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Guideline for Specifying Windstorm Products

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Guideline for Specifying Windstorm Products

1 Introduction

Modern building design and construction science have evolved to a degree where 'near-absolute' protection can be achieved, providing occupants and contents safety from nature's most severe wind storms. In parallel to this evolution, building codes have advanced to provide both optional and mandatory requirements to ensure life safety and the protection of property from these destructive forces of nature.

This guide is intended to inform the reader about the methodology and criteria used for specification and selection of windstorm resistant door opening assemblies for non-residential construction. In order to properly specify products for these applications, the user must first understand the type of threat – hurricane or tornado – the geographic area in which the building is located and the design pressures as calculated by the structural engineer of record. Once these parameters have been identified, a specification and product selection process can begin. The following sections provide an overview of the definitions and process for determining the design requirements for each threat.

2 Definitions

ASCE 7 – Minimum Design Loads for Buildings and Other Structures.

Design Pressure – expressed in pounds-per-square-foot, the positive and negative loads to which a door opening assembly is subjected.

Enhanced Hurricane Protection Area (EHPA) – criteria within the FBC applicable to specific portions of K-12 and Florida college educational facilities to provide emergency shelter and protection for people for a period of up to 8 hours during a hurricane.

Florida Building Code **(FBC)** – adopted by Florida to govern non-residential construction within the state.

High Velocity Hurricane Zone (HVHZ) – the geographic area of Broward and Dade counties.

ICC 500 – Standard for the Design and Construction of Storm Shelters.

International Building Code (IBC) – a model building code developed by the International Code Council (ICC) and adopted for use as a base code by most jurisdictions in the United States.

International Existing Building Code (IEBC) – a model code applicable to renovations and additions to existing buildings, developed by the International Code Council (ICC) and adopted for use by many jurisdictions in the United States.

Large Missile – a No. 2 or better Southern Yellow Pine or Douglas Fir 2 × 4 in. lumber having a mass of between 9 and 15 lbs.

Registered Design Professional – an individual registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed.

Risk Category – a categorization of buildings and other structures for determination of wind loads. The classification is based on the risk associated with failure of the building or structure.

Small Missile – a solid steel ball having a mass of 2 g with an 8-mm nominal diameter.

Wind-borne Debris Region – Areas within hurricane-prone regions located within 1 mile of the coastal mean high water line where the ultimate design wind speed is 130 mph or greater; or in areas where the ultimate design wind speed is 140 mph or greater.

Wind Speed Map – graphic depiction of wind velocity indicated by contour lines.

3 Hurricane Resistant Opening Protectives

The *Florida Building Code* is widely regarded as the most comprehensive document for addressing the unique performance characteristics of hurricane resistant construction. The *6th Edition Florida Building Code* went into effect December 31, 2017 and classifies building types by Risk Category I through IV, using three distinct wind speed maps for the categories (see Figure 1).

In order to calculate the design pressure for a particular opening, the Registered Design Professional must first define the following variables as they pertain to the project:

1. Risk Category of the building
2. Applicable Wind Speed Map for the identified Risk Category
3. Geographic location of the building on the wind speed map and the wind speed associated with that location

Following the methodology of *ASCE 7,* these variables are utilized to calculate design pressures for each specific opening. The unique calculation takes into account the openings' location relative to the height above grade-plane, proximity to the corners of the building, the orientation towards the water and other attributes. The result of the calculation is a design pressure, expressed in both positive and negative values, in pounds-per-square foot.

Openings located in the wind-borne debris region also require a level of impact resistance. During testing, the windborne debris is simulated by small or large missile impacts as described in the *Florida Building Code*. The determination of small versus large missile requirements is based on the elevation

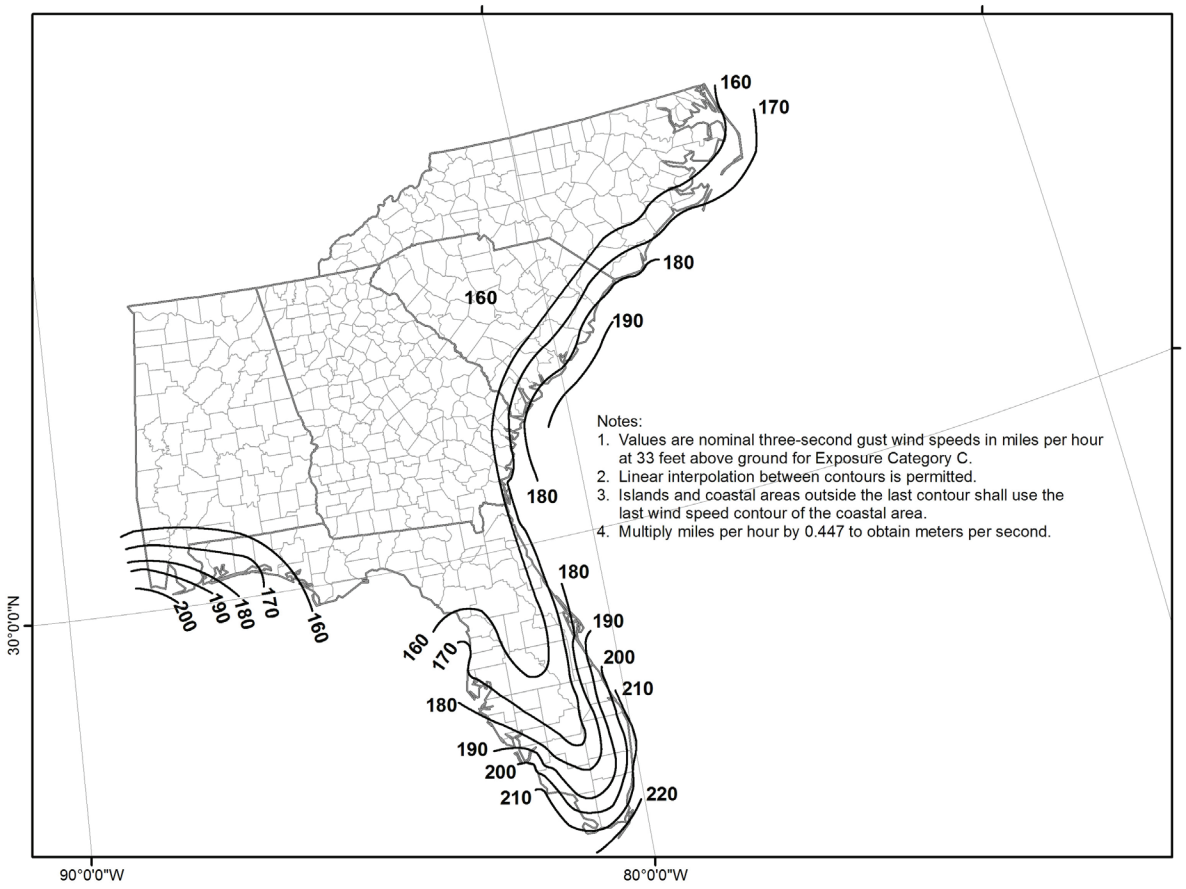

Figure 1 – Wind speed map

of the opening in the building envelope, relative to grade-plane. This test, when combined with the dynamic pressurized cycling of the assembly, will ensure the integrity of an opening so that it does not fail during a hurricane and allow the building envelop to be breached.

Design pressures, missile impact requirements and the specific attributes (size, swing, and glazing) of an opening, most often found in a door schedule, provide the basis for the selection of hurricane resistant door opening assemblies.

4 Tornado Resistant Opening Protectives

With the issuance of the ICC 500 Standard in 2008, a distinct standard explicitly written for the design and construction of storm shelters was available for the first time. This document sought to improve and further develop the concepts of protection against tornadic winds and windborne debris as first discussed in FEMA 320 and FEMA 361, for all parts of shelter design including residential and non-residential structures.

Since the introduction of the ICC 500 Standard, it has been a referenced standard in the IBC and subsequently became a mandated requirement for protection of life against tornados in an area stretching from Colorado to Ohio and from North Dakota to Texas and Alabama (see Figure 2).

ICC 500 was first included in the 2009 Edition of the IBC and was mandated within the 2015 IBC for K-12 schools and critical emergency operation centers located where the design wind speeds for tornados are designated at 250 mph. These facilities include 911 call stations, emergency operation centers and fire, rescue, ambulance and police stations as well as educational occupancies through grade 12, with occupant loads of 50 or greater. The *2015 International Residential Code* requires storm shelters, when provided, to be constructed and evaluated in accordance with ICC 500. ICC 500 was also included in the 2018 Edition of the IEBC, relative to additions constructed for existing educational occupancies.

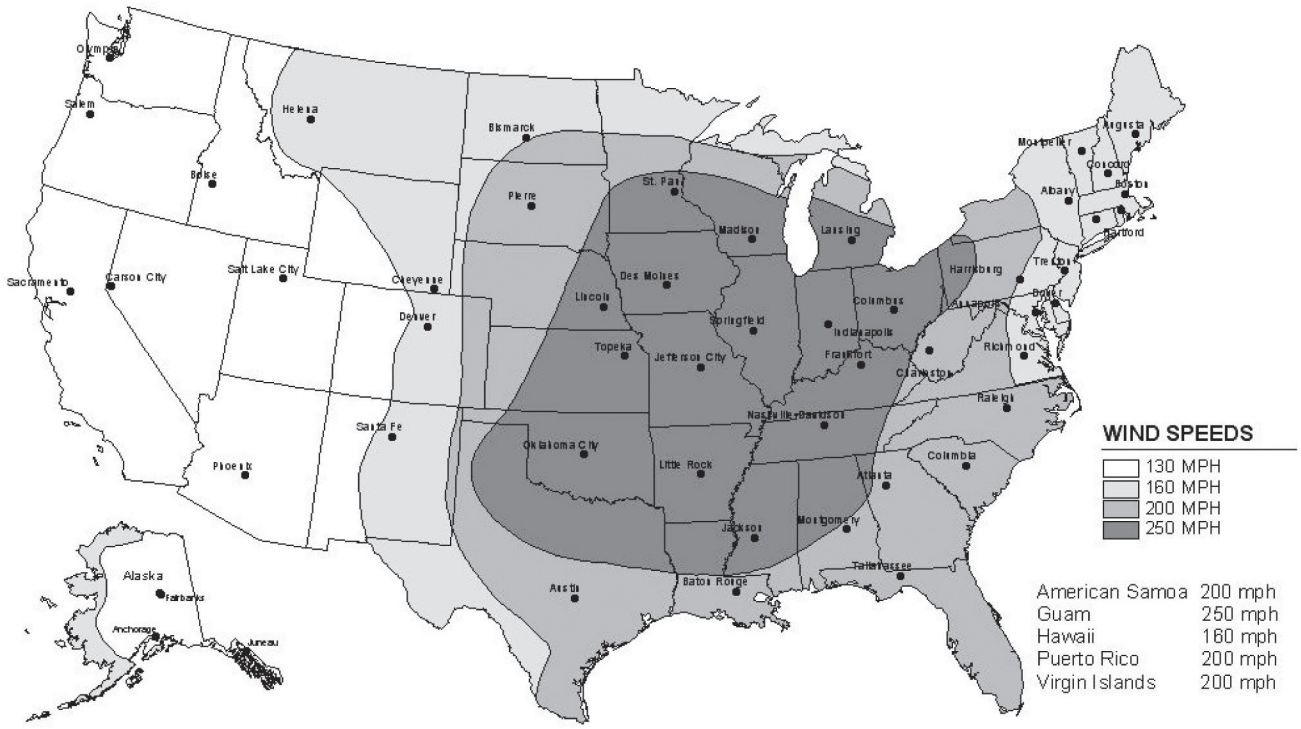

Figure 2 – Shelter design wind speeds for tornadoes

Like hurricanes, the maximum design pressure is calculated based upon the location of the structure and the maximum wind speeds shown in the shelter design wind speed map (Figure 2). The test standard requires a protective assembly and the components within the assembly to be able to sustain a specified Design Pressure with a safety factor of 20%, as well as resist up to four impacts of a fifteen pound 2x4 missile fired at a velocity of one hundred miles per hour, while providing protection for the occupants inside.

ICC 500 evaluates protective assemblies such as swinging shutters or doors with frames, latching hardware and all other assembly components. The Registered Design Professional must determine key parameters for the project such as:

1. design pressure
2. opening size
3. occupant load and egress requirements
4. swing direction
5. geographic location of building

These factors will allow someone to properly specify the openings. Since these tornado resistant assemblies are a product of many components working together, substitution of other types of hardware or any materials is not permitted without additional testing or evaluation being completed by the listing agency. Even the smallest change can have significant consequences to the performance of an assembly in a severe weather event.

5 Summary

Tornado and hurricane resistant opening protectives, often required by the building code, are complex pieces of the overall building envelop. To ensure their proper function, it is essential that they be specified correctly and installed per the manufacturers' listing and installation instructions. This guideline is provided by the Steel Door Institute to assist the reader in doing so.

6 Disclaimer

This guideline is intended to provide general information and should not be used as a substitute for the role of a Registered Design Professional.

7 Additional Resources

American Society of Civil Engineers,
www.asce.org

Florida Building Commission,
www.floridabuilding.org

Intertek SpecDIRECT,
spec-direct.com

International Code Council,
www.iccsafe.org

Underwriters Laboratories Directory,
www.ul.com/ul-databases-and-directories

Steel Door Institute,
www.steeldoor.org

AVAILABLE PUBLICATIONS

Specifications

ANSI/SDI A250.6	Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames
ANSI/SDI A250.8	Specifications for Standard Steel Doors and Frames (SDI-100)
SDI-108	Recommended Selection & Usage Guide for Standard Steel Doors
SDI-118	Basic Fire Door, Fire Door Frame, Transom/Sidelight Frame, and Window Frame Requirements
SDI-128	Guidelines for Acoustical Performance of Standard Steel Doors and Frames
SDI-129	Hinge and Strike Spacing
SDI-133	Guideline for Specifying Steel Doors & Frames for Blast Resistance
SDI-136	Guideline for Specifying Windstorm Products

Test Procedures

ANSI/SDI A250.3	Test Procedure & Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames
ANSI/SDI A250.4	Test Procedure & Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors
ANSI/SDI A250.10	Test Procedure & Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames
ANSI/SDI A250.13	Testing and Rating of Severe Windstorm Resistant Components for Swinging Door Assemblies for Protection of Building Envelopes (Not applicable for FEMA 320/361 or ICC-500 Shelters)
SDI-113	Standard Practice for Determining the Steady-State Thermal Transmittance of Steel Door and Frame Assemblies
SDI-131	Accelerated Physical Endurance Test Procedure for Steel Doors

Construction Details

ANSI/SDI A250.11	Recommended Erection Instructions for Steel Frames
SDI-110	Standard Steel Doors & Frames for Modular Masonry Construction
SDI-111	Recommended Details for Standard Steel Doors, Frames, Accessories and Related Components
SDI-122	Installation Troubleshooting Guide for Standard Steel Doors & Frames

Miscellaneous Documents

SDI-112	Zinc-Coated (Galvanized/Galvannealed) Standard Steel Doors and Frames
SDI-117	Manufacturing Tolerances for Standard Steel Doors and Frames
SDI-124	Maintenance of Standard Steel Doors & Frames
SDI-127	Industry Alert Series (A-L)
SDI-130	Electronic Hinge Preparations
SDI-134	Glossary of Terms for Hollow Metal Doors and Frames
SDI-135	Guidelines to Measure for Replacement Doors in Existing Frame Openings

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1/1/2023