CRA
COLORADO
ROOFING ASSOCIATION

# Wind, Cracks and Condensation Issues

**Webinar | June 18, 2020**

**Starts Promptly at 2:00 p.m. MST**

## Video Conference Courtesies:

- Thank you for being on-time.
- PLEASE STAY MUTED!
- Use the Q&A at the bottom your screen to send your questions to Debbie. She can then relay them to me.
- Due to the number of participants, we may not get to all the questions, but we will try.
- In order to earn CIUs, you will be required to answer a final poll question at the end of today's presentation.

## Wind, Cracks and Condensation

- Originally presented in 2013
- Presented by Richard Boon, P.E.
  - 40 years in roofing
  - Former Director: The Roofing Industry Educational institute
  - Walked almost 200 million sq. ft. of roofing in career
  - Umpire for roofing-related disputes over $1 million

## Current Issues Facing Colorado Roofing Contractors

- Wind has been the big change for Chapters 15 and 16 recently.
- This past February we saw some temperature extremes and created condensation problems where there had not been problems before.

## The Green Codes

- See Energycodes.gov


## Residential

## Changes to the Building Code

- Changes from the 2006 to the 2009 and so forth to 2018
  - Drainage started referring to the Plumbing Code
  - The beginning of the high wind attachment
    - Added requirement to meet D7158

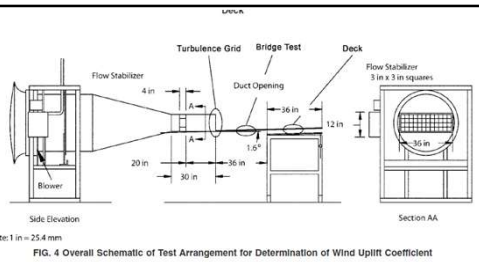



**FIG. 4 Overall Schematic of Test Arrangement for Determination of Wind Uplift Coefficient**

**4. Types and Classes of Shingles**

4.1 Shingles are classified based on their resistance to wind velocities determined from measured data (Section 11), calculations of uplift force (Section 12), and interpretation of results (Section 13), as follows:

4.1.1 *Class D*—Passed at basic wind speeds up to and including 145 km/h [90 mph].

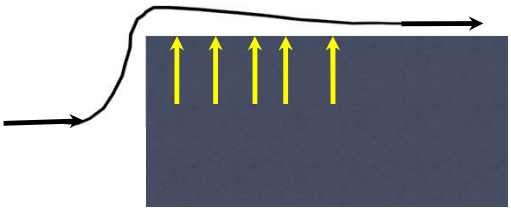
4.1.2 *Class G*—Passed at basic wind speeds up to and including 193 km/h [120 mph].

4.1.3 *Class H*—Passed at basic wind speeds up to and including 242 km/h [150 mph].

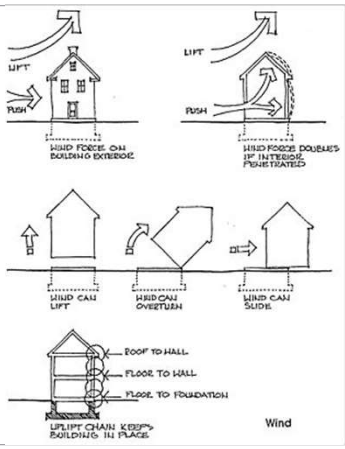
## Wind Effects: What is the wind velocity?

- There are two values for wind.
- They are equal, but have different designations
- Ultimate Velocity
- Design Velocity
- Design Velocity =Ultimate velocity x 0.775
- YOU MUST REPORT Ultimate, but use Design velocity

## Wind moving across the top of a building reduces the vertical pressure



## Ways the wind acts on Buildings



# Design vs Ultimate

TABLE 1609.3.1
WIND SPEED CONVERSIONS[a, b, c]

| $V$ | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $V_{asd}$ | 78 | 85 | 93 | 101 | 108 | 116 | 124 | 132 | 139 | 147 | 155 |

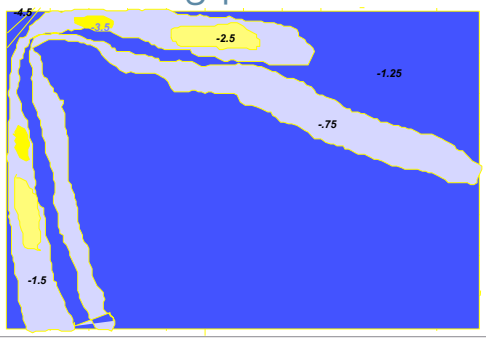
For SI: 1 mile per hour = 0.44 m/s.

a. Linear interpolation is permitted.
b. $V_{asd}$ = allowable stress design wind speed applicable to methods specified in Exceptions 1 through 5 of Section 1609.1.1.
c. $V$ = basic design wind speeds determined from Figures 1609.3(1) through 1609.3(8).

# Modifiers to uplift

- Other things such as buildings that are similar in height and near the subject building
- The height of the building
- The direction the wind strikes the building
- In the newest version elevation has a reducing affect on the wind

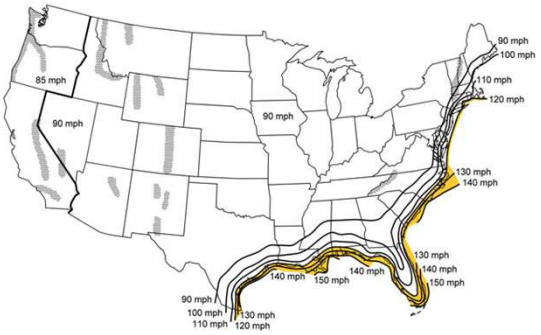
# Faster wind in corners and along perimeter



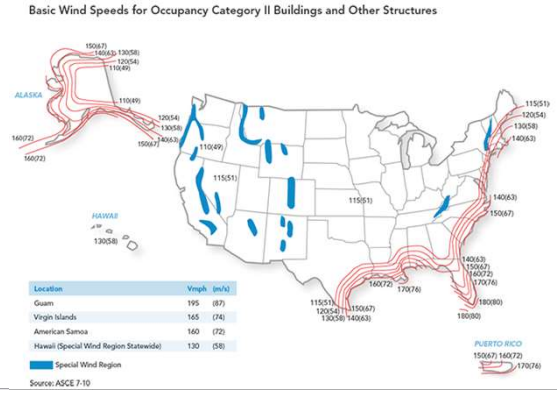
## How Do We Calculate the Uplift?

- $q=0.00256 K_z K_{zt} K_d V^2 \partial$
- Where: $K_z$=a Pressure coefficient that varies with Exposure and Height
- $K_{zt}$ =Topographical factor if the building is on a ridge or cliff
- $K_d$= Directionality factor=0.85
- $V^2$ = The DESIGN velocity squared
- $\partial$=Air Density For the Denver area the value is 0.85

## ASCE7-05 Wind Speed map




## What is different between ASCE7-05 and -10



## 30-foot tall building
## 115 mph wind
## Exposure C

- $q=0.00256 K_z K_{zt} K_d V^2 \partial$
- Where: $K_z$=a Pressure coefficient that varies with Exposure and Height =0.85
- $K_{zt}$ =Topographical factor if the building is on a ridge or cliff =1.0
- $K_d$= Directionality factor=0.85
- $V^2$ = The design velocity squared
- $\partial$= Density 0.85

## Chapter 30 ASCE7

- The values can be taken from a table and just multiply by a factor based on the height and exposure of the building.
- $p_{net}=\partial K_{zt} p_{net30}$
- $p_{net30}$ =-23.8 for the field
- $\partial$=1.4 for a 30 ft tall roof Exposure C
- $K_{zt}$ =1.0 for a flat area

## Comparing Results

- ASCE7-05
- Field: -33.35 psf
- Perimeter: -55.97
- Corner: -84.24

- ASCE7-10
- Field: -33.32
- Perimeter: -55.86
- Corner: -84.14

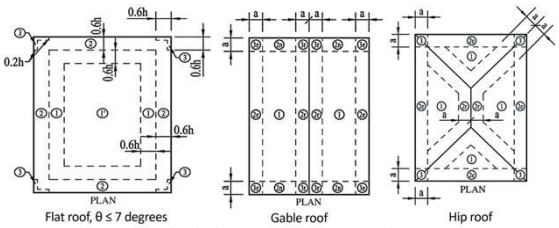
BUT THE WIND VELOCITY WENT UP TO 115 MPH FROM 90 MPH

## Add Density to the mix

- ASCE7-10
- Field: -33.32 psf
- Perimeter: -55.86
- Corner: -84.14
- ASCE7-16
- Field: -28.32
- Perimeter: -47.48
- Corner: -71.52

THE AIR DENSITY MAKES A BIG DIFFERENCE ON UPLIFT

## ASCE7-16




LOTS OF LITTLE LETTERS
CONSIDER USING THE HIGHER DENSITY PATTERN OVER A LARGE AREA TO SIMPLIFY THE TASK ON THE ROOF.

FASTENERS ARE STILL PRETTY CHEAP

## What about Ballasted Systems?

› *Table 1504.8 for maximum height for ballasted roofs*

| *Ultimate Wind Speed* | *110* | *117* | *123* | *130* | *136* | *143* | *149* | *156* | *>156* |
|---|---|---|---|---|---|---|---|---|---|
| *Design Wind Speed* | *85* | *90* | *95* | *100* | *105* | *110* | *115* | *120* | *>120* |
| *B* | *170* | *110* | *75* | *55* | *40* | *30* | *20* | *15* | *NP* |
| *C* | *60* | *35* | *20* | *15* | *NP* | *NP* | *NP* | *NP* | *NP* |
| *D* | *30* | *15* | *NP* | *NP* | *NP* | *NP* | *NP* | *NP* | *NP* |

## Fastener position and count is important



## Overdrive?

## Overdriven nails don't hold

## The Code Official says the wind requirement is 155 mph.

Which of these is most likely true:

1. The roof will blow-off
2. The velocity is the ultimate not the design
3. Only a heavy ballasted system can be used

## House Movement

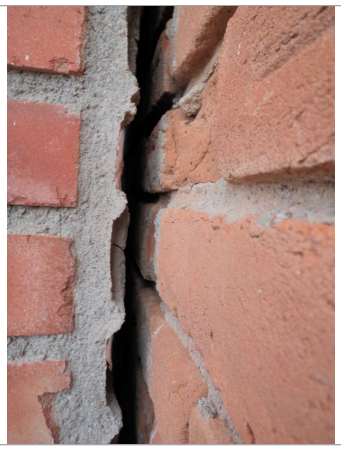
- All house do it
- Some more than others

## Denver has seen an increase in number and severity of hail storms

- Lots of new roofs.
- More tile
- Heavy Weight shingles
- People think “roof” if they look up and.....

## See a Crack. It must be the roof!

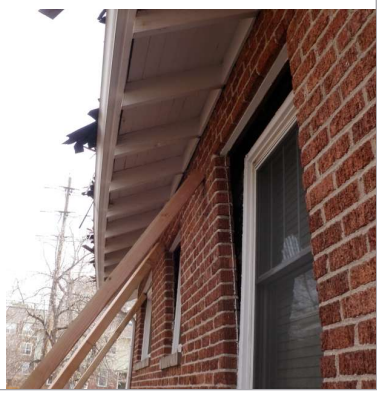
## Houses are moving!



## When you get a complaint:

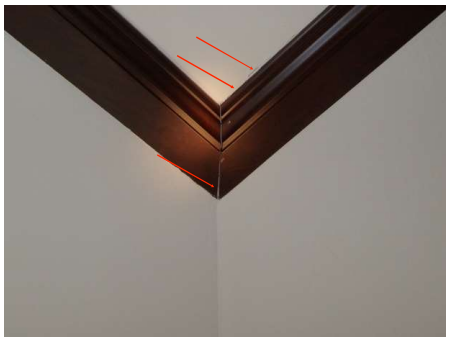
- Always check it out.  It could be a problem!
- Let the homeowner show you all the problems they are seeing
- Make sure the “crack” isn’t a cobweb or something else.
- First floor cracks are rarely roofing related in a two story house.
- Different materials move differently so interfaces will develop cracks over time.

## Could be a real problem



## First floor problems not usually roofing related

## Long wood sections and drywall always have cracks at the interface



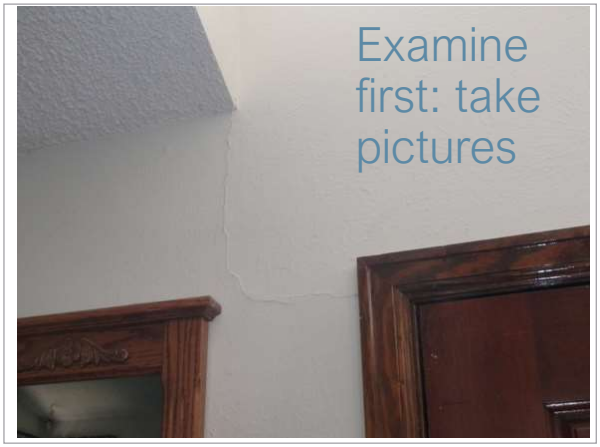
## Common causes of roofing related cracks

- Tear-off vibration
- Loading of the roof
  - Keep it uniform and avoid concentrated loads
- Installation of the roof
- Change in weight over first 6-8 weeks

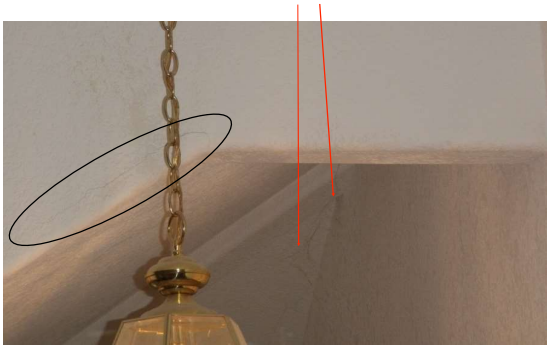
## How to protect yourself

- Examine the house for cracks before you start
  - Take pictures
- Note in your contracts that small cracks is a hazard of the reroofing process.
- Get to know a drywall/paint contractor just in case

## Examine first: take pictures



## Note the cobwebs



Big crack, But the trusses are only bearing on the outside walls!

See how the crack turns, that is because this is house movement

Document obvious house movements

## Inside the house

The little arrows indicate that this not truly level


## Hello Mr. Roofer: I have a crack in my house.

- You should:
  1. Verify it is one of your customers
  2. Tell them not to worry and hang-up
  3. Compare the description of the crack with the photos you took before you started to see if it was pre-existing.

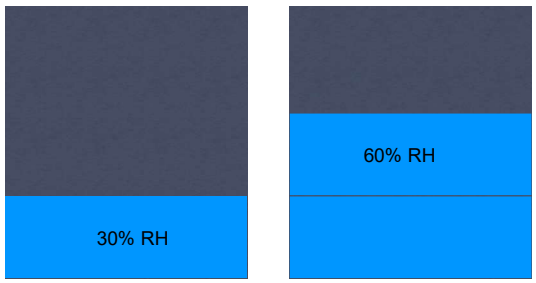
## Condensation

Terminology and Background
Physical Evidence
What can you do about it

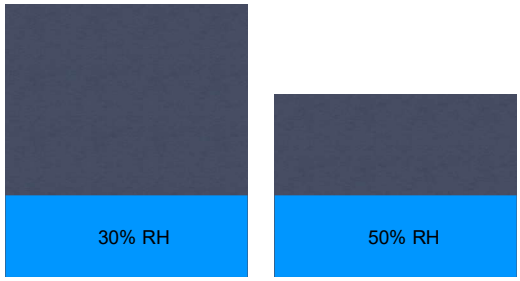
## Condensation:Terminology

- Humidity: Water Vapor in air
  - Absolute: the amount of humidity in the air in grains per pound
  - Relative: the amount of humidity in the air relative to how much the water can hold
- Dew Point: The temperature at which water begins to condense

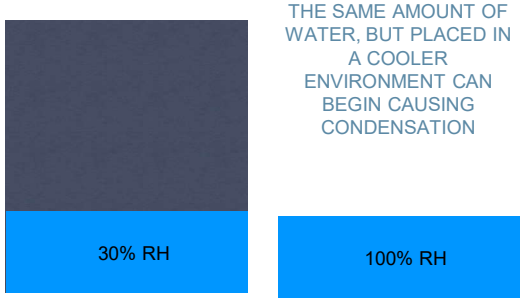
## Relative Humidity




## Lower Temperature Same Water: Higher RH



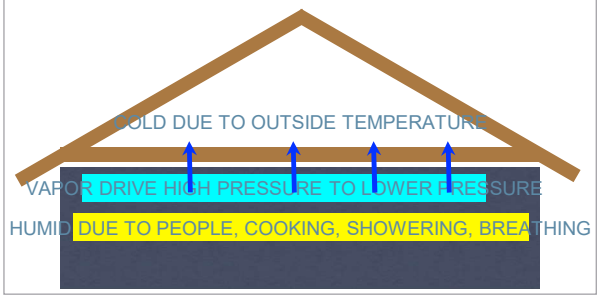
## Dew Point: the temperature when condensation begins.




THE SAME AMOUNT OF WATER, BUT PLACED IN A COOLER ENVIRONMENT CAN BEGIN CAUSING CONDENSATION

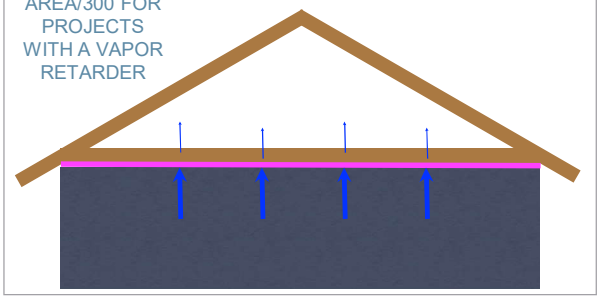


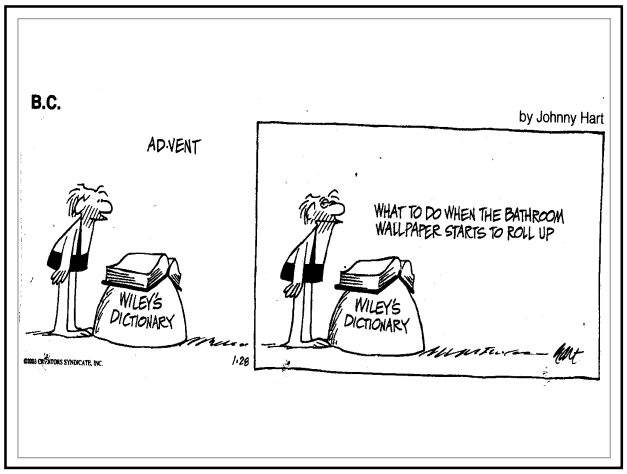

## Its all about controlling the location of the water vapor




## Vapor Retarder: Placed on the "warm" side to slow vapor movement

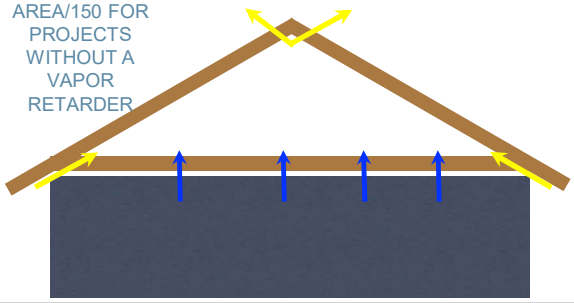
THE CODE ALLOWS AREA/300 FOR PROJECTS WITH A VAPOR RETARDER





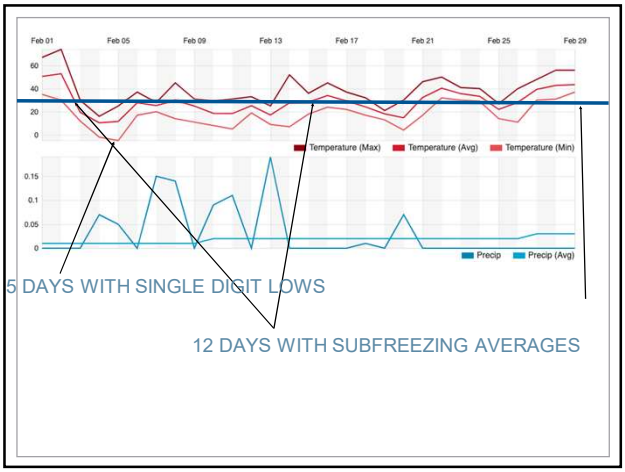

## More Venting: Dilute the vapor as it enters the attic and exhaust it

THE CODE REQUIRES: AREA/150 FOR PROJECTS WITHOUT A VAPOR RETARDER



## That is all nice and neat. This is the real world!

## 2020 has been particularly bad. Why?



## Things to ask:

- When does it leak?
  - During a rain?
  - After a rain
  - During thawing conditions?
- When did it start?
- Flood tests will be negative
- How much water?
- Look in attic, if you see.....

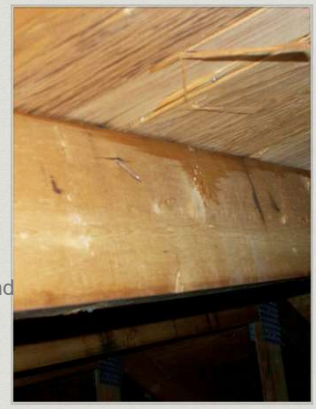
## OR

## What are you seeing?

- On the north side the deck stays colder. It holds snow which keeps the nails colder. This provides a place for condensation to form

## Roof Leak:

- Localized water
- water stains on wood
- small area of damage at water entry point and spreads



## Condensation:

- Nails rusty
- Wood at nail discolored
- Large area effected
- North facing worse
- Dark stains over flat part of deck

## So how do you describe this?

## This is not acceptable as a way to increase ventilation!

## Check the Whole House Humidifier

- April-Aire Units can put enough water in the air to cause rain!
- Should have a “humidistat” to control humidity levels
- Winter setting at 30% Relative Humidity
- Check humidity levels in the house to see how accurate the setting is.

## Solutions:

- This is not a roof leak!
- Find the source of the moisture
  - Control the source FIRST
- Can a retarder be added?
- How much venting can be added?

## Best way to reduce condensation:

1. Use Peel and Stick underlayment over the whole roof.
2. Switch to wood shakes.
3. Put 6-mil poly film over all the insulation.
4. Increase attic ventilation.

## Thank You, Questions?