

MOBILE/MANUFACTURED HOME DAMAGE ASSESSMENT

CENTRAL FLORIDA TORNADOES FEBRUARY 2, 2007



**Bureau of Mobile Home and RV Construction
Division of Motor Vehicles
Department of Highway Safety and Motor Vehicles**

February 7, 2007

**MOBILE/MANUFACTURED HOME DAMAGE ASSESSMENT
CENTRAL FLORIDA TORNADOES
FEBRUARY 2, 2007**

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NOTE: LIMITATIONS OF THE REPORT

The purpose of this report is strictly for the use of the Florida Department of Highway Safety and Motor Vehicles to determine the effectiveness of current department administrative rules governing the installation of mobile/manufactured homes.

All statistics reported here are from a sample of mobile home parks and areas visited. In addition, due to debris, entry into some areas was not possible to make more specific determinations. Consequently, the statistics reported here are estimates. There may be differences between what is reported here and determinations by local building departments, insurance companies or other government agencies

When reporting the number of homes "destroyed or non-repairable" the totals represent homes with severe roof damage to the point of the roof being blown from the home, one or more exterior walls being separated from the home or water completely penetrating the unit.



State of Florida
DEPARTMENT OF
HIGHWAY SAFETY AND MOTOR VEHICLES
TALLAHASSEE, FLORIDA 32399-0500

FRED O. DICKINSON
Executive Director

DATE: February 7, 2007

TO: Phil Bergelt, Program Manager
Bureau of Mobile Home and RV Construction

FROM: Wayne Jordan, Community Assistance Consultant
Bureau of Mobile Home and RV Construction

SUBJECT: Assessment of tornado damage to manufactured/mobile homes in Lady Lake, Lake Mack area and Deland.

On February 1, 2007 the National Weather Service (NWS) upgraded the way its measures tornado damage. The new version is now called the Enhanced Fujita Scale. The next day was to be the first test of checking the enhanced scale.

Severe weather was predicted and on February 2, 2007 a tornado touched down in the Villages in Sumter County (3:20 am) and crossed the county line into Lake County hitting Lady Lake. The tornado then dissipated and another touched down further to the east in the Lake Mack area (3:49 am) and continued into Deland (4:02 am). This tornado dissipated and a third touched down in the New Smyrna Beach area (4:27 am).

The tornadoes destroyed or heavily damaged everything in their path including site built homes and commercial buildings as well as mobile/manufactured homes. The NWS categorizes the Villages/Lady Lake tornado as a high end EF-3 with wind speeds of 155 to 160 mph. The Lake Mack/Deland tornado was also categorized at a high end EF-3 with wind speeds of 160 to 165 mph.

In the Villages officials report several hundred site built homes damaged with several destroyed. In Lady Lake a church built to withstand high winds and was to serve as a storm shelter was destroyed. In Deland several businesses including our Department's regional Division of Motor Vehicles (DMV) office sustained major damage. Mobile homes were no exception.

After hitting the Villages the tornado headed into a mixed neighborhood of mobile homes, site built homes and some businesses. We figure as many as 80% of the mobile homes were destroyed or damaged beyond repair. Estimates are difficult with piles of debris everywhere and all homes being on private property. All of the homes we surveyed were older and in the age range of 70s and 80s. One local resident called this area the Spencer Loop area.

The tornado moved across the street and completely destroyed the Church of God before moving into the Sunshine Mobile Home Park (MHP). This Park contained about 80 mobile homes and 20 RV spaces. Up to 70% of these homes were destroyed or heavily damaged with many homes missing from their foundations. This was an older park (70s with a few 80s) with no new homes and of the damaged homes no evidence of any being installed since 1994.

The Lady Lake MHP was next door and is an older park with homes ranging in the 70s and 80s. Damage was somewhat less since this park had several homes located down a hill. Still approximately 50% of these homes were destroyed or heavily damaged.

The next area we studied was the hard hit area of Lake Mack referred to in the media as Paisley. This area was devastated with winds up to 165 mph. Up to 90 to 95% of these homes were destroyed in the area we could study. All of this was private property and we could not see all homes due to debris, trees down and electrical lines down. Sergeant Delahoz of the Florida Highway Patrol escorted us into this area and other law enforcement officers advised us to go no further without 4 wheel drive vehicles due to road conditions.

Our next study was the Hawthorne Hills MHP in Deland with 158 units. This was also an older park with no new homes surveyed. The tornado seemed to be lifting here and the suction caused significant damage to roofs and carports. One home left its foundation and was completely destroyed. Fifteen to twenty homes were blown off their foundation, but up to 75% of all homes may be totaled due to roof damage and tree damage.

We were not able to study the effects of the our stringent mobile/manufactured home installation administrative rules implemented in March of 1999, however, we found 40 or more case studies of older homes where anchors sliced through the ground (installed before stabilizer plates). Too few anchors proved to be the loss of many homes with some homes having 2 or 3 anchors per side. The old style buckle for locking the strap around the I-beams proved once again to be inadequate. The straps simply pull through the buckle during high winds. One newer home found in the Lake Mack area was damaged by being blown off its foundation with windows broken and roof damaged when the front porch blew away and the centerline of the home started to leak. Two plastic stabilizer plates were broken on this home.

No building whether commercial or residential faired well in the path of these tornadoes.

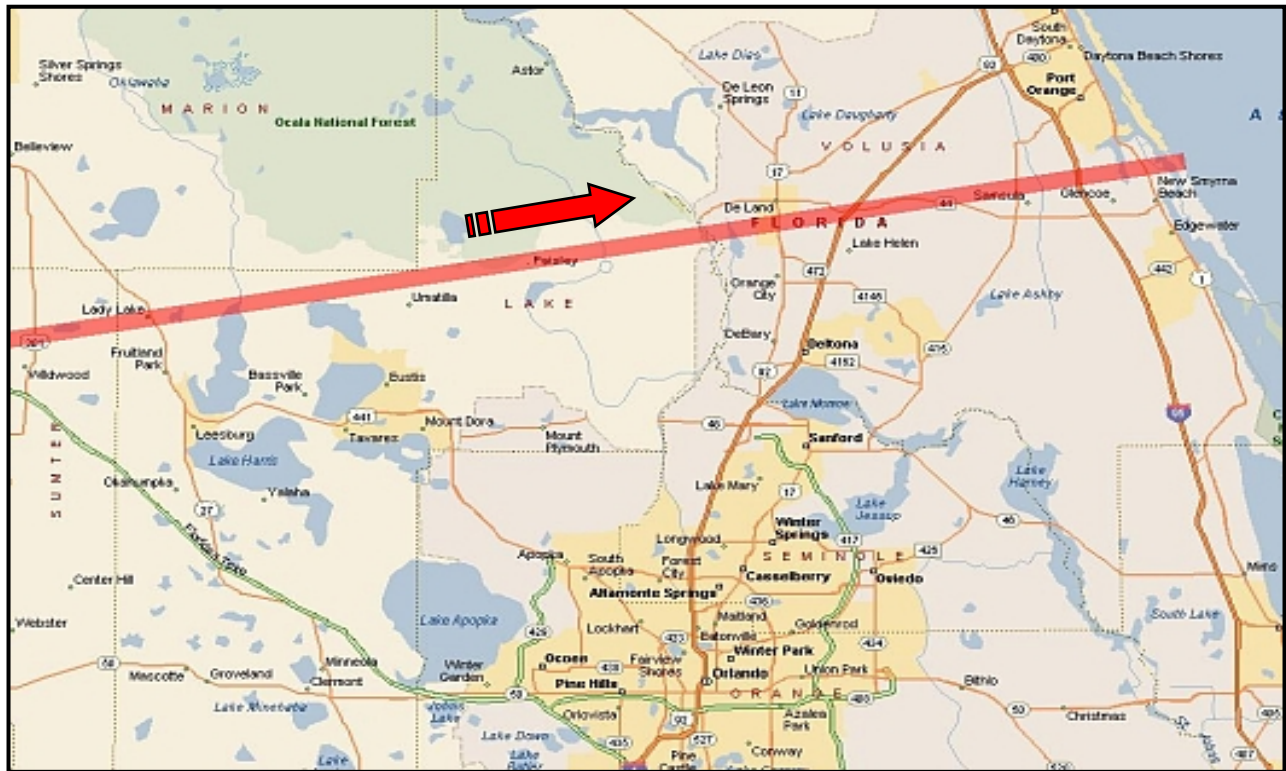
Note:

The purpose of this report is strictly for the use of the Florida Department of Highway Safety and Motor Vehicles to determine the effectiveness of current department administrative rules governing the installation of mobile/manufactured homes.

All statistics reported here are from the Sumter, Lake and Volusia Counties. In addition, entry into the mobile homes and/or private property was not always possible to make more specific determinations. Consequently, the statistics reported here are estimates. There may be differences between what is reported here and determinations by local building departments, insurance companies or other government agencies.

FIGURE 1

The path of the tornados of February 2, 2007



map courtesy of NOAA

The Enhanced Fujita Scale was implemented February 1, 2007.

Its uses three-second gusts estimated at the point of damage based on of levels of damage to 28 different indicators. One of the indicators is manufactured homes and 12 different degrees of damage determine the strength of the storm. The degrees of damage listed for manufactured homes are determined by typical construction techniques such as frame straps and anchors spaced at 10 to 12 foot intervals.

Enhanced Fujita Scale	
EF Number	3 Second Gust (mph)
EF 0	65-85
EF 1	86-109
EF 2	110-137
EF 3	138-167
EF 4	168-199
EF 5	200-234

FIGURE 2

AREAS MENTIONED IN REPORT

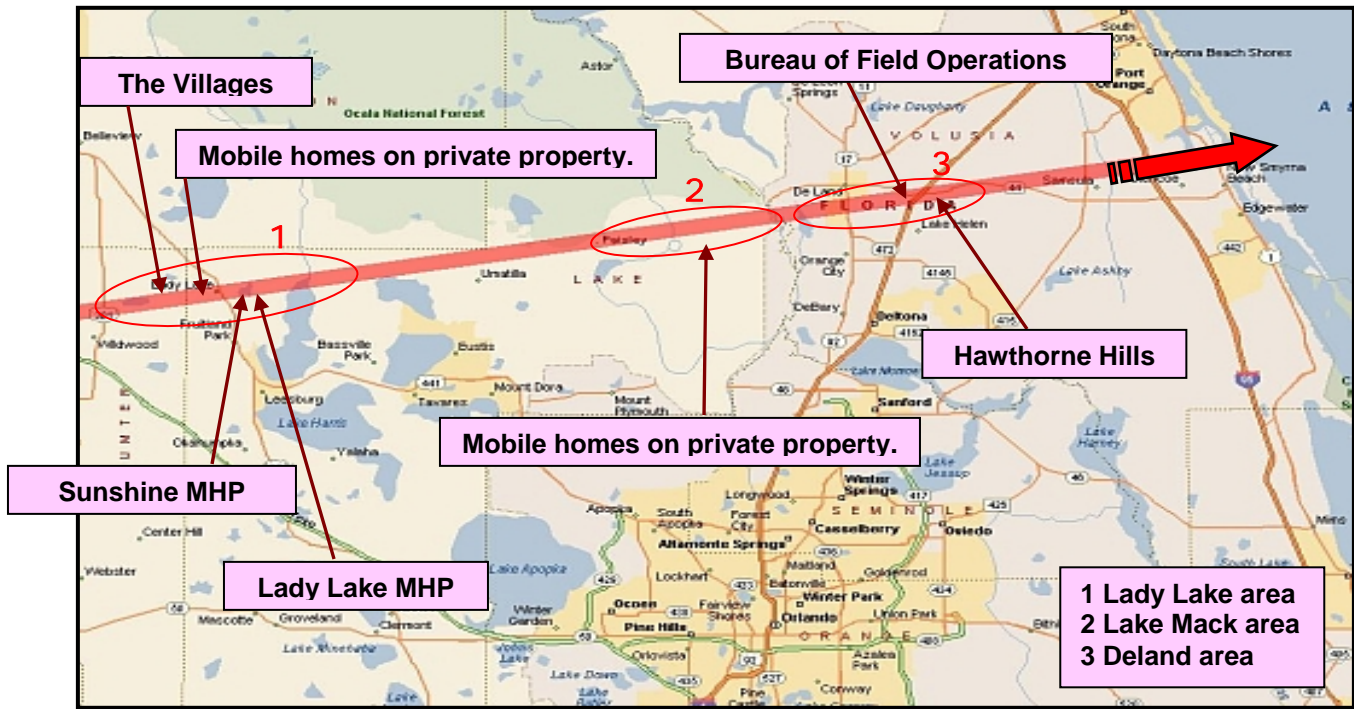


TABLE 1

Central Florida Tornadoes									
A study of manufactured homes (MH) in Lake and Volusia Counties									
					Estimations				
Date	Mobile Home Park	Address	City	County	Age of park by decade	Homes in park	No. of MH destroyed or non repairable	post 94 homes	post 94 homes damaged
2/2/07	Private property	no addresses *	Lady Lake	Lake	70s – 80s	30 – 40	30*	0	0
2/2/07	Sunshine	401 Sunshine Blvd.	Lady Lake	Lake	70s – 80s	86	40	0	0
2/2/07	Lady Lake	2934 Griffin View Rd.	Lady Lake	Lake	70s – 80s	158	79	0	0
2/3/07	Lake Mack area	no addresses *	Paisley	Lake	70s – 80s	30 – 40	37*	1	1
2/3/07	Hawthorne Hills	1275 Garfield Av S	Deland	Volusia	70s – 80s	182	90	0	0
* estimates on private property were extremely difficult due to roads closed, power lines down and search and rescue teams.									

**PHOTOS OF MOBILE/MANUFACTURED HOME
DAMAGE CAUSED BY THE TORNADOES THAT
HIT CENTRAL FLORIDA ON FEBRUARY 2, 2007**

**NO TYPES OF STRUCTURES WERE IMMUNE TO
THE TORNADO'S PATH**



**The Lady Lake Church of God which was built for high winds and was
designated as a storm shelter.**



**Our own department's Bureau of Field Operations regional office sustained
heavy damage along with another building in the same complex.**



Automobiles and recreational vehicles were no match for the tornado.



Aerial photography shows the magnitude of damage caused by a high end EF-3 tornado to a mobile home community in the Lady Lake area.



Trees caused major damage to mobile homes in this storm.

**ITEMS USUALLY FOUND IN STORM DAMAGED HOMES.
THESES HOMES WERE NO EXCEPTION.**



Termite damage.



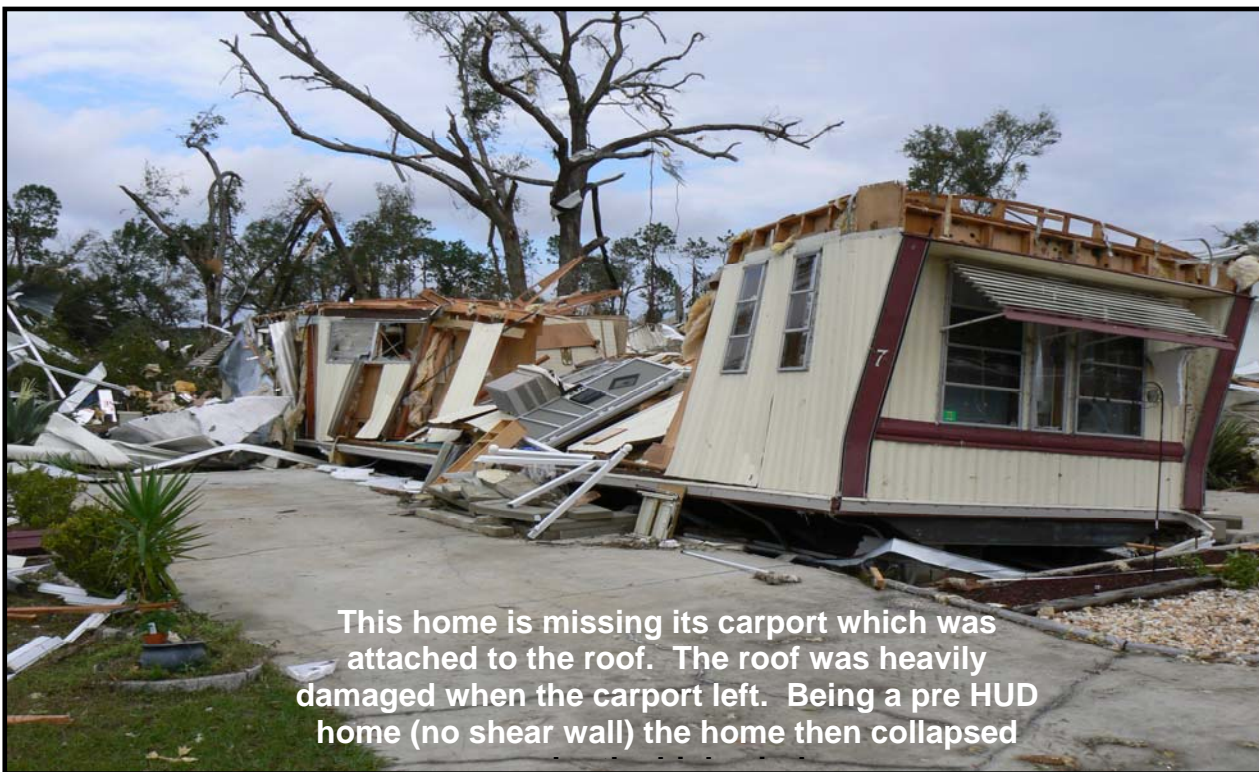
Wood rot.



Carports and additions causing damage to the home.



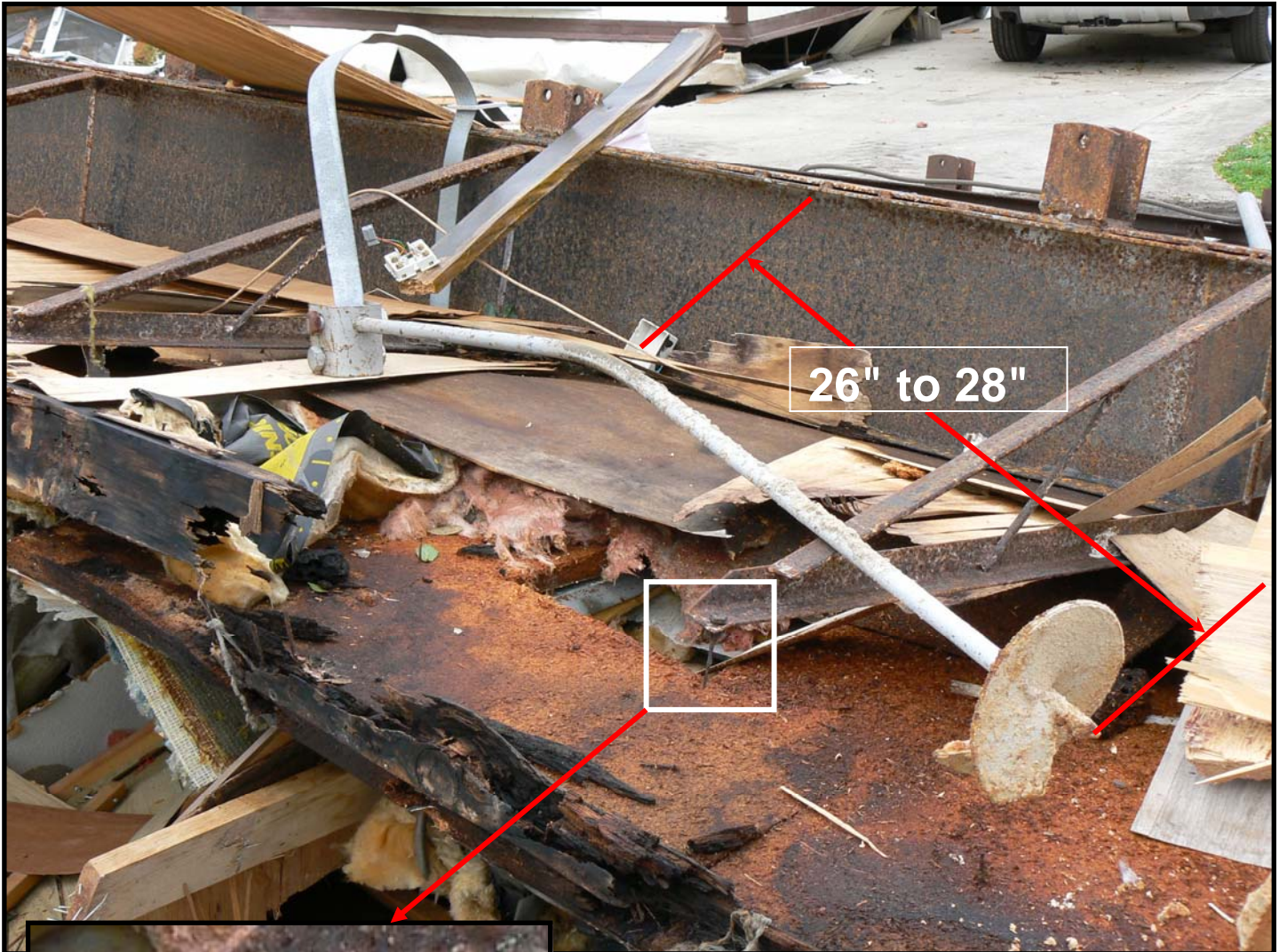
A damaged carport caused by uplift winds.



This home is missing its carport which was attached to the roof. The roof was heavily damaged when the carport left. Being a pre HUD home (no shear wall) the home then collapsed

OLD STYLE TIEDOWN COMPONENTS PERFORMING BADLY.

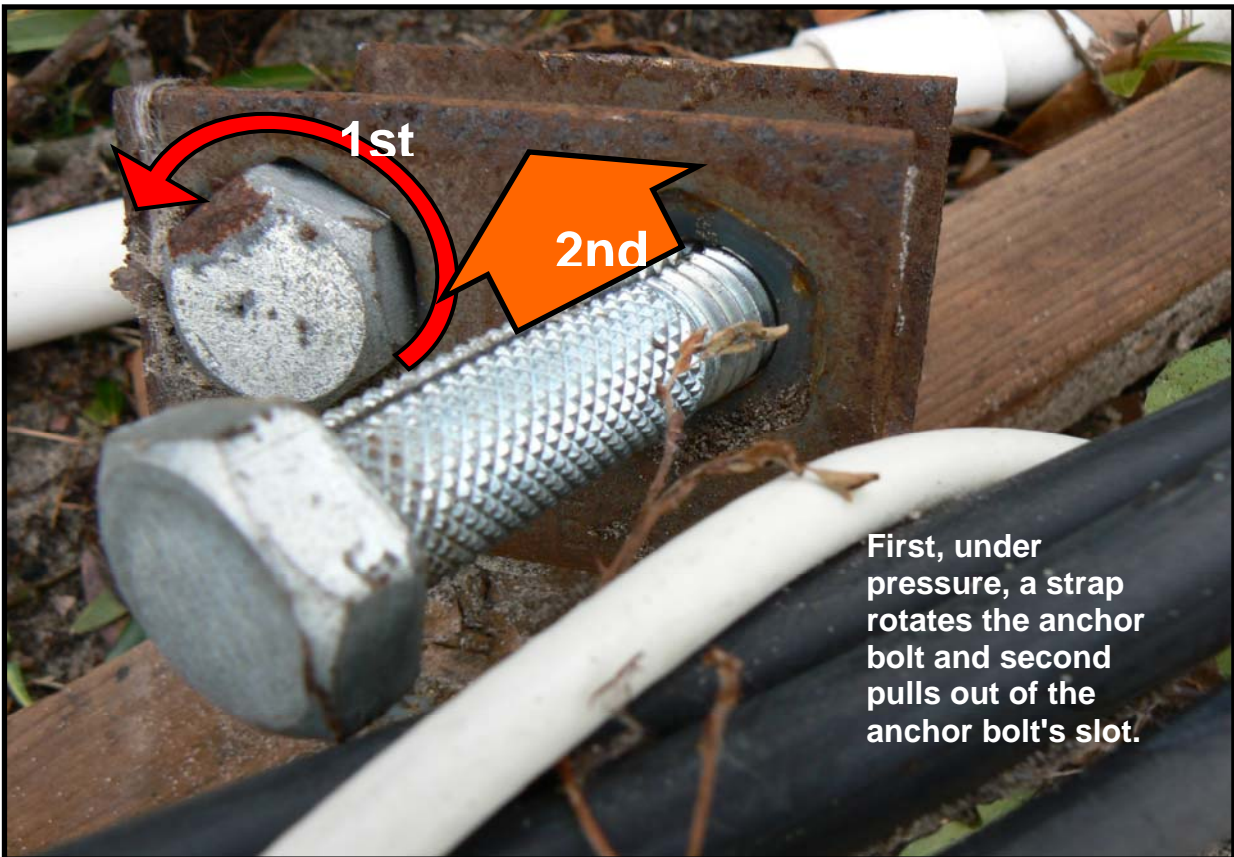




Too few anchors and improperly installed anchors contributed to many of the homes being destroyed. Three or more anchors had been pulled out of the ground, but were only installed to a depth of 26 to 28 inches.

Note the wood rot. The lag bolt holding the frame to the perimeter rail had all but rusted away. The perimeter rail and part of the particle board floor had deteriorated.







Wall brackets pulled from the perimeter rail. Six or more side wall brackets broke.



Pictures of the steel mechanical steel systems under the home. Two of the three collapsed. The galvanized pans act as large stabilizers and appear to have been installed too shallow.



**EXAMPLE DESTRUCTION OF HOMES OTHER THAN
MOBILE/MANUFACTURED HOMES**

This is a site-built home.



This is another site-built home.



**NEWS ARTICLES ABOUT THE TORNADOES
THAT HIT CENTRAL FLORIDA ON
FEBRUARY 2, 2007**

THE NATIONAL WEATHER SERVICE PUBLIC INFORMATION STATEMENT SATURDAY, FEBRUARY 3, 2007

PUBLIC INFORMATION STATEMENT
NATIONAL WEATHER SERVICE MELBOURNE FL
6:15 PM EST SAT FEB 3 2007

...THE LATEST FIELD REPORT FROM BOTH THE LAKE COUNTY AND VOLUSIA COUNTY SURVEY TEAMS REGARDING YESTERDAYS KILLER TORNADO EVENT...

...DAMAGE SURVEYS NOW INDICATE THAT AT LEAST THREE TORNADOES ARE RESPONSIBLE FOR THE DEATH AND DESTRUCTION...

A PRELIMINARY STORM SURVEY CONTINUES IN BOTH LAKE AND VOLUSIA COUNTIES WHERE EXPERT NATIONAL WEATHER SERVICE SURVEY TEAMS ARE ASSESSING THE DEVASTATION. THE LATEST REPORT FROM THE LAKE COUNTY TEAM IS THAT THE TORNADO WHICH RIPPED THROUGH THE VILLAGES AND LADY LAKE WAS HIGH END EF-3 WITH WINDS OF 155 TO 160 MPH. THE FIRST OF THREE TORNADOES INITIALLY TOUCHED DOWN IN SUMTER COUNTY NEAR WILDWOOD AND THE VILLAGES AND THEN CROSSED OVER INTO LAKE COUNTY TO STRIKE LADY LAKE WHERE THE FIRST EVENT FATALITIES OCCURRED. CURRENTLY...THERE ARE 7 KNOWN FATALITIES IN THE LADY LAKE AREA.

THE VILLAGES/LADY LAKE TORNADO...TORNADO NUMBER 1...HAS BEEN CLASSIFIED AS AN EF-3 TORNADO WHICH CAUSED DAMAGE TO STRUCTURES WHERE MOST WALLS COLLAPSED EXCEPT FOR THEIR INTERIOR ROOMS...AS WELL AS LARGE TREES BECAME DEBARKED WITH ONLY THE STUBS OF THE LARGEST BRANCHES REMAINING. MOBILE HOMES WERE COMPLETELY DESTROYED. THIS TORNADO WAS ONE-QUARTER MILE WIDE DURING ITS MOST FIERCE MOMENTS. THE TORNADO LIFTED EAST OF LADY LAKE WITH AN APPROXIMATE PATH LENGTH OF ABOUT 15 MILES. THE TORNADO STRUCK LADY LAKE AT 3:20 AM. AGAIN...7 KNOWN FATALITIES ARE ASSOCIATED WITH THIS TORNADO.

THE LAKE MACK/DELAND TORNADO...TORNADO NUMBER 2...WAS ALSO HIGH END EF-3 WITH WINDS OF 160 TO 165 MPH. IT WAS ALSO ONE-QUARTER MILE WIDE. IT RESULTED IN COMPLETE DESTRUCTION OF MOBILE HOMES...AND CAUSED LARGE TREES TO BECOME DEBARKED. THE ESTIMATED TORNADO WINDS NEAR LAKE MACK PEAKED AT 165 MPH WHICH RESULTED IN 10 FATALITIES...AND 150 TO 155 MPH WINDS AT FOREST DRIVE AND STATE ROAD 44 WHICH RESULTED IN 3 MORE FATALITIES. A TOTAL OF 13 KNOWN FATALITIES OCCURRED WITH THIS DEADLY TORNADO. THE TORNADO CONTINUED ACROSS THE COUNTY LINE NEAR HONTOON ISLAND...CROSSING INTO VOLUSIA COUNTY...AND STRIKING DELAND AS A HIGH END EF-2 TORNADO WITH WINDS OF 130 TO 135 MPH AS REPORTED BY THE VOLUSIA COUNTY TEAM. IT WAS ONE-EIGHTH MILE WIDE AND LIFTED EAST OF INTERSTATE 4 NEAR THE VOLUSIA COUNTY FAIRGROUNDS. THE PATH LENGTH WAS APPROXIMATELY 22 MILES. THE TORNADO STRUCK LAKE MACK AT 3:48 AM AND DELAND AT 4:02 AM.

THE NEW SMYRNA BEACH/PONCE INLET TORNADO...TORNADO NUMBER THREE... HAS BEEN INITIALLY RATED AS AN EF-1 TORNADO WITH WINDS OF 100 TO 105 MPH. THE TORNADO UPLIFTED ROOFS ON MANY STRUCTURES...CAUSING A SIGNIFICANT LOSS OF ROOFING MATERIAL...THE COLLAPSE OF CHIMNEYS... AND COLLAPSING GARAGE DOORS. ADDITIONAL DAMAGE OCCURRED TO PORCHES AND CAR PORTS. THIS TORNADO TOUCHED DOWN JUST EAST OF INTERSTATE 95 NORTH OF HIGHWAY 44 IN NEW SMYRNA BEACH AND MOVED THROUGH PONCE

INLET. THE PATH LENGTH IS ABOUT 5 MILES. THE TORNADO STRUCK PONCE
INLET AT 4:27 AM.

THIS STATEMENT IS ONLY AN INITIAL REPORTING FROM THE SURVEY TEAMS.
IN THE COMING DAYS...CONSIDERABLE EFFORT WILL BE INVESTED TO ENSURE
THAT THIS HISTORICAL EVENT IS ACCURATELY DOCUMENTED.

A WORD ABOUT THE NEW ENHANCED FUJITA (EF) TORNADO SCALE...THE
EF-SCALE WAS DEVELOPED TO BETTER ASSESS WIND SPEEDS ASSOCIATED WITH
A WIDE VARIETY OF STRUCTURAL DAMAGE...FROM SINGLE-WIDE MOBILE HOMES
TO INDUSTRIAL BUILDINGS TO FRAMED ONE OR TWO FAMILY HOMES...AND MANY
MORE. THIS SCALE IS CONSIDERED A DAMAGE SCALE...WHEREAS THE
TRADITIONAL FUJITA SCALE (F-SCALE) WAS MORE OF A WIND SPEED SCALE.

FOR MORE INFORMATION ON THE NEW EF-SCALE...PLEASE SEE THE FOLLOWING
WEBSITE:

[HTTP://WWW.SPC.NOAA.GOV/FSCALE](http://www.spc.noaa.gov/fscale)

NBC6.NET

Tornado Kills 19, Flattens Homes, Stuns Central Florida

POSTED: 4:15 pm EST February 2, 2007

UPDATED: 10:42 pm EST February 2, 2007

LADY LAKE, Fla. -- In places, it looks like a scene from the old movie "The Day After," where the landscape looks like a world torn apart from a nuclear bomb.

Around Lady Lake in central Florida, a tornado left just foundations to homes, skeletal remains of others and pieces of aluminum roof entangled in oak branches.

Stunned people dug through piles of debris looking for belongings.

The tornado that swept through central Florida overnight killing 19 people laid waste to hundreds of homes across a 30-mile swath.

There are 10,000 families without power.

At the Lady Lake Church of God, parishioners picked up torn Bibles from amid the jumble of broken pews, altar and glass.

Mike Barfield, whose trailer home sits about 100 feet from the church, lost his roof in the tornado. As he huddled with his wife and their baby granddaughter, he looked out the window and saw the church explode.

He said he doesn't know if was a transformer blowing up, but that there was a green glow right over the top of the church and then the explosion.

The state Emergency Operations Center has been activated and Gov. Charlie Crist announced at 10:30 a.m. that he had declared a state of emergency for Lake, Sumter, Volusia and Seminole counties.

"I spoke with the director of FEMA and told him how important it was to get as much assistance as possible," Crist said. "I've talked with the White House. They said they would give us the full support of the federal government."

The storm destroyed mobile homes, lifted a tractor-trailer in the air and left debris clinging to tree branches. Some homes are off their foundations. One church with a steel structure has been flattened.

Power lines are down, and outages have been reported.

A Lake County spokesman says 11 deaths are reported in the town of Paisley, and three in Lady Lake.

A line of severe thunderstorms and possible tornadoes ripped through Central Florida before dawn Friday morning, destroying more than 100 homes.

Officials in Lake County said there were several fatalities in Lady Lake.

Emergency managers have called for a massive search and rescue effort following the storms, and they're asking for help from surrounding counties.

"This area of Lady Lake has been hit very hard by a confirmed tornado," Lake County sheriff's Sgt. Christie Mysinger told WKMG-TV. "The city of Lady Lake is in a state of emergency as declared by its mayor. And also, the county is in a state of emergency."

Heather Danehower of the Marion County Sheriff's Office, which is sending personnel to help, told WKMG-TV that 500 homes were damaged and 30 people were transported to hospitals from The Villages community, which spans Marion, Lake and Sumter counties.

Dozens of mobile homes near Lady Lake have been destroyed. Chairs, beds and clothes are strewn about yards, and debris hangs from trees.

Some homes were tossed from their foundations, while others had their roofs ripped off.

Volusia County Sheriff's Office spokesman Brandon Haught said there was extensive damage in the DeLand area because of multiple tornadoes, and multiple people were trapped across the city.

Volusia County closed DeLand Middle School, Southwestern Middle School and Starke Elementary on Friday. Officials have also closed Daytona Beach Community College West Campus because of power outages and storm damage.

Several New Smyrna Beach subdivisions report extensive damage. The area around Turnbull Bay and New Smyrna Beach Airport was heavily damaged.

At least five crashes took place within a quarter-mile of each other near Interstate 4's New Smyrna Beach exit. The highway was closed for about three hours.

Florida Highway Patrol spokeswoman Kim Miller said the most serious incident was when a semitrailer was lifted up and landed on another semi, pinning the driver in his cab. The driver didn't suffer life-threatening injuries.

Officials have opened a shelter at "Babe" James Community Center in New Smyrna Beach in Volusia County. The state Emergency Operations Center has been activated and Gov. Charlie Crist was expected to tour the area Friday.

Progress Energy said 20,000 of its customers had lost electricity, but crews were already in the field working to restore the power.

The National Weather Service issued a tornado warning for Orange County and Seminole County Friday morning.

About 3:15 a.m., radar showed rotation early Friday morning in Oviedo and in several Volusia County cities.

19 Dead in Central Fla. Storms

[The Associated Press](#)

By JIM ELLIS

February 02, 2007

It was terrifying. You're not thinking consciously. You're just trying to save your life. Disaster crews with dogs went from one pile of debris to another in a search for bodies Friday after powerful storms, including at least one tornado, smashed hundreds of homes across central Florida and killed 19 people or more.

It was the deadliest combination of thunderstorms and tornados to hit Florida in nearly a decade, cutting a 40-mile swath of destruction across four counties just before daybreak, terrorizing residents of one of the nation's biggest retirement communities, and leaving trees and fields littered with clothes, furniture and splintered lumber.

Residents helped pull the dead from the ruins.

'It was scary, really scary,' said Patrick Smith, who lives in the [Paisley](#) area, where at least 13 deaths were reported. He said he saw a weather alert on television, grabbed his wife and 'went straight to the floor.' After the storm passed, he pulled the bodies of a man and his 9- or 10-year-old son from a neighboring house.

Florida's emergency management chief, Craig Fugate, said it could take several days to determine the exact number of dead, and the main priority was finding survivors who may be trapped.

Gov. Charlie Crist declared a state of emergency in four counties, but the worst damage was reported where the twister touched down in northern Lake County and eastern Volusia County. In typical tornado fashion, the storm hopscotched across the landscape, demolishing some homes and leaving others virtually untouched.

'Our priority today is search and rescue,' said Crist, who toured the damaged area in his first natural disaster since taking office last month. 'Everything's being done to get them the aid and assistance that they need.'

Lake County spokesman Christopher Patton said there were 19 confirmed deaths, all in Lake County, about 50 miles northwest of Orlando. The dead included at least two [high school students](#), authorities said. Numerous injuries were reported, but officials could not immediately estimate how many.

Officials in Lake and Volusia counties ordered dusk-to-dawn curfews in heavily damaged areas to prevent looting and injuries to residents trying to sift through wreckage in the dark.

Authorities said hundreds of houses, mobile homes and other buildings were damaged or destroyed. Volusia County reported a preliminary estimate of \$80 million in damage involving 500 properties.

The storm left yards strewn with chairs, beds and clothes, knocked tractor-trailers onto their sides as if they were toys, and tore away roofs. Debris hung from trees, and some homes were thrown off their foundations.

Bernadette Fields, 67, said two of her neighbors in mobile homes were blown through a bedroom wall into Lake Mack. Their bodies were found by their own dog, she said.

Dozens of rescue workers _ many hardened by experience with Florida's multiple hurricanes _ went from house to house, spray-painting big red X's to mark the husks of buildings that they

had checked. Often they found people who awoke to the storm's roar and watched their homes disintegrate around them.

Lee Shaver, 54, said he and his wife, Irene, and their dog had 'about 10 seconds' to take shelter in a closet before their roof was torn off.

'Every muscle and bone in my body shook,' said Lee Shaver outside his damaged home in [The Villages](#), one of the nation's largest retirement communities.

'It was terrifying. You're not thinking consciously. You're just trying to save your life,' added his 55-year-old wife.

Tornado watches had been posted hours before the twister struck, and warnings were issued between eight and 15 minutes before they touched down, said meteorologist Dave Sharp of the National Weather Service in Melbourne.

But few people were listening to the radio or watching television at that hour, and few communities in the region have warning sirens.

'The most dangerous tornado scenario is a threat for killer tornadoes at night, and that was the case,' Sharp said.

Vern Huber, 87, said his weather radio alarm went off around 3:30 a.m. and he and his wife, Louedna, 81, huddled in the hall and put pillows from the couch on top of themselves.

'It was a deafening roar,' Huber said.

In [Lady Lake](#), the Church of God was demolished, its pews, altar and torn Bibles left in a jumbled mess. The 31-year-old, steel-reinforced structure was built to withstand 150-mph winds, the Rev. Larry Lynn said.

By daybreak, parishioners gathered on the lot where the church once stood, hugging each other and consoling Lynn. They planned to clear the debris and hold Sunday services on the empty lot.

'That's just the building, the people are the church. We'll be back bigger and stronger,' Lynn said.

While Lake County got the worst of it, Volusia County officials reported that 69 homes were damaged in [New Smyrna Beach](#). A county medical clinic in [DeLand](#) was severely damaged.

'We heard a big boom then we heard the freight-train noise. All five of us got in the closet,' said Linda Craig, 44, who lives in Hontoon Island, a heavily damaged area of Volusia County.

The winds lifted one tractor-trailer and dropped it on another, pinning the driver in his cab, said Kim Miller, a spokeswoman with the Florida Highway Patrol. The driver's injuries were not considered life-threatening.

About 10,000 customers were without power. Several counties opened shelters for those who lost their homes.

Friday's storms were reminiscent of past tornados during years where El Nino was a weather factor, as it was again in this case, said state meteorologist Ben Nelson.

In February 1998, five twisters hit near Orlando over two days, killing 42 people and damaging or destroying about 2,600 homes and businesses. It was Florida's deadliest tornado event on record.

KILLER TORNADOES: THE AFTERMATH

Tougher anchoring rules: A life-or-death difference?

Proper straps were crucial to how mobile homes held up in the storm, an expert says.

Ludmilla Lelis | Sentinel Staff Writer

Posted February 7, 2007

Amid the riot of destruction in Lake Mack, Larry Tanner fixated on a few twisted metal straps protruding from the ground.

Through them, he could see what might have made the difference between life and death during last week's tornadoes.

Mobile homes lacking enough of those straps, or the right kind, were pulled off their foundations, Tanner said.

Not far away, a home with superior anchoring fared better, and the homeowners survived.

It didn't surprise Tanner, an engineering researcher from Texas Tech University in Lubbock who is examining the aftermath of Friday's storm.

But it did confirm for him that Florida's current system of tougher building standards -- strengthened after Hurricane Andrew in 1992 and again after Central Florida's 1998 killer tornadoes -- were needed.

"The newer standards are working," Tanner said as he walked amid the devastated Lake County homes, most of which were built in the 1970s. "You can see definitely the difference in performance with the difference in construction in older structures.

"Florida has been the leader in the industry as a result of Hurricane Andrew," he said. "The hurricane standards have proven to be beneficial."

Tanner and Texas Tech doctoral student Tanya Brown are visiting Central Florida to assess how homes in the path of the tornadoes fared and why some failed to hold up. During the weekend, they toured The Villages and Lady Lake and then spent most of Monday in Paisley and DeLand.

Their university has one of the nation's leading institutes in wind research, dating back to a devastating 1970 tornado that killed 26 people in Lubbock and wrecked the city.

In recent years, Texas Tech professors helped to rewrite the enhanced Fujita scale that the National Weather Service now uses to rate tornado strength.

For 10 years, Tanner has rushed to dozens of other disasters -- from the Oklahoma City tornadoes of the late 1990s to hurricanes Ivan and Katrina -- to learn from clues left in the rubble. He has already seen some payoff from that work -- benefits that likely helped homeowners in The Villages.

On site-built homes, garage doors are often the weakest element, succumbing to the high winds of a hurricane or tornado and causing the entire house to fall apart.

Tanner saw that in Oklahoma City and worked with other researchers and the Federal Emergency Management Agency to recommend that new garage doors be built to withstand higher winds.

Florida's building code was revised in 2001 to require the fortified garage doors.

"In The Villages, most of those structures are built to hurricane standards," he said. "If they weren't under the influence of the vortex, they performed very well." Instead of collapsed homes, he saw roof damage, he said.

Those new standards, however, do nothing to help older homes.

During his Florida tour, Tanner saw evidence of lax construction and the consequences for older mobile homes that were not required to meet the new anchoring regulations.

Those newer regulations include more and stronger straps designed to last longer and keep the home better secured.

At Lake Mack, Tanner and Brown went from one wrecked home site to another, counting the number of visible straps and measuring the distance between them, both of which affect the home's durability.

Ideally, mobile homes need straps that wrap through the roof structure and criss-crossing horizontal straps to restrict sideways motion.

Few of the mobile homes he saw had those type of anchors.

But extra straps apparently made a difference for Bill Barth, whose Lake Mack home sustained severe damage but didn't get flipped over or pulled off its foundation.

"It saved my life, I'm 100 percent certain," said Barth, who felt his home start to pull away when the tornado swept through. "We were floating," he said. "It was going, until it got caught by those straps."

Just before last year's hurricane season, Barth had checked the straps. He and his father found that some seemed loose, so he tightened each of them using a heavy-duty jack.

Barth said he hopes other homeowners can learn the lesson that he did, of the value of checking those straps.

"I did that just before hurricane season, then when we didn't have hurricanes, I wondered why I bothered," he said. "But now I know why."