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Wind and Hurricane Preparedness



Introduction

Reducing property loss during severe wind events such as tornadoes, hurricanes, and derechos / thunderstorms starts with preserving the integrity of the building envelope and maintaining an up-to-date emergency plan.

If the windows, roof, glazing, or cladding fails, storm water can enter the structure. Experience shows that once water enters, the risk of substantial property damage and business interruption increases significantly.

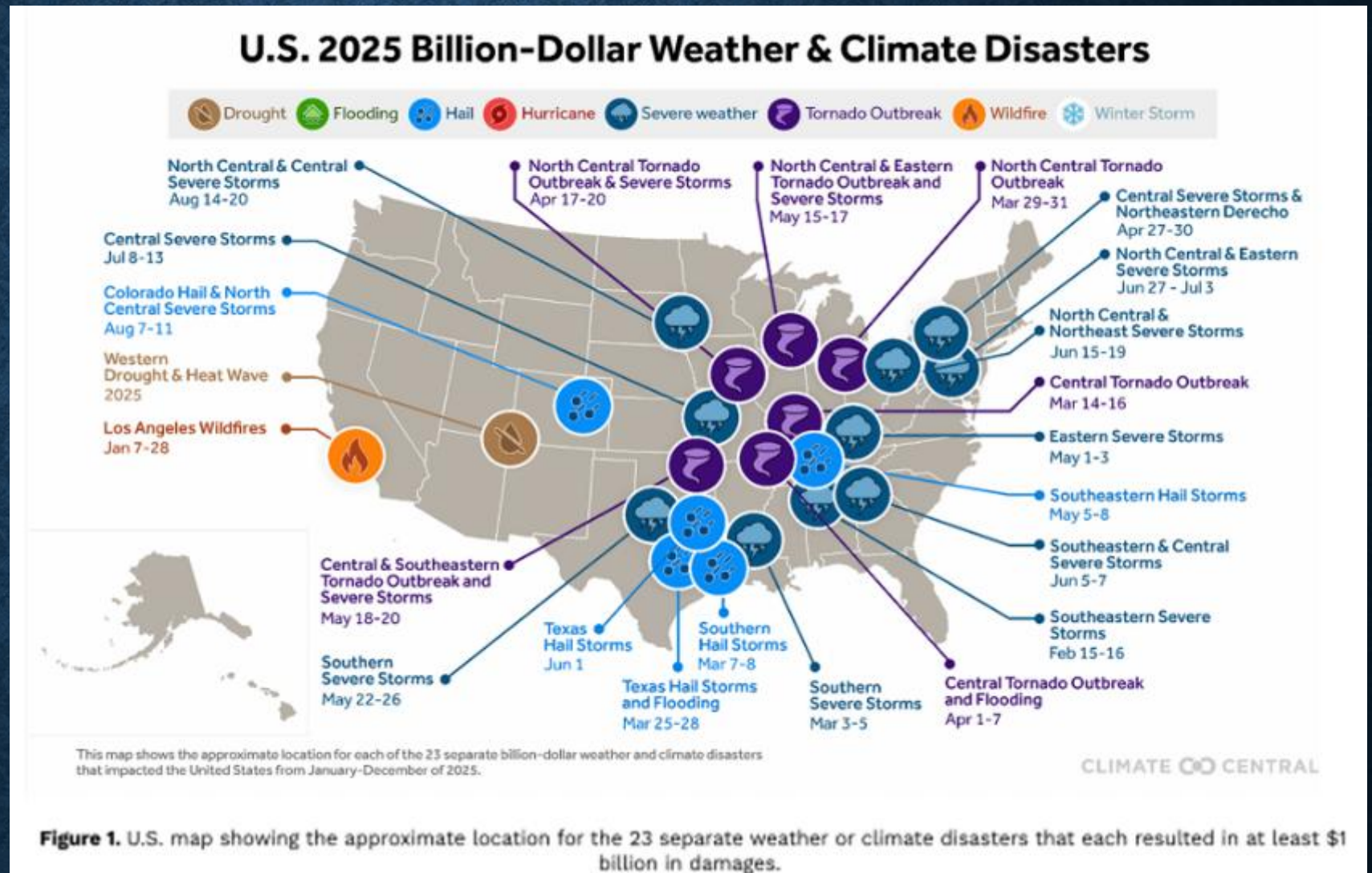


LOSSES

2025, was the third-highest count of billion-dollar disasters since 1980.

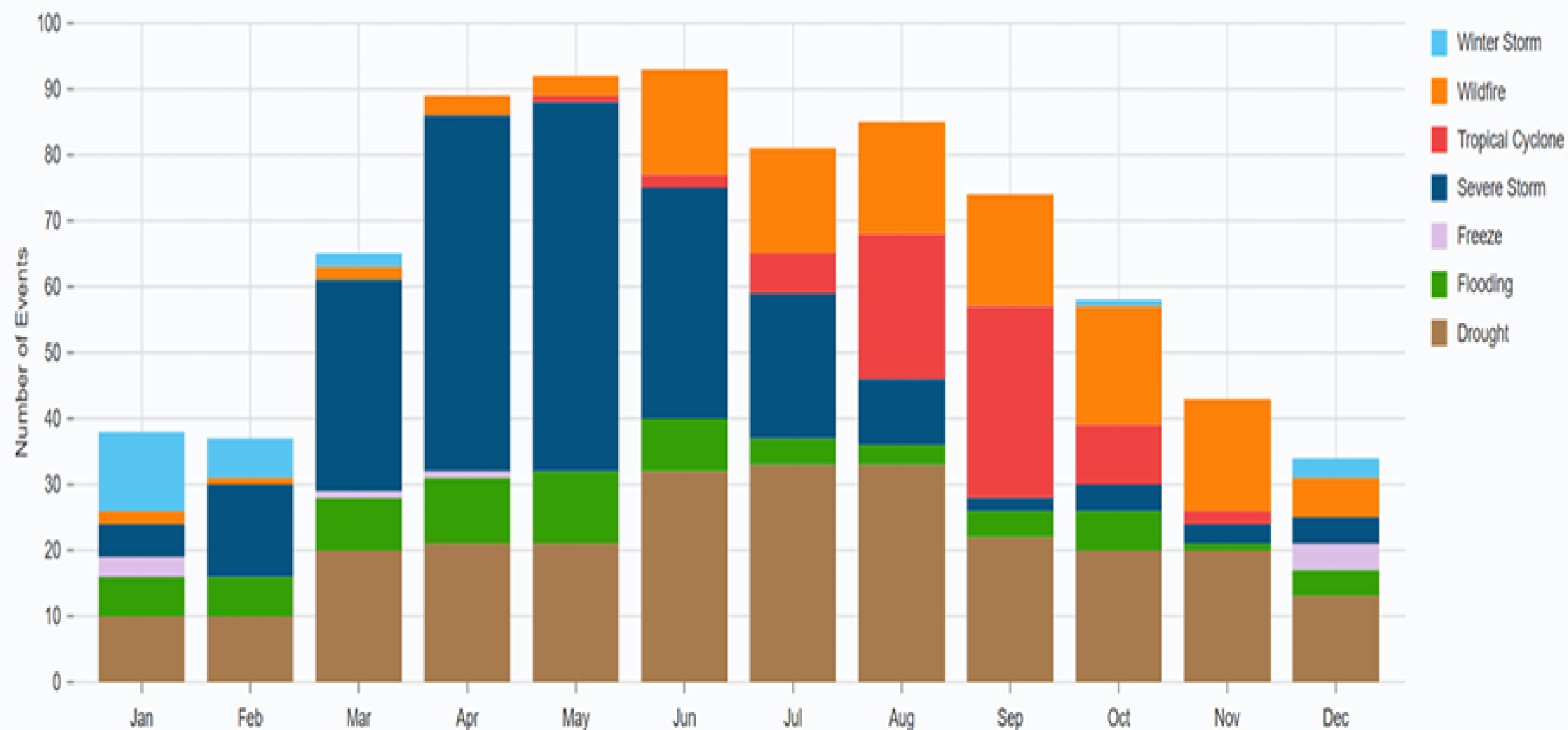
The total, direct cost of the 23 biggest events in 2025 was approximately **\$115.0 billion**, with 276 direct and indirect fatalities.

Severe wind events (including tornadoes, hail, and straight-line winds) in the U.S. exceeded **\$68 billion** in 2025.

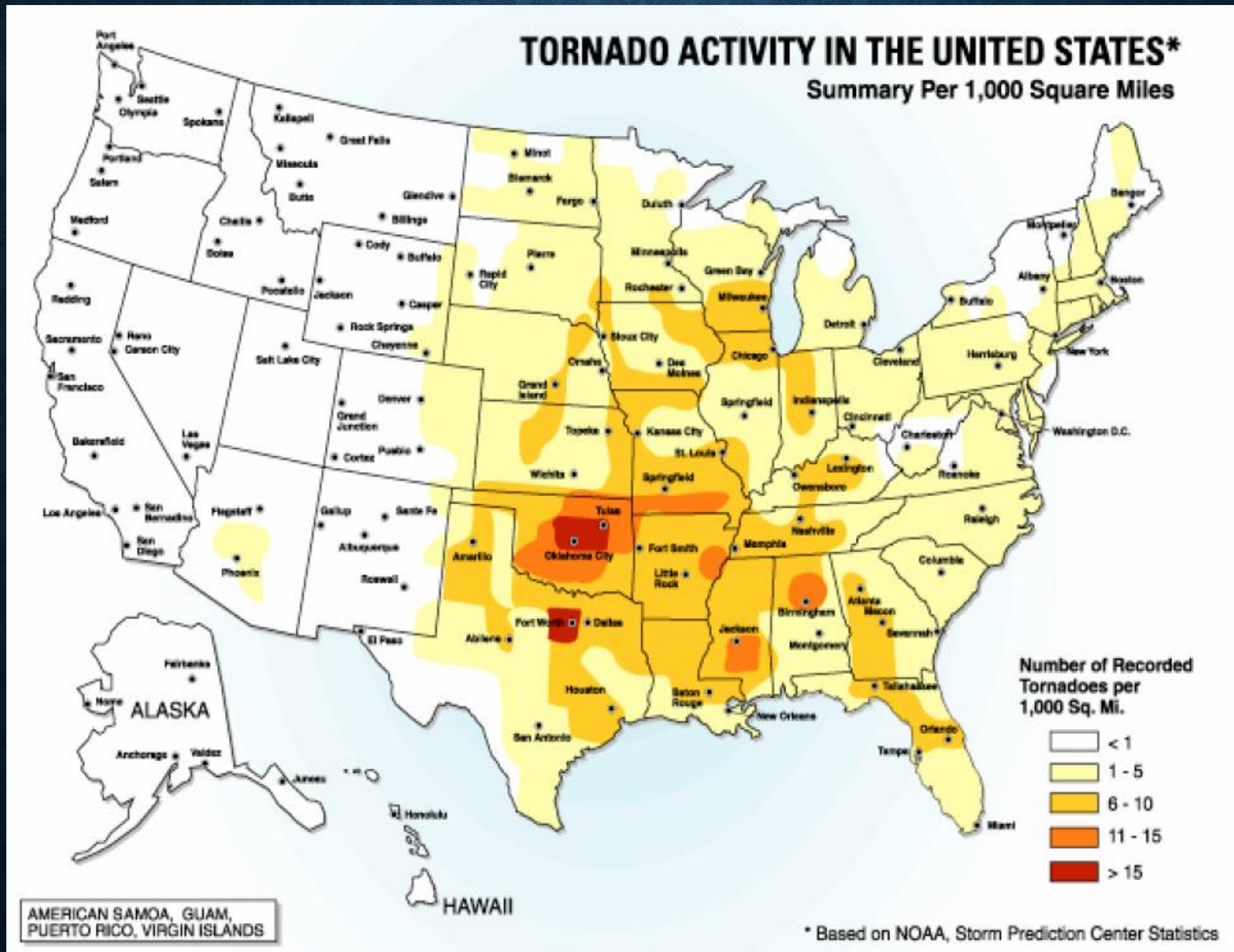


Monthly Climatology of Billion-Dollar Disasters (46 years)

CLIMATE CENTRAL

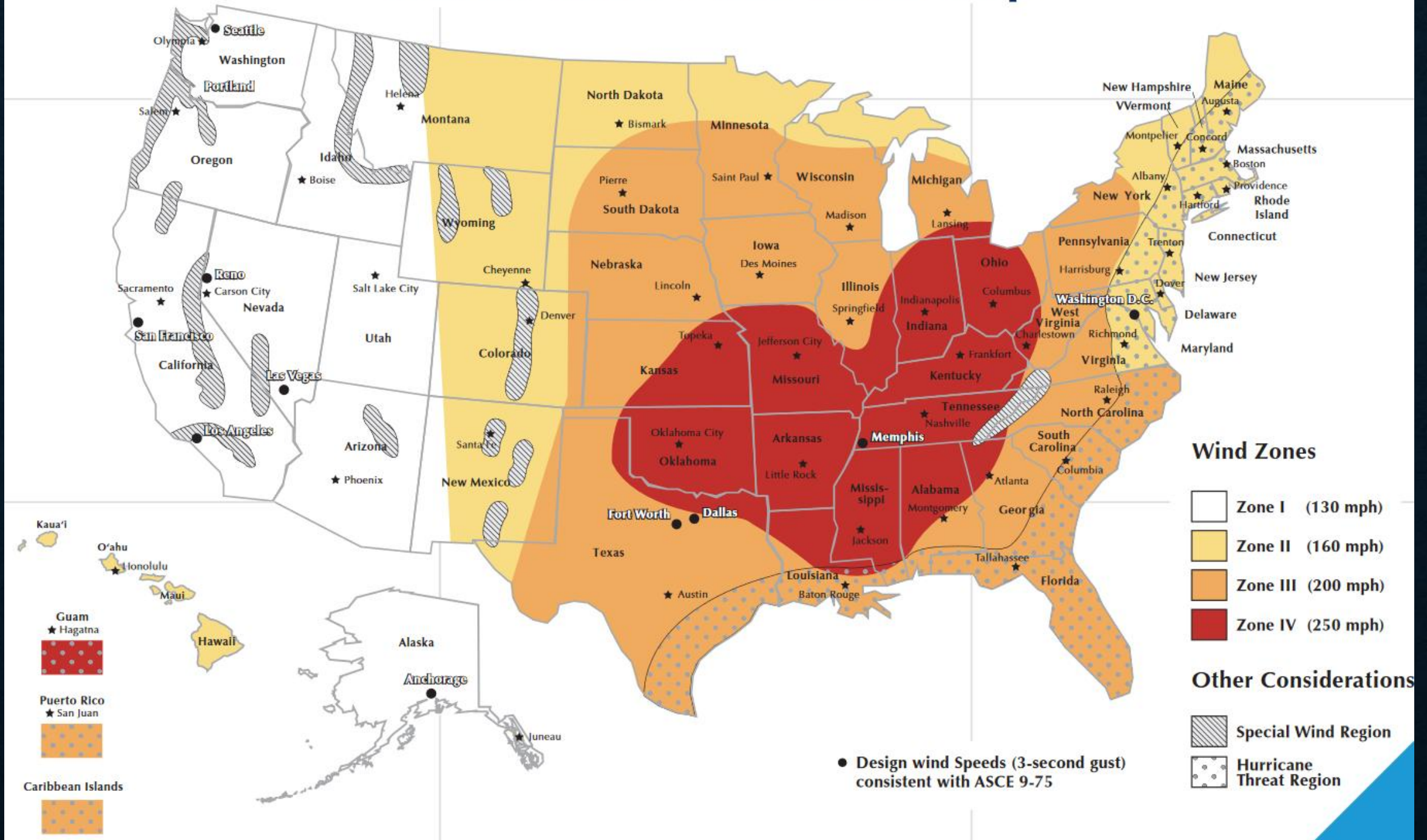


WIND ZONES - TORNADO



WIND ZONES

United States Wind Zones Map



Hurricane-prone Regions And Special Wind Regions



HELENE TRACK HISTORY

SEPTEMBER 2024



Category 4 major hurricane

1-minute sustained (SSHWS/NWS)

Highest winds 140 mph (220 km/h)

Lowest pressure 939 mbar (hPa); 27.73 inHg

Overall effects

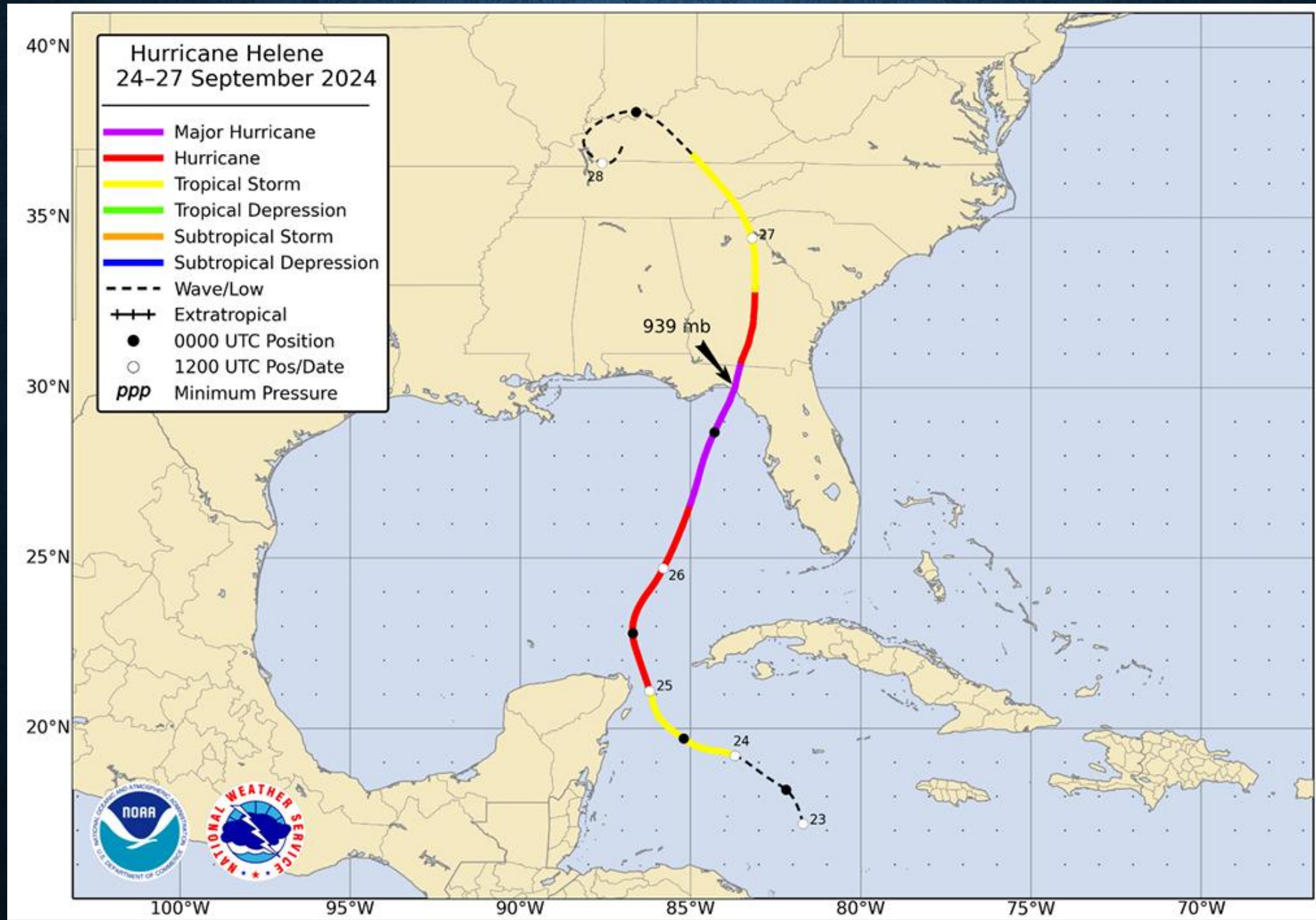
Fatalities 252 total

Injuries ≥117

Missing 4

Damage \$78.7 billion (2024 USD)

HELENE TRACK HISTORY



OTHER HURRICANE PATHS

8 MAJOR HURRICANES IN 7 YEARS



Hurricane Laura
Thursday August 27, 2020
1 AM CDT Intermediate Advisory 29A
NWS National Hurricane Center

Current information: x
Center location 29.8 N 93.3 W
Maximum sustained wind 150 mph
Movement N at 15 mph



MAX DEFENDER 8 HURRICANE IDA

ADVISORY	LOCATION	MOVEMENT	MAX WINDS	PRESSURE
11:00 PM	27.2°N 88.0°W	NW at 16	105 mph	964 mb

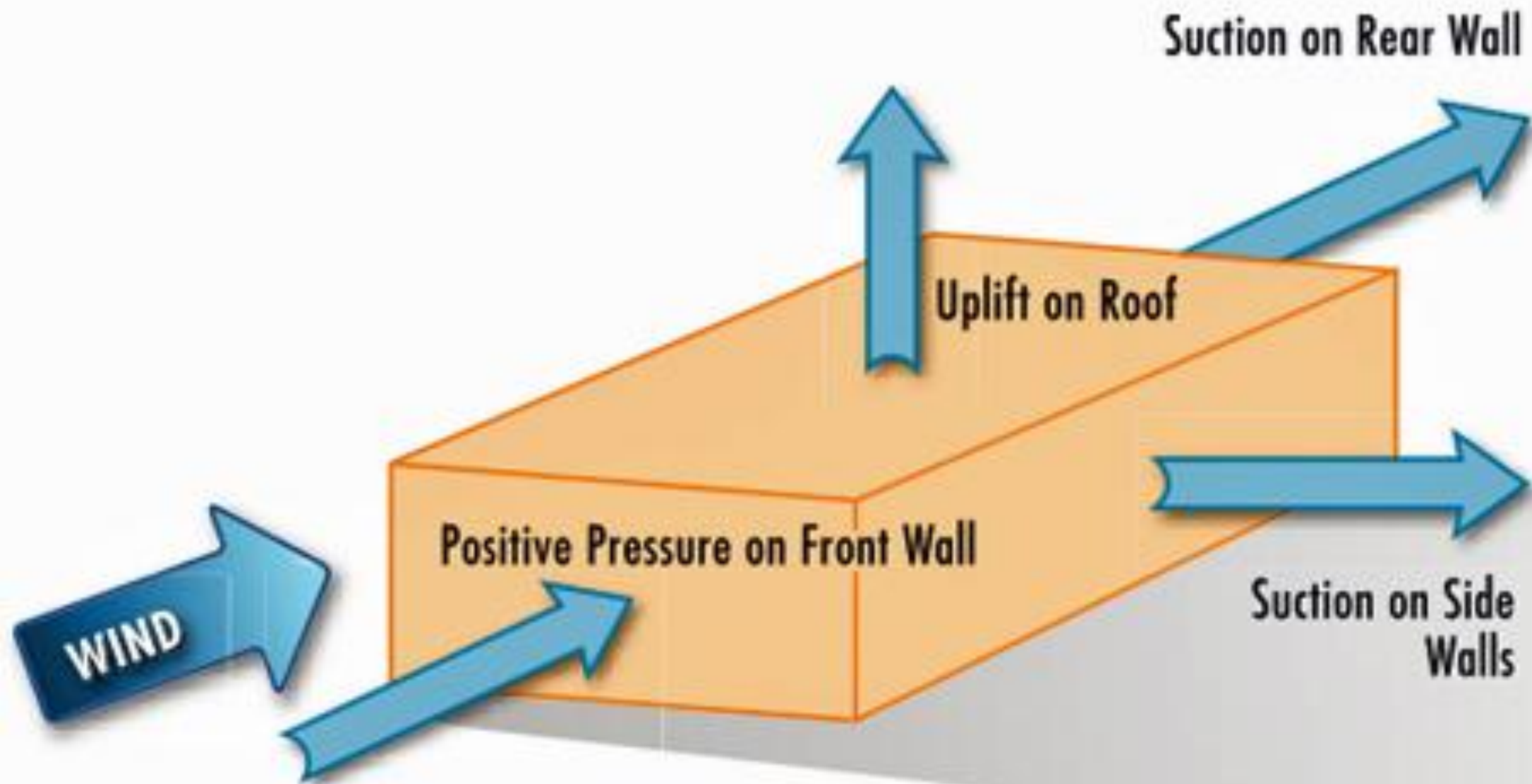
TUE 8:00 AM 30 MPH	MON 8:00 PM 35 MPH	MON 8:00 AM 50 MPH	SUN 8:00 PM 100 MPH	SUN 8:00 AM 130 MPH
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Vulnerability: What Wind Can Do To Buildings

- Roof covering damage (including rooftop mechanical, electrical, and communications equipment)
- Exterior wall coverings and soffits
- Structural damage (e.g., roof deck blow-off, blow-off or collapse of the roof structure, collapse of exterior bearing walls, or collapse of the entire building or major portions thereof)



Schematic Of Wind-induced Pressures On A Building



Evaluating Buildings For Risk From High Winds

STEP 1:

Determine the basic wind speed. As the basic wind speed increases beyond 90 mph, the risk of damage increases, and it continues to increase as the speed increases. To compensate for the increased risk of damage, design, construction and maintenance enhancements are recommended.

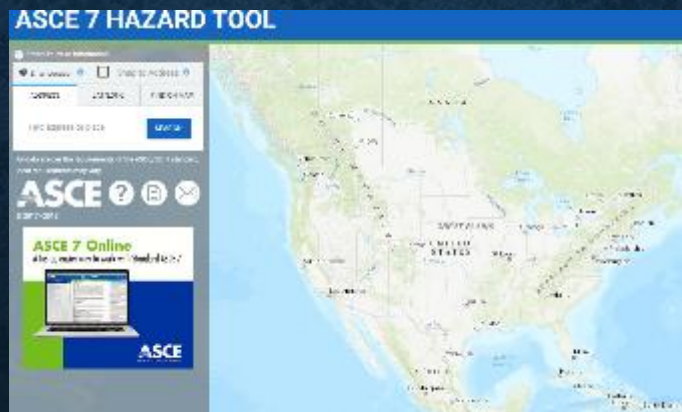
<https://asce7hazardtool.online/>

STEP 2:

For buildings not located in hurricane-prone regions, determine if the building will be used for emergency response after a storm (e.g., temporary housing, food or clothing distribution, or a place where people can fill out forms for assistance).

STEP 3:

For buildings in wind / hurricane-prone regions, determine if the building will be used for a hurricane shelter and/or for emergency response after a storm.



WHAT TO DO:

1. Ensure a robust wind emergency plan is in place for Pre and Post events

2. Existing rooftop equipment:

It is recommended that the building owner perform routine maintenance.

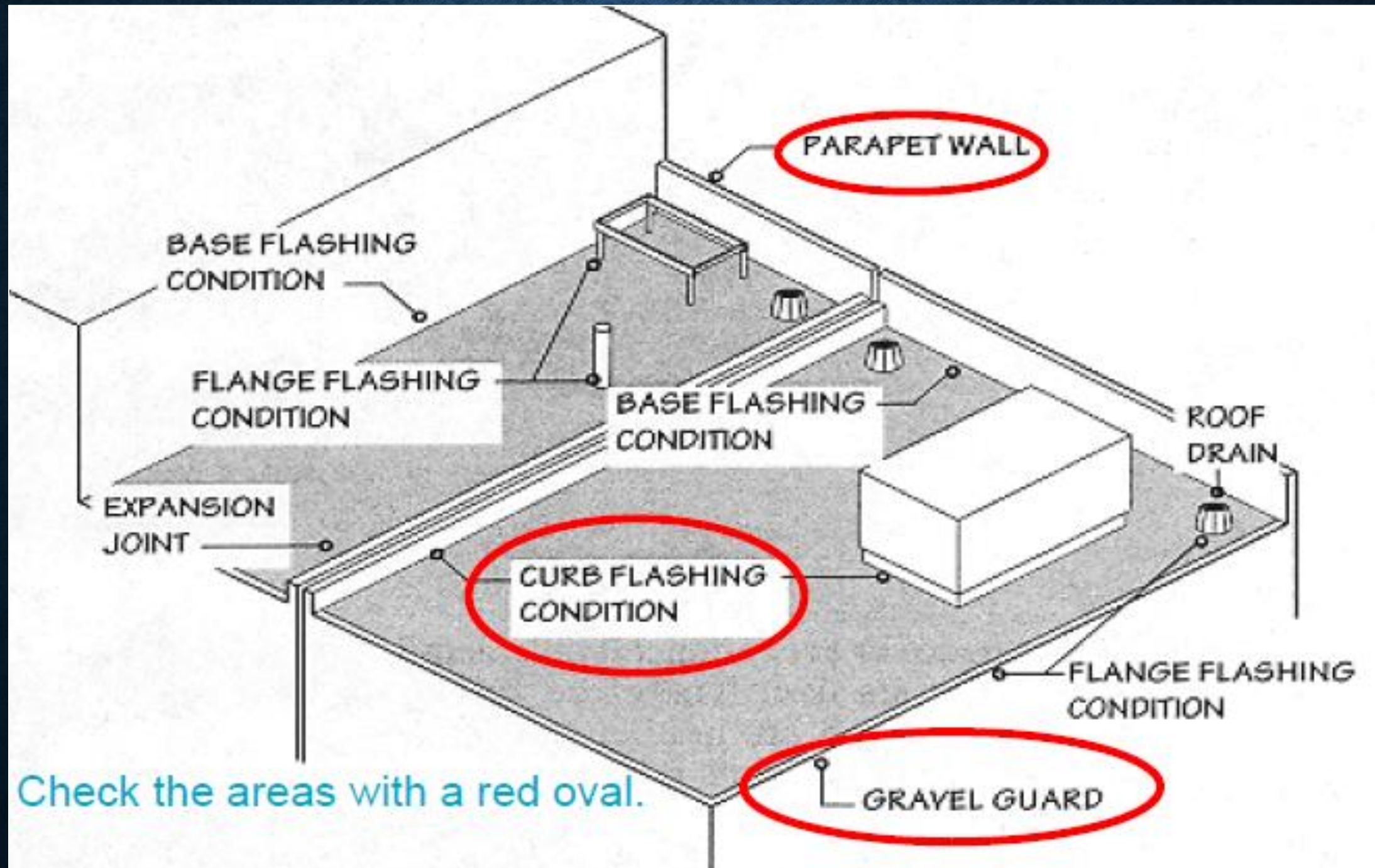
3. Preparations prior to wind or hurricane event:

- ☐ Remove debris from roof drains, scuppers, and gutters.
- ☐ Remove loose objects (such as buckets, lumber, and sheet metal) from the roof.
- ☐ Install 3-inch wide (minimum) truck cargo straps around heating, ventilation, and air conditioning (HVAC) units
- ☐ Check attachment of all rooftop equipment to its curbs or other mountings and add anchors if the existing attachment is inadequate.

4. After a high-wind event:

Post-event assessments of buildings should be done to determine any damages to rooftop equipment.

ROOF COVER



HIGH WINDS - ROUTINE MAINTENANCE

- Check equipment for rust on metal panels, screws, and metal flashing on curbs.
- Inspect equipment's connection to the curb it sits on. Look for visible signs of curb leaks; these can be repaired using readily available roof sealant and caulk. If a water leak is suspected, check curbing for rot, and replace if needed.
- Pull on all cables and straps to verify they are tightly secured; there should be little to no slack. Check manufacturer guidelines for more specific information.
- After all inspections and repairs are complete, re-inspect equipment to make sure all screws, cables and straps are tightened and back in place.



Example of large equipment with non-engineered connection

WHAT TO DO ABOUT EQUIPMENT



Number Of #12 Screws For Base Case Attachment Of Rooftop Equipment, From FEMA P-424 Table 6.1

To anchor fans, small HVAC units, and relief air hoods, the following minimum attachment schedule is recommended

Case No.	Curb Size and Equipment Type	Equipment Attachment	Fastener Factor for Each Side of Curb or Flange
1	12 in. x 12 in. Curb with Gooseneck Relief Air Hood	Hood Screwed to Curb	1.6
2	12 in. x 12 in. Gooseneck Relief Air Hood with Flange	Flange Screwed to 22 Gauge Steel Roof Deck	2.8
3	12 in. x 12 in. Gooseneck Relief Air Hood with Flange	Flange Screwed to $15/32$ in. Gauge Steel Roof Deck	2.9
4	24 in. x 24 in. Curb with Gooseneck Relief Air Hood	Hood Screwed to Curb	4.6
5	24 in. x 24 in. Gooseneck Relief Air Hood with Flange	Flange Screwed to 22 Gauge Steel Roof Deck	8.1
6	24 in. x 24 in. Gooseneck Relief Air Hood with Flange	Flange Screwed to $15/32$ in. OSB Roof Deck	8.2
7	24 in. x 24 in. Curb with Exhaust Fan	Fan Screwed to Curb	2.5
8	36 in. x 36 in. Curb with Exhaust Fan	Fan Screwed to Curb	3.3
9	5 ft. 9 in. x 3 ft. 8 in. Curb with 2 ft. 8 in. High HVAC Unit	HVAC Unit Screwed to Curb	4.5*
10	5 ft. 9 in. x 3 ft. 8 in. Curb with 2 ft. 8 in. High Relief Air Hood	Hood Screwed to Curb	35.6*

FAN COWLING ATTACHMENT

Fans are frequently blown off their curbs because they are poorly attached. Unless the fan manufacturer specifically engineered the cowl attachment to resist the design wind load, cable tie-downs are recommended to avoid cowl blow-off. For fan cowlings less than 4 feet in diameter, 1/8-inch diameter stainless steel cables are recommended. Two cables are recommended for areas with less than 120 mph wind speed; four cables for regions with 120+ mph winds. Larger cowlings should use 3/16-inch cables.



DUCTWORK

To avoid wind and windborne debris damage to rooftop ductwork, it is recommended that ductwork not be installed on the roof. If ductwork is installed on the roof, it is recommended that the gauge of the ducts and their attachment be sufficient to resist the design wind loads.



Inadequate securement

Source – FEMA



Adequate securement

Source - FEMA



CONDENSERS

In lieu of placing rooftop-mounted condensers on wood sleepers resting on the roof, it is recommended that condensers be anchored to equipment stands. (Note: the attachment of the stand to the roof deck also needs to be designed to resist the design loads.) In addition to anchoring the base of the condenser to the stand, two metal straps with two side-by-side #14 screws or bolts at each strap end are recommended .



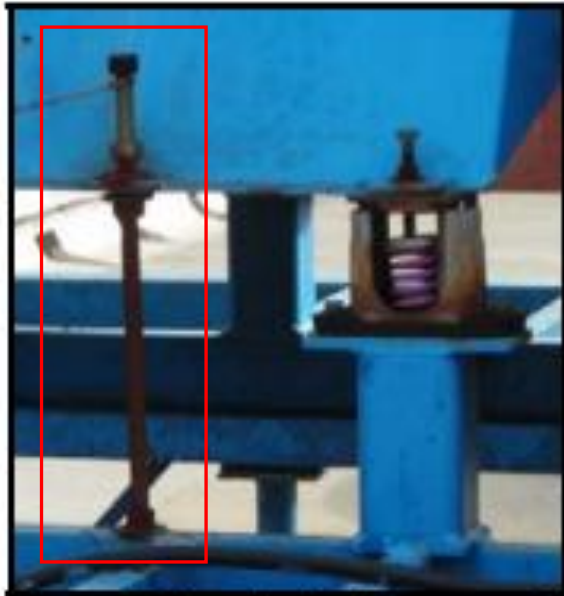
This condenser has supplemental securement straps (see arrows). Two side-by-side screws with the proper edge and end distances are recommended at the end of the strap



This condenser is bolted to the curb (blue arrows), and has tie-down cables (red arrows).

VIBRATION ISOLATORS

When equipment is mounted on vibration isolators, an isolator that has sufficient resistance to meet the design uplift loads should be specified and installed, or an alternative means to accommodate uplift resistance should be provided



Vibration isolator with threaded rod for upward travel limit



After a storm the equipment on this stand was resting on vibration isolators that provided lateral resistance but no uplift resistance (above). A damaged vibration isolator is shown in the inset (left)



ACCESS PANEL ATTACHMENT

Access panels frequently blow off. To minimize blow-off of access panels, job-site modification will typically be necessary (for example, the attachment of hasps and locking devices such as a lock or carabiner). The modification details will need to be tailored for the equipment, which may necessitate detail design after the equipment has been delivered to the job site. Modification details should be approved by the equipment manufacturer.

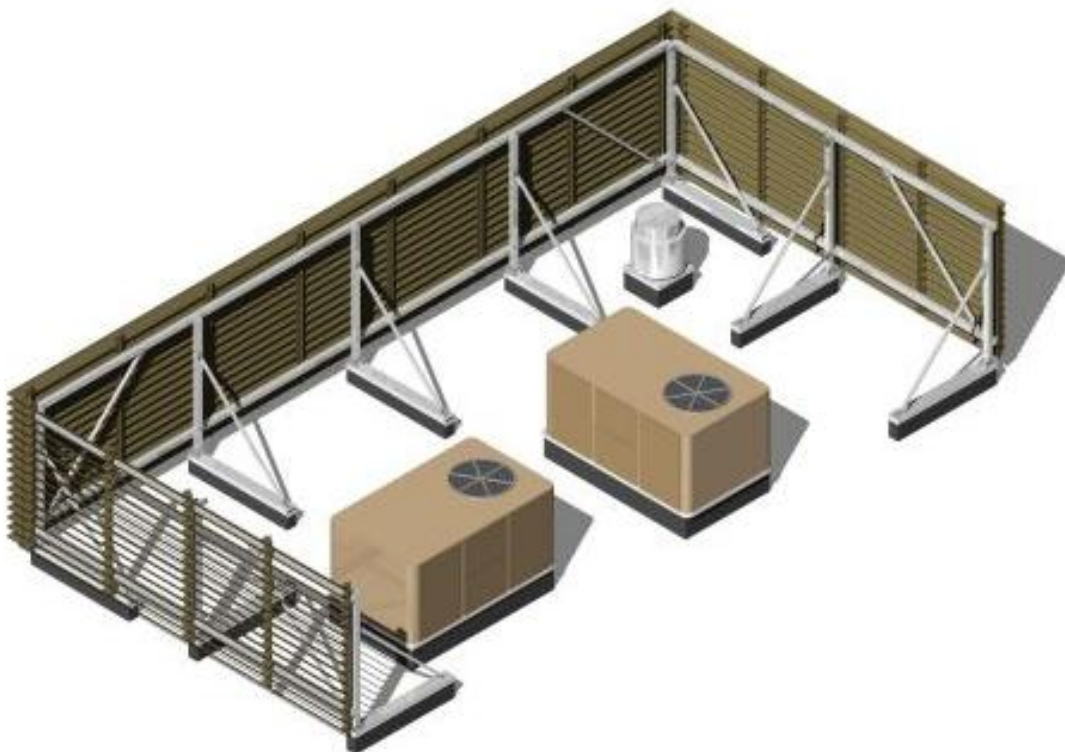


EQUIPMENT SCREENS

Equipment screens around rooftop equipment are frequently blown away. Equipment screens should be designed to resist the wind loads derived from ASCE 7.

Note: The extent that screens may reduce or increase wind loads on equipment is unknown. Therefore, the equipment behind screens should be designed to resist the loads previously noted.

Prefab Structural Framing System



RESOURCES

FEMA. Design Guide for Improving Hospital Safety in Earthquakes, Floods, and High Winds. FEMA 577.

<https://www.fema.gov/library/viewRecord.do?id=2739>

FEMA. Design Guide for Improving Critical Facility Safety from Flooding and High Winds. FEMA 543.

<https://www.fema.gov/library/viewRecord.do?id=2441>

[USVI-RA2 Attachment of Rooftop Equipment in High-Wind Regions](#)

Marsh Tornado Emergency Response Checklist

Before a Tornado Event

- Know the designated shelter area(s) for your office
- Review the building evacuation and shelter map
- Keep emergency contact information current
- Confirm staff know who the office lead and floor wardens are
- Participate in tornado safety drills
- Ensure emergency supplies are available:
 - Flashlight
 - First-aid kit
 - Water
 - Emergency contact list
 - Battery-powered radio or alert device

When a Tornado Warning Is Issued

- Stop work immediately
- Notify nearby employees and visitors
- Follow instructions from building management, security, or Marsh leadership
- Move quickly to the designated shelter area
- Assist visitors and anyone who needs help
- Do not use elevators
- Avoid windows, glass doors, and exterior walls
- Go to an interior room or hallway on the lowest possible floor
- Protect your head and neck with your arms, coat, or bag
- Remain in shelter until an all-clear is given

During the Event

- Stay calm and remain in the shelter area
- Keep away from windows and large open spaces
- Listen for updates from building management or emergency officials
- Account for team members if safe to do so
- Report injuries or missing persons immediately

After the Tornado

- Wait for the official all-clear before leaving shelter
- Check for injuries
- Report damaged property, broken glass, and hazards
- Avoid downed power lines and unstable structures
- Notify facilities, IT, and leadership of any issues
- Document the incident and any follow-up actions needed
- Confirm all employees and visitors are safe



Any questions or queries contact

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