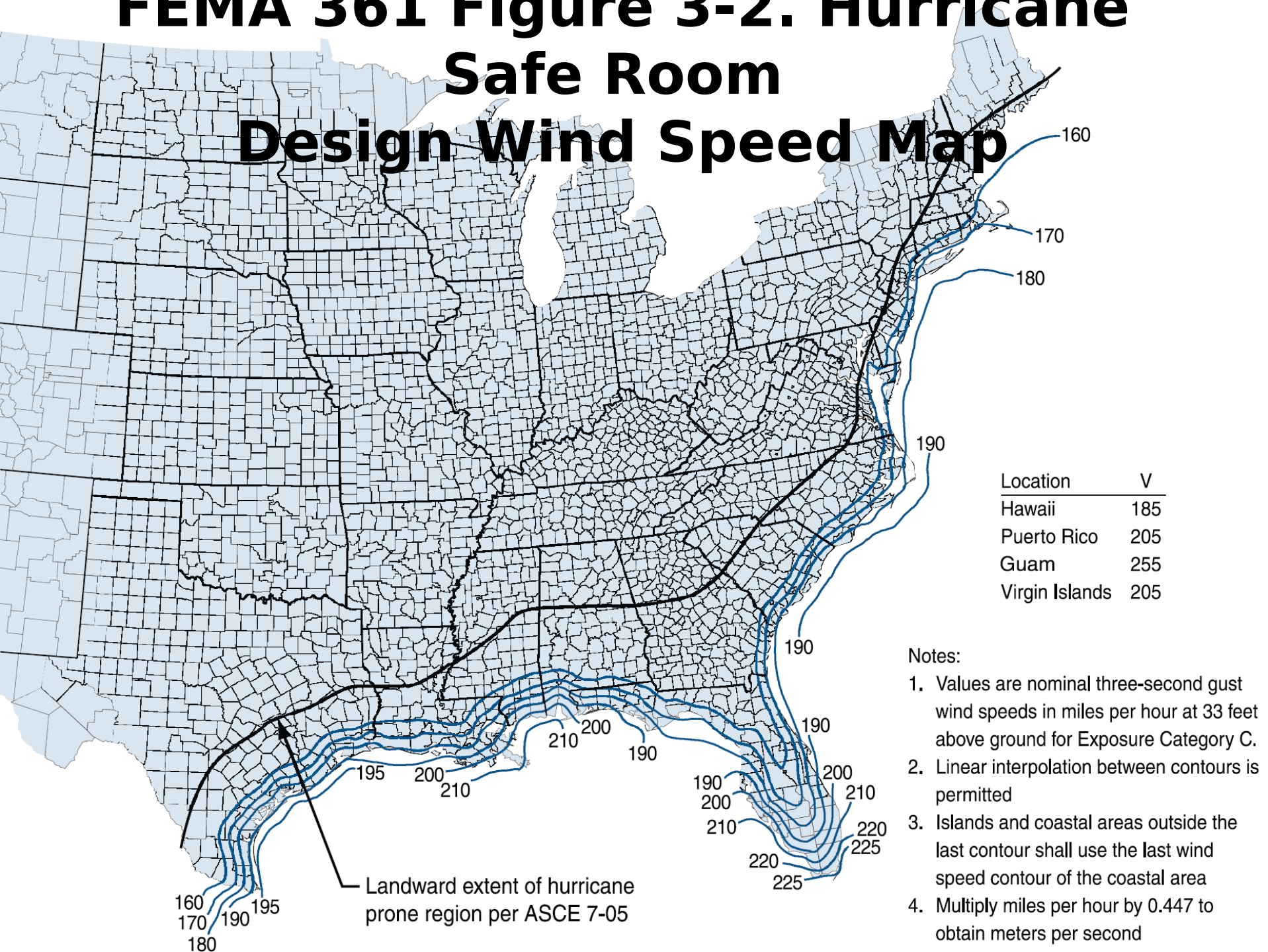
- Notes:
1. Values are nominal three-second gust wind speeds in miles per hour at 33 feet above ground for Exposure Category C.
 2. Multiply miles per hour by 0.447 to obtain meters per second.

- American Samoa 200 mph
- Guam 250 mph
- Hawaii 160 mph
- Puerto Rico 200 mph
- Virgin Islands 200 mph

Wind Speeds



FEMA 361 Figure 3-2. Hurricane Safe Room Design Wind Speed Map



Protection of Building Envelope

- All safe rooms:
 - Walls and roof systems must be impact resistant
 - Roofs cannot have loose-laid roof coverings
 - Openings required to be debris impact resistant or have impact resistant coverings



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FEMA Missile Tests

Tornado - Design Wind Speed	Horizontal Missile Speed - Tornado	Vertical Missile Speed - Tornado
Zone IV - 250 mph	100 mph	67 mph
Zone III - 200 mph	90 mph	60 mph
Zone II - 160 mph	85 mph	56 mph
Zone I - 130 mph	80 mph	53 mph

Hurricane Safe Room Design Wind	Horizontal Missile Speed (0.5 x V) - Hurricane	Vertical Missile Speed (0.1 x V) - Hurricane
255 mph	127 mph	26 mph
250 mph	125 mph	25 mph
240 mph	120 mph	24 mph
230 mph	115 mph	23 mph
220 mph	110 mph	22 mph
210 mph	105 mph	21 mph
200 mph	100 mph	20 mph
190 mph	95 mph	19 mph
180 mph	90 mph	18 mph
170 mph	85 mph	17 mph
160 mph	80 mph	16 mph



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Flood Hazards Recommendations

Community & Residential Safe Rooms

- Safe rooms should be located outside of the following high risk flood hazard areas:
 - Coastal High Hazard Area (VE Zones)
 - Coastal A Zones
 - Floodways
 - Areas behind levees that have not been certified
 - Outside Category 5 hurricane surge zones (Residential only)
- For Residential safe rooms, within floodplain areas subject to flooding of 3 feet or less



Elevation Requirement for Citing Safe Rooms in Floodplains

- The safe room floor shall be elevated above the highest elevation determined from:
 - Local floodplain management requirements
 - 100-year flood elevation + 2 ft (BFE+2)
 - 500-year flood elevation, when determined
 - 500-year flood elevation based on wave crest, when determined
 - Above maximum inundation elevations from a Category 5 hurricane surge (Community only)



Operational and Human Factors

- For Community Shelters, FEMA also provides information on construction including:
 - Ventilation
 - Back-up/emergency power
 - Emergency lighting
 - ADA compliance
 - Fire barrier ratings
 - Toilets and handwashing fixtures
 - On-site potable water
 - Supplies (such as first-aid kits)



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In Summary

- Distinct need to protect the public from high wind hazardous events
- Differences between merely sheltering from the wind vs. Safe Rooms are now clearly defined
- FEMA has provided prescribed guidance for the construction of both residential and community safe rooms
 - Materials, methods, and siting recommendations
 - Goal is near-absolute wind protection for inhabitants
- In Tornado Alley and along our coasts, Safe Room construction should be a paramount consideration for new construction to fulfill population protection



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FEMA Safe Room Help Line

Via email:

saferoom@dhs.gov

Via telephone:

866-222-3580



**Design and Construction
Guidance for Community
Safe Rooms**

FEMA 361, Second Edition / August 2008



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the Storm:**

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