

## **TESTIMONY**

of

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to the

Subcommittee on Technology

Committee on Science, Space, and Technology

House of Representatives

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I have been part of the wind program at Texas Tech University since 1970 when the Lubbock Tornado occurred. I was chairman of the Civil Engineering Department at that time. With your support we have developed a world class program to mitigate the wind hazard. Capabilities include:

- Unparalleled facilities (Attachment 1)
- Unique doctoral program in Wind Science and Engineering, initially funded with an NSF IGERT grant.

A lot is known about windstorms, especially forecasting. Awesome things are being done in warnings, tracking and using modern technology to make information available and useful. Forecasting helps us prepare for extreme winds such as tornadoes and hurricanes but we still have to deal with the effects of extreme winds. Investments in weather forecasting have produced good return on investment and saved many lives. Similar investments need to be made in other program areas.

### **NEEDED RESEARCH**

Much more research is needed for us to understand the nature and characteristics of extreme winds. Knowing more would help designers and planners increase safety and reduce damage. Forecasting is giving us more accurate information on storm locations, paths and lead times. But if we don't know what to do or where to go for safety the warnings lead to anxiety. The cost of anxiety and uncertainty is enormous. Based on a study we did about 30 years ago, I would estimate that over 6 billion person hours are spent annually under severe weather watches or warnings. Storm shelters can save lives, but I believe more importantly they relieve anxiety.

A focused approach to research, development, and implementation has potential of significantly reducing impact of windstorms on urban society. Specific focus areas include:

- Testing facilities for simulating winds in hurricanes, tornadoes and thunderstorms, enabling us to test structural components and systems.
- Repository for documented windstorm damage that is organized and made available to researchers, code writing bodies and practicing professionals.
- Development of computational wind engineering for wind/structure interaction, wind/urban infrastructure interaction, and simulating structural mechanics for fluctuating loads.

- Implementation of known research results in to standards and codes through economic, social behavior studies.
- Development of manpower who can pursue meaningful research and professional practice in aspects of mitigation, response and recovery.
- Education/outreach programs that convey sound, consistent guidance that leads to intelligent responses to potentially disastrous perils.

Some programs are in place but most need a reliable, sustained source of funding for maturation and expansion.

### **ROLE OF BUILDING CODES**

Property damage can be abated by improved building codes including informed design, higher design wind speeds, and stricter code enforcement. States or local jurisdictions may adopt provisions of building codes. Model codes such as the International Building Code (IBC), the International Residential Code (IRC) and many others are available for consideration by jurisdictional code bodies. Building codes are adopted at state or local levels and are implemented at the local level. It is appropriate to require states and local jurisdictions to be required to develop and periodically update hazard mitigation plans as prerequisite to federal or state grants. They may be required more broadly, forcing locals to identify the most relevant hazards and mitigation strategies.

States, local jurisdictions, governmental agencies, education institutions and profession societies should be incentivized to offer educational programs to architects, engineers, and building inspectors on design, construction and inspection of new and retrofitted buildings. A wealth of information is available but implementation is lacking, even in new construction. Some sound, inexpensive improvements such as connections along the load path are not implemented in some cases. This should not surprise us but should motivate us to action. After all, people still die in rollover auto accidents who are sitting on their seat belts!

### **STORM SHELTERS AND SAFE ROOMS**

In the early 1970's we developed the concept of the above ground storm shelter. I have spent my career supporting development, deployment and quality in storm shelters/safe rooms. Elements of the well-established technology include:

- Available Standards and Guidelines
  - ICC 500, ICC/NSSA Standard For The Design And Construction Of Storm Shelters
  - FEMA P-320, Taking Shelter From The Storm: Building a Safe Room For Your Home or Small Business
  - FEMA P-361, Design and Construction Guidance for Community Safe Rooms
- Industry Association, The National Storm Shelter Association (NSSA), an IRS 501-c-6
- NSSA Standards-Compliance Verification Program (Attachment 2)

- NSSA Seal Program of NSSA Producer Members who have demonstrated standards compliance

Available now is a wide variety of storm shelters:

- Residential, Community
- Aboveground, Underground
- Concrete, Steel, Timber, Fiberglass

For every situation and circumstance a storm shelter solution can be found to meet needs.

I will make unequivocal statement that...

**Above-ground storm shelters that meet these standards and guidelines provide near-absolute protection with a margin of safety from a worst-case tornado--yes an EF-5 Tornado. To say or imply that the only safe place is underground is false and misleading.** Studies in Moore, OK following their EF 5 tornado of May 20, 2013 confirm this statement.

Widespread deployment of storm shelters (safe rooms), residential and community, can produce significant societal benefits. Several programs are available to augment the cost of shelters. The FEMA Hazard Mitigation Grant Program (HMGP), with funding driven by Stafford Act had funded approximately 22,000 residential and 1,200 community shelters. There are many positive characteristic of the HMGP program--stimulates mitigation activities, leverages private capital, ... A major downside is that HMGP benefits a few qualified recipients after an event. With funding generated by Hurricane Ike (2008), storm shelter education programs are nearing completion in 2013 and community storm shelter construction is commencing along the Texas coast.

Sustained funding bases are needed to assist in preparing for unforeseen events. Some state-funded programs provide continuity. State/Federal partnerships to provide continuous funding are encouraged more vigorously.

### **ON MANDATING SHELTERS**

A much debated question is: "Should storm shelters be mandated by law?"

There is considerable impetus and positive sentiment, mine included, for states or local jurisdictions to make storm shelters or safe places mandatory in new public buildings such as K-12 schools, colleges, day care centers located in high-risk areas. Alabama has had good results with such a law as have isolated jurisdictions such as the city of Omaha, NE. Mandatory shelter laws are also appropriate for new multi-family residential units housing vulnerable populations who are tenants, not owners. This includes but is not limited to nursing homes, mobile home parks, and apartments. Tenants should expect to pay a major portion of the cost of providing protection rental or leasing agreements. Public funding might provide subsidies for low-income families.

Shelters should not be made mandatory for privately owned single or multifamily residences. Rather, incentives such as property tax credits, financing or competitive grants will suffice. We do have an obligation to present reliable information on what is technology is available and concomitant costs. Educational programs are needed for design professionals, architects and engineers, building officials including inspectors, school boards, public officials, builders, and the public. Passage of the proposed NWIRP bill will be helpful in this regard.

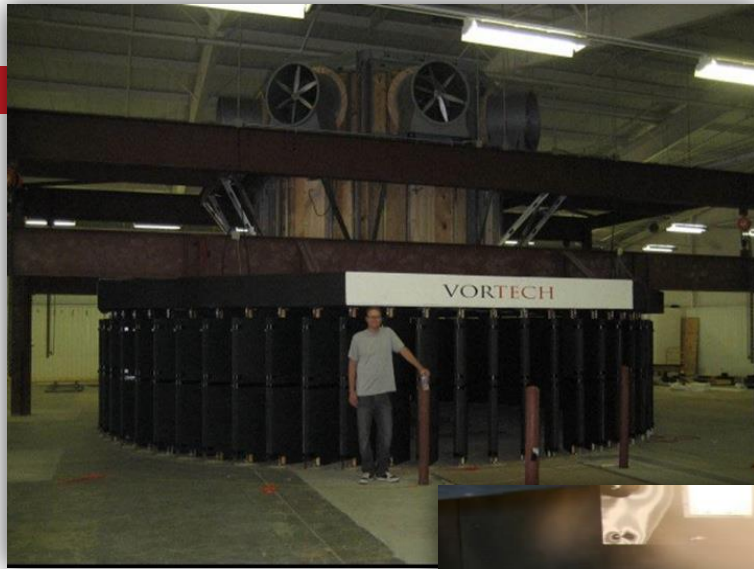
### **RECOMMENDED ACTION**

I believe passage of the proposed NWIRP bill will facilitate mitigating the effects of the wind hazard in the United States. The agencies identified to administer the NWIRP --NIST, FEMA, NOAA, and NSF--are all experienced and coordinated to effectively manage large-scale programs. Many capable professional personnel are available to conduct research and education to mitigate the wind hazard. **I therefore urge Congress to pass the bill that contains the NWIRP program and that escalating property values at risk and the expected large return on investment (ROI) be recognized in establishing funding levels. An unprecedented return on investment may be expected.**



# **ATTACHMENT 1**

# Facilities at Texas Tech University



# Facilities at Texas Tech University



# Facilities at Texas Tech University







# **ATTACHMENT 2**

# Applicable **Standard** & FEMA Guidelines

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- FEMA 361
- FEMA 320
- NSSA/ICC-500

## Additionally

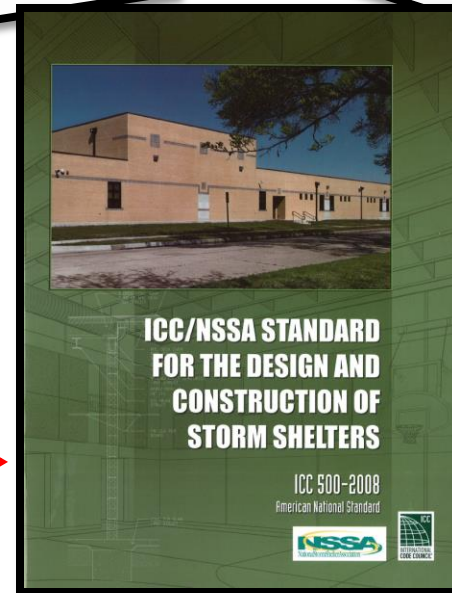
- ASCE 7-05
- I-Codes



Guidelines  
↔



Standard  
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# **ATTACHMENT 3**

# Quality Assurance Verification



1/20/12

## Insurers of Quality in Safe Rooms (Storm Shelters)

**PRODUCER MEMBERS** - are persons, firms, corporations, or partnerships who are engaged in the manufacture or construction of safe rooms (storm shelters) and who certify that the manufacture and installation or construction are in compliance with the ICC/NSSA Standard, FEMA 320 and FEMA 361 Guidelines. Producer Members apply an NSSA seal bearing the Producer Member's name and a serial number to each safe room (storm shelter) produced. Producer Members may have AUTHORIZED REPRESENTATIVES perform designated functions for which the Producer Member assumes responsibility.

**AUTHORIZED REPRESENTATIVES** - are persons, firms, corporations, or partnerships that are contractually authorized representatives of a Producer Member, who are trained by the Producer Member to perform functions assigned by the Producer Member.

**INSTALLER MEMBERS** - are persons, firms, corporations, or partnerships who install safe rooms (storm shelters) for Producer Members and who bear responsibility for compliance with installation instructions provided by the Producer Member.

**PROFESSIONAL MEMBERS** - licensed design professionals such as architects and engineers who are engaged in the storm shelter industry and who subscribe to the NSSA Bylaws and applicable standards and guidelines.

**THIRD PARTY EVALUATORS** - independent, NSSA-approved, third party, evaluators--architects and engineers--who verify that the Producer Member's design complies with all aspects of the ICC/NSSA Standard and FEMA 320 and 361 Guidelines, as applicable. Legal considerations dictate that the third-party evaluator can only verify designs and calculations produced by a registered design professional architect or engineer who is the designer of record.

**CHIEF COMPLIANCE OFFICER** - A registered design professional, appointed by NSSA, who is responsible to assure compliance of NSSA Producer Members with the *ICC/NSSA Standard* and other applicable standards and guidelines and to assure compliance of all NSSA members' business practices with the NSSA Bylaws. The Chief Compliance Officer is informed of the *ICC/NSSA Standard* and relevant guidelines and is competent in the field of design of safe rooms (storm shelters) for protection against the effects of tornadoes and hurricanes. The Chief Compliance Officer may be a Producer Member and/or a Professional Member of NSSA.

## Processes for Verifying Standards-Compliance of Safe Rooms (Storm Shelters)

**General:** Producer Members may present a Quality Assurance Plan (QAP) on or with each set of Construction Documents covering compliance issues. The QAP shall meet requirements of Section 107 of the ICC/NSSA Standard. It shall include the general construction sequence and the type and frequency of construction observations and/or inspections.

The QAP shall be evaluated by an NSSA-approved Third-Party Evaluator before presentation to the authority having jurisdiction (AHJ).

## NSSA Compliance Verification Process

### Designer of Record

For each model, the Designer of Record, who is a licensed design professional:

- o Provides engineered drawings and specifications for safe room (storm shelter) to Producer Member. Seals, signs and dates each sheet of drawings.
- o Identifies applicable standards and guidelines met or exceeded in design. Include latest editions of ICC/NSSA Standard; FEMA 320 and 361 Guidelines. If differences exist in design criteria, the most stringent shall be met.
  - Alternate -- Producer/Contractor specifies which prescriptive design presented in FEMA 320 will be followed. Designer of Record verifies standards-compliance of any design changes or variation from FEMA 320 prescriptive designs
- For above ground safe rooms (shelters), provide:**
  - Minimum specifications for foundation or slab design--thickness, reinforcement, overhang; avoidance of pre-tensioning or post-tensioning strands; anchoring details.
  - Assembly and installation instructions including detailed step-by-step installation checklist or a Quality Assurance Plan.
- For below ground safe room (shelter), provide:**
  - Specification for site preparation, minimum and maximum slope of grade, slope stabilization
  - Design of anchorage, ballasting to prevent buoyancy with saturated soil conditions.
  - Step-by-step installation instructions including backfilling, encasement, and compaction or a Quality Assurance Plan. Under-slab-on-grade safe rooms (storm shelters) are included in the standards listed above.
- o Provide installation checklist.
- o Provide list and schedule of needed inspections (may be included in a Quality Assurance Plan).
- o Provides these documents to Producer Member and to NSSA home office.

### Third-Party Evaluator for standards compliance.

- o Evaluates for standards compliance all elements of design
- o Reviews and evaluates construction documents and/or detailed Quality Assurance Plan
- o Issues statement of scope of third-party evaluation
- o Provides evaluation report to Producer Member and to NSSA home office

### Producer Member

- o Provides design drawings and specifications and/or Quality Assurance Plan to authority having jurisdiction when requested
- o Follows design drawings and specifications
- o Has third party evaluator verify compliance with standards of any change from approved drawings and specifications
- o Permits plant or construction site visits by NSSA Chief Compliance Officer and/or inspectors of jurisdictional authorities if required by either. Purpose and focus of visit shall be stated in writing upon arrival
- o Provides drawings/specifications and Third Party Evaluator report to NSSA home office if not already sent
- o Provides drawings and specifications to owner or installer to obtain building permits as required
- o Notifies owner that site must be verified to be outside the floodway to meet FEMA guidelines
- o Affixes NSSA Producer Member Seal (Type 1 or Type 2) to each safe room (storm shelter) installed

### Installer (NSSA Installer Member or Authorized Representative of Producer Member)

- o Completes installation checklist.
- o Signs Certificate of Installation or separate document that installation instructions were followed. Attach completed installation check list.
- o Records GPS Coordinates of installation site; encourages owner to register site with local emergency management agencies
- o Records serial number of Producer Member Seal. Affix Type 3 Seal if Type 2 seal has been affixed.

### Inspector

- o Producer/Contractor performs or has Authorized Representative perform scheduled inspections in accordance with the list and schedule of inspections or the Quality Assurance Plan.
- o When required by the Authority Having Jurisdiction (AHJ) or by grant authority, the AHJ or a duly appointed inspector performs scheduled inspections and produces an Inspection Report after the final inspection.
- o When required by the grant authority, a licensed design professional issues an Inspection Report including a statement of compliance that relevant standards are met.
- o When required by the grant authority, the inspector and licensed design professional provide signed copy of inspection report to Producer Member to attach to Certificate of Installation for submittal to authority having jurisdiction (AHJ) or grant administering agency, if any.