RE: ASCE-7-10 / 60'+ Building

ASCE 7 – 10 Wind Code Understanding

Coastal Medical Center
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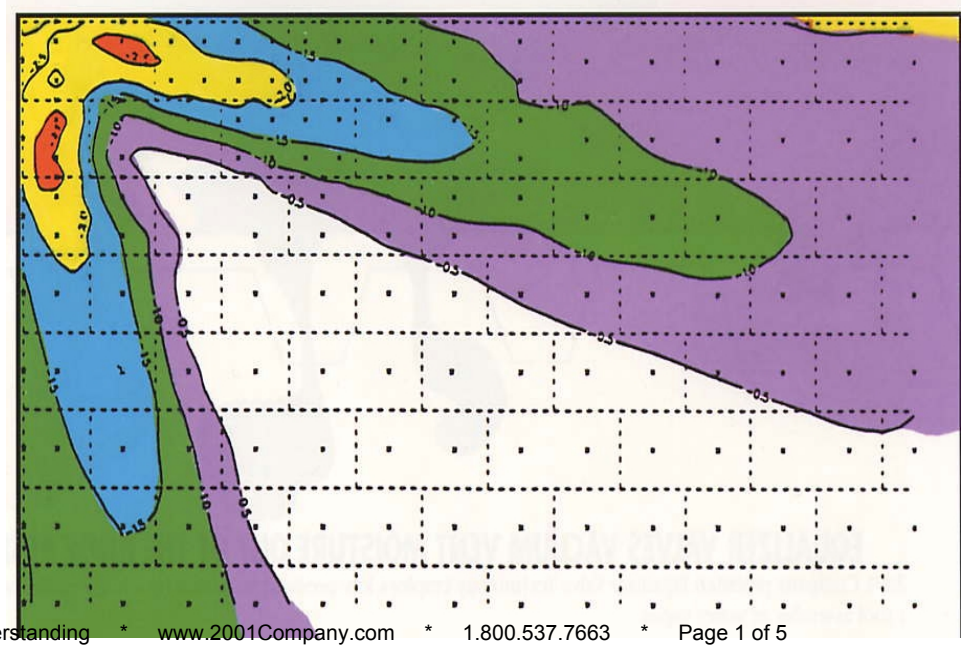
To Whom It May Concern:

There is no test in the roofing industry that blows 110 mph winds at a roof assembly to provide a test result for a 110 mph windstorm resistance. To prove roofing manufacturers' claims to issue 110 mph wind warranty like 2001 Company, the roofing industry has aerodynamic building engineering criteria contained in ASCE 7 – 10 codes for Minimum Design Loads for Buildings and other Structures, which is used as the present wind load design code for the United States. Attached is an evaluation.

To determine wind resistance of a buildings roof, the UBC, Uniform Building Code, and most local building code departments require an engineer to analyze the specific buildings height, shape and 8 other wind factors of the current ASCE 7 – 10, (American Society of American Civil Engineers Division 7 for construction document for roofing and side wall wind engineering requirements).

Another accepted method to meet the building code requirement for wind is to perform a small scale wind tunnel model test of a specific building to analyze the anticipated wind up lift pressures over a roof. Wind tunnel model testing is very expensive for low-sloped flat roofs.
The present United States building code for wind is ASCE 7 – 10 and this engineering protocol calculates a PSF (pounds per square foot) pressure for three regions of a building roof.

This picture is of a Wind Tunnel Graph of Negative wind pressures over a roof on the North West Corner.



First, the corners: Inside and outside corners.
Second, the perimeter: Depending on the height and shape of the building this could be up to 12 feet around the whole building perimeter.

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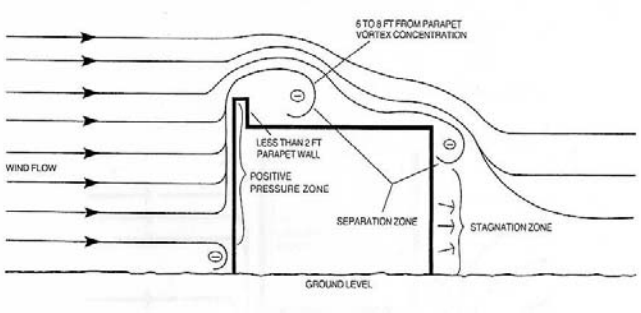
Third, the interior field:
Remaining interior field area.

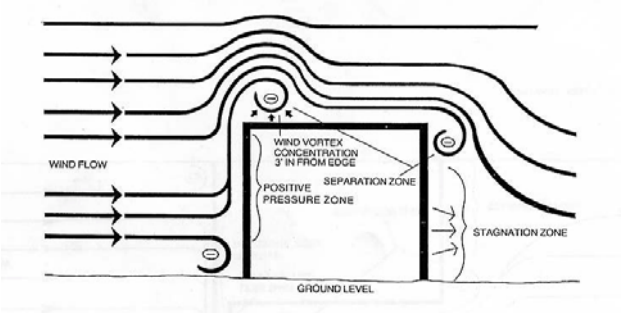
Understanding ASCE 7 – 10

ASCE 7 – 10 means **American Society of Civil Engineers** division 7, on architect's blueprint for roofing and sidewall construction. The 10 means that in the year 1998 the licensed engineers across North America voted to accept these engineering design criteria to calculate expected wind pressures on a building's roof and side wall construction.

The uniform building code across the United States, for designing a building to withstand the anticipated local winds of ASCE 7 – 10, requires an engineering calculation according to ASCE 7 – 10 that will determine vacuum pressures of wind up lift calculated in PSF (pounds per square foot) depending on the following nine parameters which will intensify wind up lift on a building.

To understand wind effects on a building, imagine water in a giant stream flowing around and over your specific building. Wherever wind flows up the side of a building and meets the roof it spills over in a curling wave action. This creates a vortex of intense negative pressure similar to a horizontal tornado.





The following nine parameters increase or decrease the intensity of the wind vortex and total negative psf (pounds per square foot) pressure and are part of an ASCE 7 – 10 calculations.

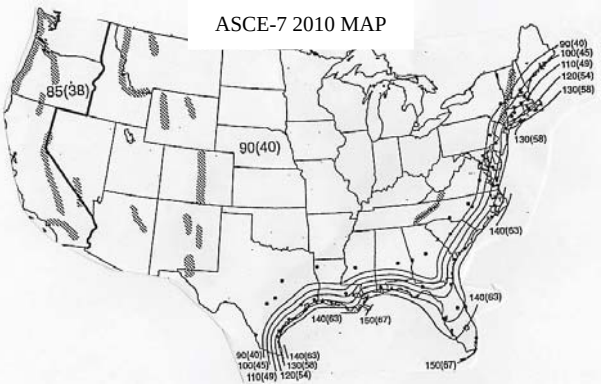
1. **The height of the building**. The higher the building the higher is the wind speed, harder it hits the building, rises up the side, and interacts with the wind flow over the top.

2. **Maximum design wind speed (miles per hour):** The expected wind speed to hit the building over its expected life depends on specific geographical area the building is located. The present 2098 wind code has significantly increased all design wind speeds across North America. ASCE 7 code now uses the highest 3-second gust wind speed at 33 ft reference height instead of a one-minute average wind speed of multi gusts. Note that the design wind speed is higher for buildings higher than 33 ft (reference height for the following ASCE 7 wind map).

The Central United States went from 70 to 90 mph. Costal regions along the hurricane east coast went from 80 – 90 to 120 – 130 miles per hour.

ASCE-7 1987 MAP

ASCE-7 2010 MAP



3. **Local area terrain surrounding the building** interferes with wind flow and influences its impact on a specific building. Following four categories of terrain or exposure are considered.

A. **Inner city**: areas protected by higher buildings.

B. **Suburban:** areas shielded by trees, and other buildings if the building is below the tree line under 30 feet.

C. **Open area:** open field, desert, and large parking lots where wind will flow directly into the building without trees and other buildings breaking up the flow.

D. **Large bodies of water:** that does not break up the flow of wind into the building bays, lakes, large rivers, oceans, and sounds, etc.

4. **Open building:** A 4 foot by 4 foot size hole can be made in the side of a building from flying debris that can break a, door or window etc., causing the building to fill up with air pressure. Consider this building hole like blowing air into a paper bag, this will increase wind up lift pressure under the roof assembly. All buildings should be considered open unless windows and doors are protected from flying debris.

5. **Internally pressurized buildings:** like electronic companies and pharmaceutical companies that keep air impurities out of the building by pressurizing it. This will increase wind up lift pressures on a roof because part of the wind up lift is internal building pressures migrating up into a roof assembly.

6. **Wind spill from adjoining buildings:** is the up-wind of the near by buildings which spill additional wind flow into the concerned building to increase wind pressures on the roof. Buildings built near a canyon or steep mountain can experience wind spill down a canyon wall.

7. **Adjoining higher building intersections and inside corners of a buildings:** have additional wind spillage that increases wind up lift pressures on building of those areas.

8. **Escarpment effect:** is prevalent on buildings sitting on hill side that will cause additional wind rush up or down the hillside. Fisherman knows that fish congregate in a stream behind big rocks and embankments where the water is in a back eddy vortex out of the fast flowing current. Wind pressures are increased depending on wind direction for buildings built on hillsides. The easiest and approximate way to calculate is to add the hill to the height of the building.

9. **Safety factor determination:** Constructing the roof and building structure to resist higher than the actual design minimum of ASCE 7- 10 codes.

First, to protect human life,
Second, to account for initial construction flaws, and workmanship errors during the original construction of the building.
Third, to provide a measure of safety as the building construction materials age and crumble.

Four safety factors are used:

1. **Minus 15%** for **farm** buildings and sheds where live stock is concerned no human life loss. Butler metal buildings for animals.
2. **Plus 0%** for **residential** buildings with few people.
3. **Plus 15%** for **multi-family residential** and **small business** buildings.
4. **Plus 50%** for **commercial** buildings housing a group of people during severe storms [Generally 35 or more people in a school room. FEMA Standard]
5. **Plus 100%** for **shelter buildings**, that will shelter groups of people or provide services in natural emergencies, hurricanes, tornadoes and severe storms.
Buildings used as police stations, medical buildings, 911 call centers, power plants, electric, telephone, essential life support buildings, schools and community centers used as shelters should have this safety factor.

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The United States building design code requires ASCE 7-10, American Society of Civil Engineers, Division 7 wind up lift calculations for roofing and sidewall cladding. The recent wind code changes accepted in 2010 are applicable across North America.

ASCE 7 – 10 Wind Criteria and Evaluation for your Specific Building

1. **Height of building:** ……..……. +60 Feet

2. **Anticipated maximum mph wind velocity:** on ASCE – 7 – 10 wind map ……. 120 mph.

3. **Local area terrain:** Open parking lots and sports fields…….……. D
   A. Inner city. B. Suburbia. C. Open fields. D. Near water.

4. **Open building:** 4' x 4'or larger glass windows or glass sliding doors on floor under roof that could be broken in a wind storm filling the building with internal air pressure…….……..…. Yes

5. **Internally pressurized:** HVAC causing positive interior pressure…….……. Yes

6. **Wind spill from upwind neighboring buildings…**…….…… No

7. **Abutting higher or lower building sections: and inside corners:** …..…….……...… No

8. **Escarpment:–** building built on a hillside ……..…….……. No

9. **Safety factor determination:** 50% ……... Safety factor

Describe Building Use and Safety Factor Needed: Exposure D 60 Feet High

ASCE – 7 Wind design calculations in PSF (pounds per square foot) pressure:

11.) ASCE – 7 –98 – Actual no safety factor:

Safety Factor: 0% Corner: 144 Perimeter: 96 Field: 57

12.) Safety Factor: 50%: Low occupancy 30 people or more:

Safety Factor: 50%: Corner: _____ Perimeter: _____ Field: _____

13.) Safety Factor: 100% High person occupancy Natural Disaster support facility:

Safety Factor: 100% Corner: 288 Perimeter: 192 Field: 114

Exposure D 60 Feet High

ASCE – 7 Wind design calculations in PSF (pounds per square foot) pressure:

14.) ASCE – 7 –98 – Actual no safety factor:

Safety Factor: 0% Corner: 144 **Perimeter:** **96** **Field:** **57**

Safety Factor: 100% Corner: **288** **Perimeter:** **192** **Field:** 114

The roofing industry wind standard **FM – I – 90** is deficient for your building. An FM – I – 90 means Factory Mutual approved for class I fire and 90 pounds per square foot (psf) wind up lift which is less than design uplift pressure requirements as calculated above for even 50% safety factor at 90 mph wind speed.

2001 Company has completed wind up lift testing at IRT (Independent Roof Testing) in Miami Florida for Metro Dade County wind up lift ratings on a concrete deck. The 2001 Company modified bitumen roof assembly on structural concrete roof decks obtained a **960 psf** wind up lift rating. Light weight concrete single ply systems rating is **280 psf**, slow rise adhesive foam single ply system rating **250 psf** and that of concrete decks singly ply systems is **225 psf**.

The 2001 wind uplift vented roof assembly using modified bitumen membrane exceeds the ASCE 7 – 10 wind up lift requirements on your building. Note that the 2001 Company wind up lift rating is **960 psf** on structural concrete decks with modified bitumen membrane.

Therefore, 2001 Company, after analyzing the given wind information on your specific building project within the parameters of ASCE 7 - 10, is satisfied that it can issue a "**Gail Force and Beyond Wind Rider**" up to **110 mph** (required speed by wind code of ASCE 7-10) on the roof of the building analyzed herein.

Yours truly,

Thomas L. Kelly
President