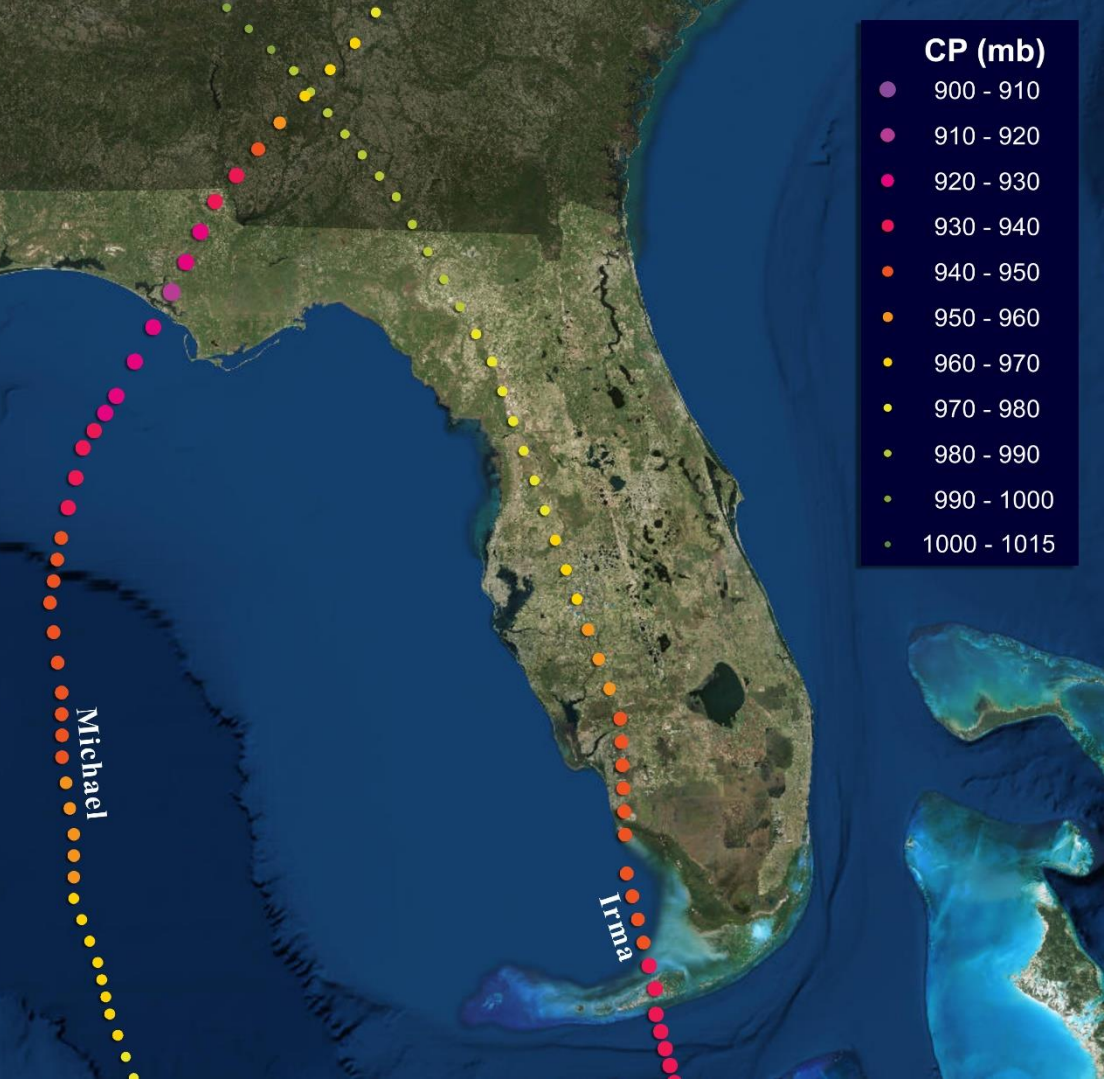
2019 AIR Florida Insurance Forum

AIR

Hurricanes of 2017 & 2018: Damage Survey Lessons Learned and Next Steps

Karthik Ramanathan, Ph.D.
Assistant Vice President & Principal Engineer
Research & Modeling, AIR Worldwide

Parker, FL
Source: AIR Worldwide



2017 Hurricane Irma and 2018 Hurricane Michael Provided Unique Learning Opportunities

Estimated wind speeds from Hurricane Irma in Florida did not approach the design wind speeds required in the last six editions of the Florida Building Code; however, they did in the case of Hurricane Michael.

AIR

AIR Damage Surveys – Gaining Important Insights Through Collaborations

AIR Currents

https://www.air-worldwide.com/Publications/AIR-Currents/2019/Modeling-Fundamentals--Why-Does-AIR-Conduct-Post-Event-Damage-Surveys-/

- Insurance Adjusters
- Insurance Institute for Business and Home Safety (IBHS)
- Academic Institutions

Collateral wind damage to properties in Florida – 2017 Hurricane Irma & 2018 Hurricane Michael

AGENDA

- History of Building Codes in Florida
- Learnings from Hurricane Irma and Michael Damage Surveys – Wind and Storm Surge Impacts
- Active Areas of Ongoing Research and Investigations within AIR

AIR

History of Building Codes in Florida

1974 State minimum building code law adopted

1992 Hurricane Andrew strikes South Florida

1996 Florida Building Code Study Commission appointed

1998 Florida Legislature – statewide minimum building code to be enforced

©2019 AIR Worldwide
CONFIDENTIAL: For Florida Insurance Forum attendees only

Emergence of the Florida Building Code

Design Wind Speed Maps

Terrain Exposure

Wind-Borne Debris Region (WBDR)

2002 FBC 2001

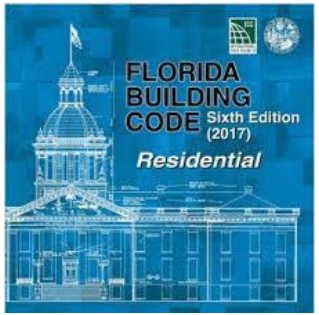
2005 FBC 2004

2009 FBC 2007

2012 FBC 2010

2015 FBC 2014

2017 FBC 2017



©2019 AIR Worldwide

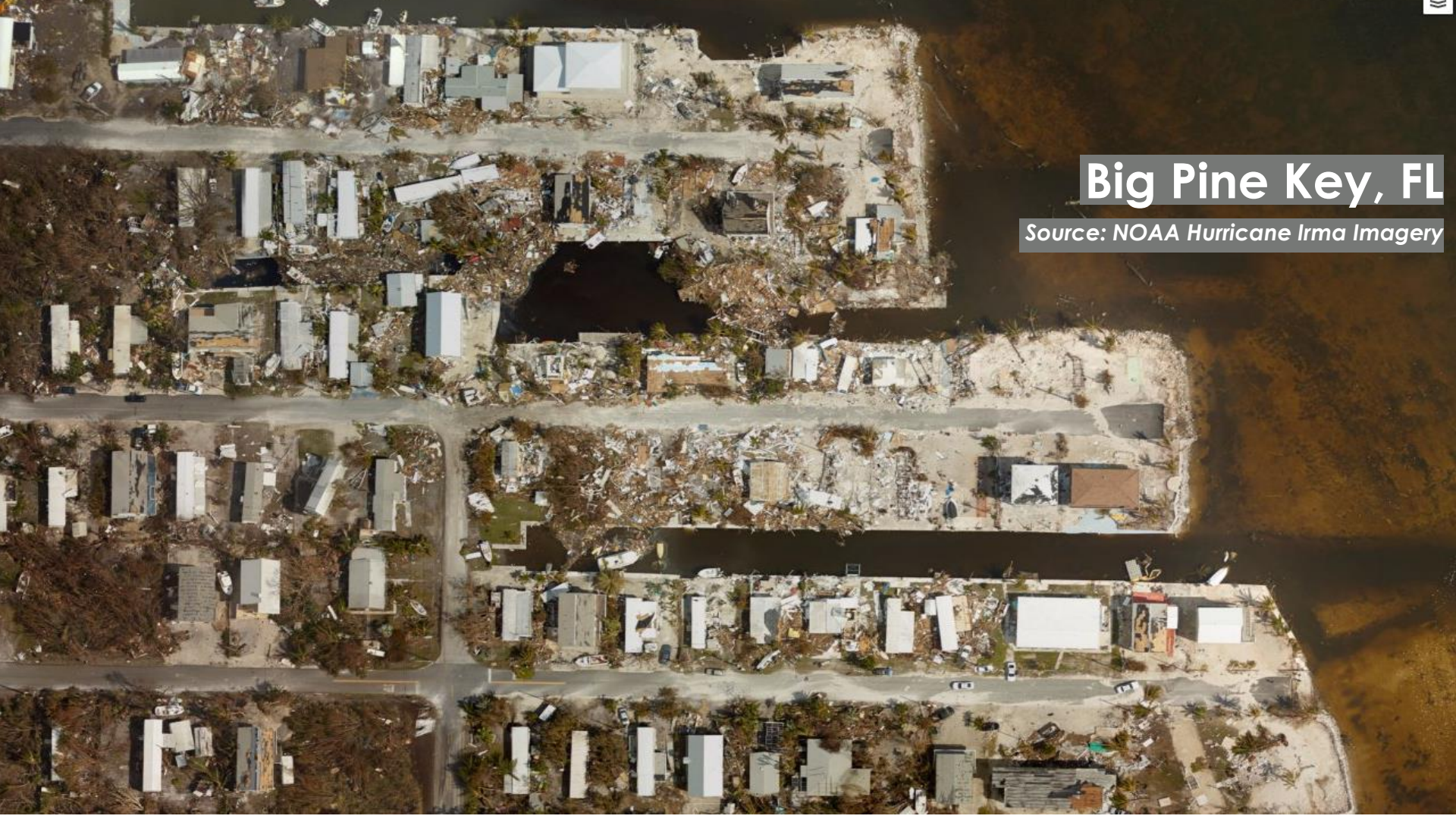
CONFIDENTIAL: For Florida Insurance Forum attendees only

AIR

Performance of Main Wind Force Resisting System

- Most buildings designed and constructed to comply with the FBC performed well structurally
- However, many of these same buildings sustained wind-induced failures of building envelope components that allowed wind-driven rain to penetrate, resulting in costly damage
- Continued presence of unreinforced masonry construction in Florida

©2019 AIR Worldwide
CONFIDENTIAL: For Florida Insurance Forum attendees only


Big Pine Key, FL
Source: NOAA Hurricane Irma Imagery

Building Performance Is a Combination of the Main Wind Force Resisting System and Envelope Components

Main Wind Force Resisting System Performance

Envelope Components Performance

Performance of Roof Systems

Roof sheathing failure due to inadequate connections to the underlying framing

Bluewater Key, FL – 2017 Hurricane Irma

Source: AIR Worldwide

Dawson, GA –
2018 Hurricane Michael

Source: AIR Worldwide

Performance of Roof Systems

Absence of roof deck

Most Observed Wind Damage Confirmed Expected Behavior

Lack of proper connections leads to load path discontinuity and member failure

Panama City, FL –
2018 Hurricane Michael
Source: AIR Worldwide

Performance of Roof Systems

Failure of roof trusses or rafters at connections to the top of the walls

Cudjoe Key, Florida – 2017 Hurricane Irma
Source: AIR Worldwide

Most Observed Wind Damage Confirmed Expected Behavior

Parker, FL –
2018 Hurricane Michael
Source: AIR Worldwide

Failures Due to Wind-Induced Suction Pressures

Lynn Haven, Panama City, FL – 2018 Hurricane Michael

Source: AIR Worldwide

Performance of Envelope Elements

Roof Covers and Soffits

Wall Siding

Opening Protection

©2019 AIR Worldwide

CONFIDENTIAL: For Florida Insurance Forum attendees only

AIR

Performance of Roof Covers

- Metal panel roofs performed better than asphalt shingles or tiled roofs
- Significant damage was seen to roofs with shingles and clay/concrete tiles

Marathon, Florida – 2017 Hurricane Irma

Source: AIR Worldwide

©2019 AIR Worldwide

Performance of Metal Roofs

- Success or failure of the metal roof coverings depends upon the fastener spacing and type, and the panel gauge
- Screws provided greater pull-out resistance than ring-shank nails

Parker, FL – 2018 Hurricane Michael
Source: AIR Worldwide

Relatively Poor Performance of Metal Roofs in Hurricane Michael Impacted Areas

Albany, GA

Source: AIR Worldwide

Damage to soffits was most common in metal panel roofs

Source: AIR Worldwide

Lower Sugarloaf Key, Florida – 2017 Hurricane Irma

Summerland Key, Florida

AIR

Clay Tile Roofs Suffered Significant Damage

- Availability of the same type, texture, and gradation of tiles for replacement can be difficult
- Can often lead to entire roof covers requiring replacement

Big Coppitt Key, FL – 2017 Hurricane Irma
Source: AIR Worldwide

Mortar and adhesive-set clay tiles suffered the most damage in comparison to mechanically attached ones

©2019 AIR Worldwide

Significant Damage to Commercial Built-Up Roofs

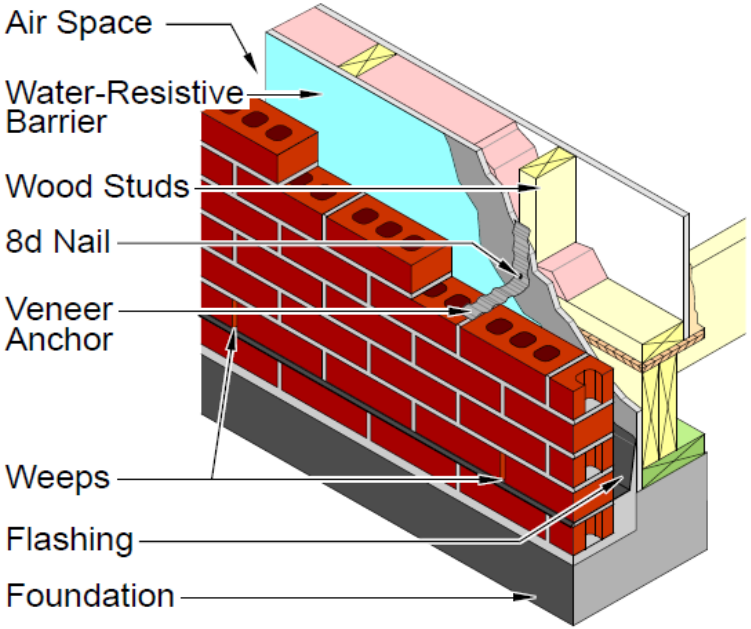
Panama City Beach, FL – 2018 Hurricane Michael

Source: AIR Worldwide

Significant Damage to Commercial Built-Up Roofs

Albany, GA – 2018 Hurricane Michael
Source: AIR Worldwide

Brick Veneer – Wooden Stud Wall System



Source: The Brick Industry Association

- Space anchors no more than 18" vertically (as per IBC)
- Space additional anchors within 12" of openings larger than 16" at a maximum spacing of 3 feet
- **Secure anchors to the studs through the sheathing and not to the sheathing alone**

Lack of connection between wall siding and brick veneer wall

Lynn Haven, Panama City, FL - 2018 Hurricane Michael

Source: AIR Worldwide

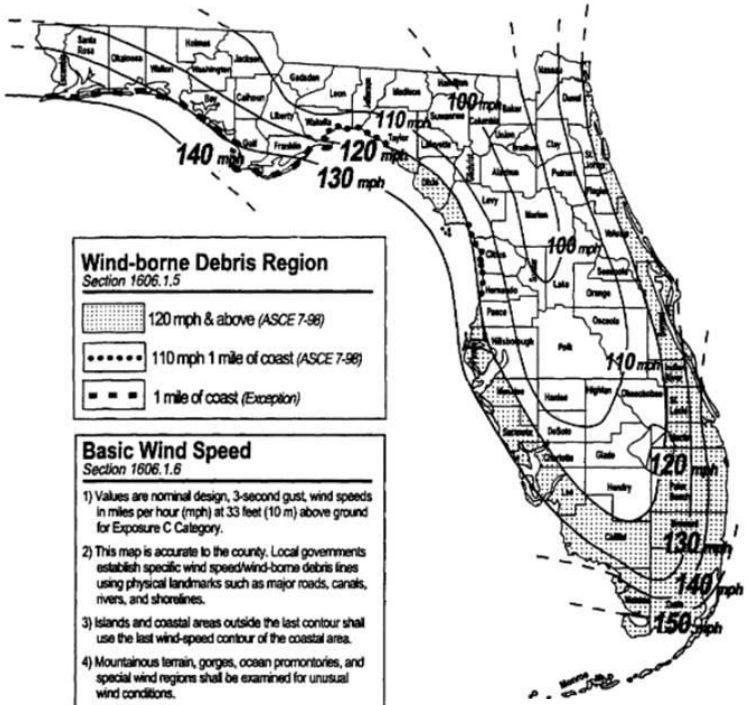
AIR

Damage to Wall Siding and Envelope Elements in Commercial High-Rise Buildings

Panama City Beach, FL – 2018 Hurricane Michael

Source: AIR Worldwide

Florida Panhandle Has a Unique WBDR History



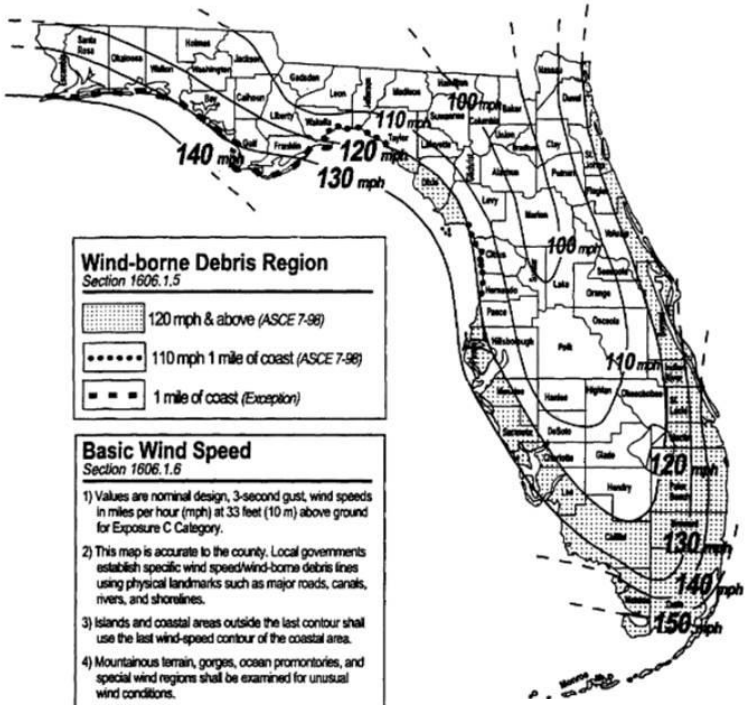
FBC 2001 – FBC 2007

What defines the Wind-Borne Debris Region (WBDR)?

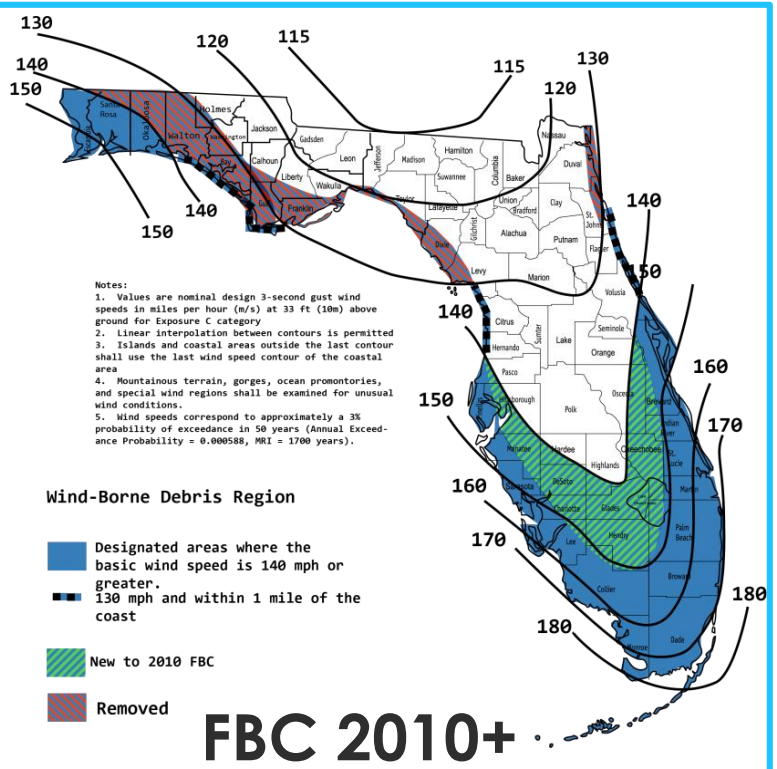
1. Areas with design wind speed ≥120 mph
2. Areas with design wind speed ≥110 mph and within 1 mile of the coastline

FBC 2001 made a political decision to exclude large swaths of the Panhandle from WBDR. Although that was reversed in FBC 2004, FBC 2010 and later significantly reduced the WBDR in this region.

Florida Panhandle Has a Unique WBDR History



FBC 2001 – FBC 2007



FBC 2010+

Figure 1609A Wind-Borne Debris Region, Category II and III
Buildings and Structures except health care facilities in Miles Per Hour

Consequences of Unprotected Openings

Panama City, FL –
2018 Hurricane Michael
Source: AIR Worldwide

Consequences of Unprotected Openings

Panama City Beach, FL – 2018 Hurricane Michael

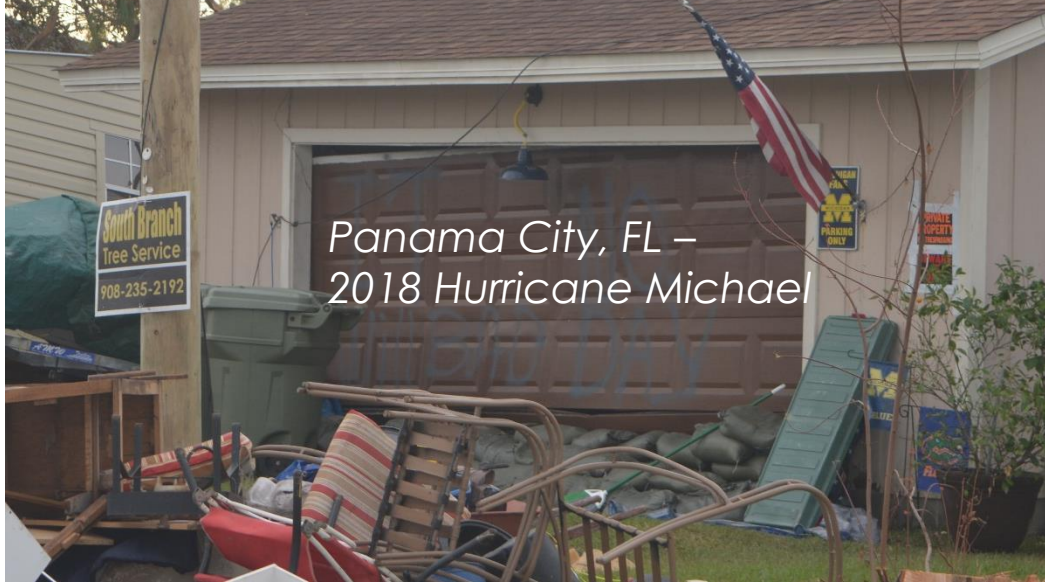
Source: AIR Worldwide

Performance of Opening Protection Systems

- Variability in the level of opening protection in Monroe County
- Improper installation of shutters

Goodland, FL – 2017 Hurricane Irma

Garage Door Failures



How Does Damage Correlate with Building Code Enforcement?

Through the BCEGS program, ISO® assesses the building codes in effect in individual communities and how these communities enforce their building codes

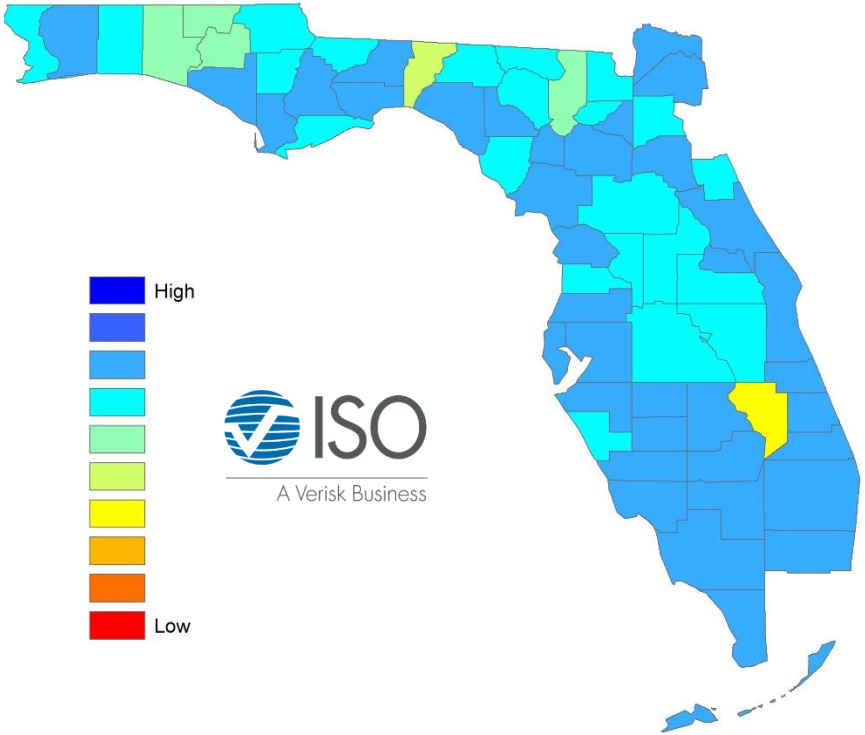
ISO
A Verisk Business

BCEGS Score

- Administration of Building Codes
- Plan Review
- Field Inspection

Separate scores for residential and commercial – scores from 0 to 100

How Does Damage Correlate with Building Code Enforcement?



Claims analysis to see if damage correlates with the county-level variation in building code enforcement within Florida

County-level variation in residential BCEGS score in Florida

©2019 AIR Worldwide

CONFIDENTIAL: For Florida Insurance Forum attendees only

AIR

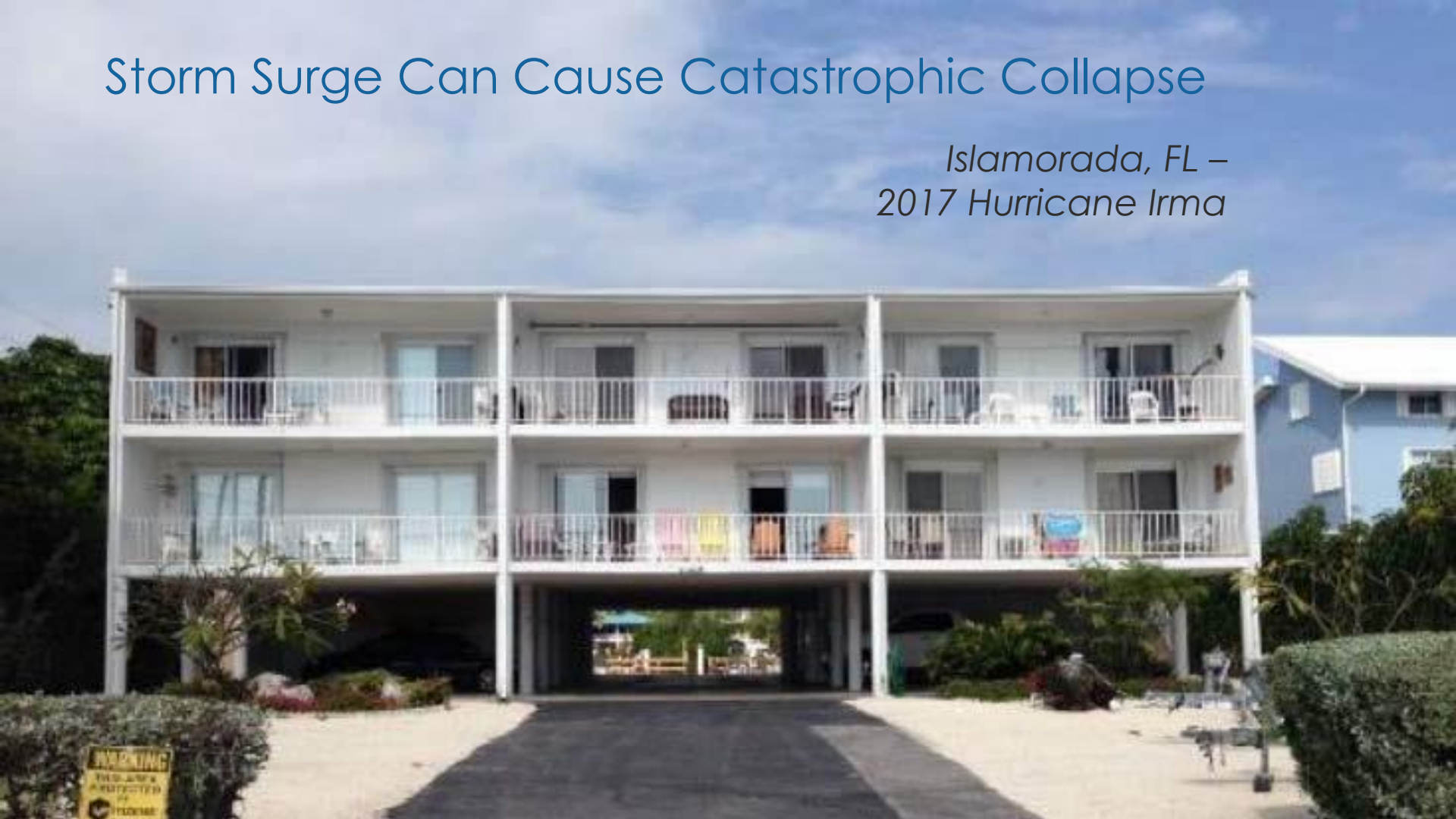
Storm Surge Can Cause Catastrophic Collapse

Mexico Beach, FL
2018 Hurricane Michael

Source: AP

Storm Surge Can Cause Catastrophic Collapse

Islamorada, FL –
2017 Hurricane Irma



Storm Surge Can Cause Catastrophic Collapse

Islamorada, FL –
2017 Hurricane Irma
Source: AIR Worldwide

Building Codes Can Minimize Surge Damage

- First floor elevated sufficiently above ground
- Elevation of service equipment

Upper Sugarloaf Key, FL – 2017 Hurricane Irma
Source: AIR Worldwide

©2019 AIR Worldwide

FEMA Flood Map for the City of Mexico Beach, FL

Source: FEMA, National Flood Hazard Layer (NFHL) Viewer

Storm Surge Devastation in Mexico Beach, FL

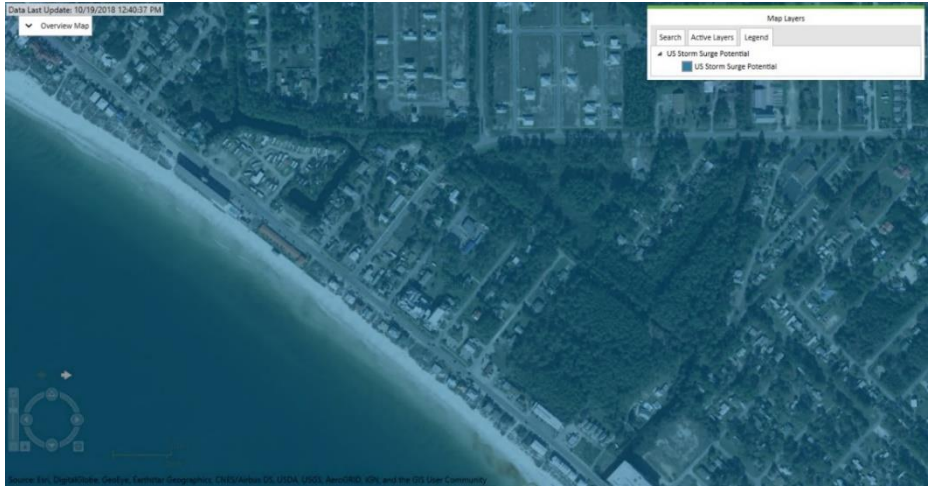
Source: The New York Times, Hurricane Michael: One Mile of Devastation in Florida

Storm Surge Devastation in Mexico Beach, FL

Source: Hurricane Michael Imagery, NOAA

How Did the FEMA Flood Maps Fare in Areas Worst Affected by Michael's Storm Surge?

The extent of storm surge went well beyond FEMA designated V, A zones and into the X zones (areas of minimal flood hazard)



Storm Surge Potential for Mexico Beach
Source: AIR Hurricane Model for the U.S.

Engaging with Clients to Gather Claims Data

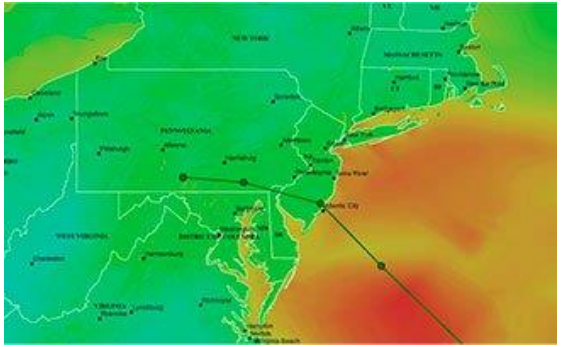
- Validate the vulnerability of the buildings built within the last decade in Florida
- Quantify the impact of assignment of benefits

©2019 AIR Worldwide

A Spectrum of Verisk Solutions for Real-Time Event Response

Pre-Event → Post-Event

Respond™



AIR ALERT™

Geomni

©2019 AIR Worldwide

CONFIDENTIAL: For Florida Insurance Forum attendees only

AIR