WINDSTORM RESISTANT STRUCTURE DESIGN

Presenters:
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A Little about the purpose of TDI – Windstorm program
- Started January 1, 1988
- Normalizes Insurance premiums in High Catastrophic areas

TDI Windstorm Program Process
- WPI-1
- WPI-2
- WPI-8

Updated Submittal Forms – Coming – Be On the Look Out

Frequently Asked Questions-
https://www.tdi.texas.gov/wind/generalquestio.html
APPLICATION FOR CERTIFICATE OF COMPLIANCE

For ongoing improvements that began construction on or after April 1, 2020

Instructions

- Print this form and type or print your responses.
- Return this form by email or mail.

Email: windstorm@tdi.texas.gov

Texas Department of Insurance
Windstorm Inspections Program, MC 104-WS
P.O. Box 149104
Austin, TX 78714-9104

Acknowledgement

I acknowledge that I am a qualified inspector appointed by the commissioner of the Texas Department of Insurance to perform inspections in accordance with Texas Insurance Code Sections 2210.251-2210.258 and with 28 Texas Administrative Code Sections 5.4601-5.4642. I affirm the following:

Location of Structure

Street address (including house or building number):

Type of Inspection performed

- Entire structure (type):
- Entire re-roof (type):
- Re-decking:
- Mechanical only (type):
- Foundation only (type):
- Partial re-roof (type and area):
- Addition (type):
- Re-decking:
- Retrofit of All Exterior Openings:

Comments:

Submitter Information:

SUBmitter NAME (please print): DATE:

TELEPHONE NUMBER:

Please check one: Owner Builder/Contractor Insurance Agent Engineer Other (Specify):

For Texas Department of Insurance Inspections: mail or email to your local field office
For inspections by engineers: mail or email to Austin office: windstorm@tdi.texas.gov

Texas Department of Insurance | www.tdi.texas.gov

1/3
MAJOR CHANGES TO WINDSTORM

- Wind Maps
  - Utilizing higher Ultimate number for windspeed

- Protection of Openings
  - Corrosion Resistant Fasteners must be permanently attached to the framing
  - All TDI areas now REQUIRE Window Protection Method
  - All TDI areas require Window Protection Inspection stage

- Roof Coverings
  - Roof Covering Nails
    - Plastic or Metal Nail Caps Required
  - Roof Covering Inspection
    - Roofing Underlayment must now bare the label of approved ASTM rating
PROTECTION OF OPENING FASTENING
PLYLOX CLIPS

Carbon Steel Residential Hurricane Window Clips

Stainless Steel Residential Hurricane Window Clips
PROTECTION OF OPENINGS
WINDSTORM RESISTANT DESIGN
– A BRIEF INTRO

- American Society of Civil Engineers (ASCE), American National Standards Institute (ANSI) and International Code Council (ICC) decide Minimum design loads.

- Wind design per IRC limits prescriptive design to structures < 140 mph (ASCE 7-16)

- Engineered Design for areas where wind speed is expected to exceed the above speeds. Design per ASCE – 7 standard “Minimum Design Loads and Associated Criteria for Buildings and Other Structures” – the latest edition in use is ASCE 7-16
Texas Department of Insurance – Windstorm program
- Adoption IRC/IBC 2018 beginning September 1, 2020
- Permits and WPI-1 must be in to TDI by September 1, 2020
- Applies to new structures constructed, repaired, or added to on or after September 1, 2020

Wind speed (V mph) criteria – what do they mean.
- V under ultimate speed design methods (ASCE 7-16)
- Wind Speed maps in ASCE-7-16 categorized per Risk Category

Catastrophe areas per TDI
- Inland I, Inland II, and Seaward Zones will no longer exist under the 2018 TDI code update
- TDI designated catastrophe area will not change.
- Wind speed within designated catastrophe area to be determined by inspector/engineer using IBC 2018 or code standards referenced in IRC 2018 (ASCE 7-16)
  - ASCE 7 Hazard Tool
  - ATC Hazard by Location Tool
TDI | Designated catastrophe area
ASCE 7 HAZARD TOOL

Location
Hitchcock, Texas,

Elevation
13 ft with respect to North American Vertical Datum of 1988 (NAVD 88)

Lat.: 29.34677
Long.: -95.01089

Standard: ASCE/SEI 7-16

Risk Category: II

Soil Class: E - Soft Clay Soil

Wind

https://asce7hazardtool.online/
Hazard by Location

Search by Address
hitchcock TX, USA
Coordinates: 29.3482395, -95.0160368

Wind
- Print these results
- Save these results

ASCE 7-16
Select a dataset to view contours.

MRI 10-Year: 79 mph
MRI 25-Year: 98 mph
MRI 50-Year: 113 mph
MRI 100-Year: 124 mph

Risk Category I
- 138 mph
You are in a wind-borne debris region if you are also within 1 mile of the coastal mean high water line.

Risk Category II
- 147 mph
You are in a wind-borne debris region.

Risk Category III
- 157 mph
If the structure under consideration is a healthcare facility and you are also within 1 mile of the coastal mean high water line, you are in a wind-borne debris region. If other occupancy, use the Risk Category II basic wind speed contours to determine if you are in a wind-borne debris region.

Risk Category IV
- 164 mph
You are in a wind-borne debris region.

https://hazards.atcouncil.org/#/
WIND LOAD TRANSFER

- Wind pressure is collected by roof and walls
- Wind pressures are distributed into diaphragms at roof and floors
- Diaphragms transfer loads to shear walls, portal frames, etc.
- Shear walls transfer loads to the foundation parallel to their planes

CALCULATING LOADS ON STRUCTURES

- Determine wind pressures for roof and wall (s)
- Convert the pressures to loads based on tributary areas
- Distribute loads to wall brace lines for shear wall design
- Reduce loads as allowed per code to determine anchoring
1\textsuperscript{ST} TO 2\textsuperscript{ND} FLOOR CONNECTIONS
BLOCKED SHEAR WALL AT EDGE
CONTINUOUS LOAD PATH CONNECTIONS

- Roof to Walls
- Wall to Floor
- Wall to Wall
- Floor to Sill Plate
- Sill Plate to Foundation
Wind Effects

- Uplift
- Shear
- Sliding
- Overturning

- Clips & Straps
- Sill Anchors
- Shear Walls
- Portal Frames
- Sill Anchors
- Shear Plates
- Hold downs
Portal Frames: Tested assemblies with empirical data. Since these are not calculated wall components, constructing them exactly per the details published by American Plywood Association (APA) TT-100 for High wind areas and IRC for other areas inland.

Sheathing options

Bay Windows: Presence of bay windows introduces a discontinuity in the wall. May be a problem for resistance elements.
Figure 1. Construction Details for APA Portal-Frame Design with Hold Downs

- Extent of header with double portal frames (two braced wall panels)
- Extent of header with single portal frame (one braced wall panels)
- 2’ to 18’ rough width of opening for single or double portal

Min. 3’ x 1 1/4’ net header, steel header not allowed

Fasten sheathing to header with 8d common or galvanized box nails of 3” grid pattern as shown.

Header to jack-stud strap per wind design. Min 1000 lb on both sides of opening opposite side of sheathing.

Min. double 2x4 framing covered with min 3/8” thick wood structural panel sheathing with 8d common or galvanized box nails of 3” o.c., in all framing (studs, blocking, and sill), etc.

Min. length of panel per table 1

Min. 3500 lb strap-type hold-downs (embedded into concrete and nailed into framing)

Min reinforcing of foundation, one #4 bar top and bottom of footing. Lap bars 15’ min.

Min footing size under opening is 12” x 12”. A turned-down slab shall be permitted for deep openings.

Min. 1 5/8” diameter anchor bolt installed per IRC R403.1.6 – with 2” x 2” x 3/16” plate washer

Header to jack-stud strap per wind design. Min 1000 lb on both sides of opening opposite side of sheathing.

Min. 3/8” wood structural panel sheathing

If needed, panel splice edges shall occur over and be nailed to common blocking within middle 24” of portal height. One row of 3” spacing is required in each panel edge.

Typical portal frame construction

Min. double 2x4 post (king and jack stud). Number of jack studs per IRC tables R502.5(1) & (2).

Min. 1600 lb hold-down device (embedded into concrete and nailed into framing)

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GARAGE PORTAL FRAME CONSTRUCTION
DESIGN FEATURES THAT MAY IMPROVE QUALITY AND COST

- Windows: Perhaps the one important and most prevalent feature of any home are the windows. Using Transoms, Window filled walls etc. add to the complexity of the Wind resistance design.

- Steep roofs: Although sometime the roof is part of the aesthetic appeal of the house, shallower roofs allow for less complex windstorm designs.

- Slab on Grade Design Vs Pier / beam or Piling design: This may not be an option in some coastal areas, but the cost increase is a factor to remember when planning a project.

- Steel or no Steel: Sometimes having Steel frames to resist wind forces may not be all bad considering the flexibility in other aspects that can be achieved.
INSPECTION PROCESS AND TDI REQUIREMENTS

- Inspections should typically include:
  - Clips, straps and shear walls
  - Roof decking and shingles
  - Siding, brick, stucco and other façade
  - Windows and doors (pressures and installation)
  - Fastening of A/C units, Garage door pressures and installation and provision for protection of openings (plywood/shutters etc.)

- Inspections must be performed in a sequence so as not to miss any inspections.

- Foundation inspection to ascertain the adequacy of foundations for uplift resistance.
INSPECTION PROCESS AND TDI REQUIREMENTS

Why are Windows and Doors inspections important?

- The basic model assumes completely enclosed buildings, which means all the windows and doors should be able to withstand wind pressure and not allow the wind to come into the structure there by causing uplift forces on the roof and lateral push out on the walls.

- In hurricane prone zones, flying debris can break the glazing and produce openings for wind to enter the house and damage roofs and walls. Therefore, in High debris areas the use of impact resistant windows recommended.

- Garage doors are the single largest opening in the house. If they fail / buckle wind can cause damage to the walls and the roof.
Wind Load Failure Example

Garage door turned inside out!
SIMPSON MUD SILL 18" OC
GARAGE RETURN STHD 14
SOLID STUD CORNER W/ STHD 14
HEADER STRAPPING
PURLIN TO JOIST
SHEAR WALL BLOCKING
COMPONENTS AND CLADDING

- TDI Design Features utilizing New IRC 2018 code
- Cladding: What are components and cladding.
  - Windows, Doors, Siding, Brick, Shingles, Tile etc
- TDI approved components and cladding only?!
- More about this topic from Doug Klopfenstein Sr.

QUESTIONS ?