**IN THE UNITED STATES DISTRICT COURT**
**FOR THE SOUTHERN DISTRICT OF MISSISSIPPI**
**SOUTHERN DIVISION**

**MICHAEL PAYMENT, M.D., PLAINTIFF**

**VERSUS CIVIL ACTION NO. 1:07CV01003-LTS-RHW**

**STATE FARM FIRE AND CASUALTY COMPANY, ET AL. DEFENDANTS**

**STATE FARM FIRE AND CASUALTY COMPANY'S MOTION *IN LIMINE* NO. 9: TO PRECLUDE TESTIMONY OR EVIDENCE THAT PLAINTIFF'S HOME WAS COMPLETELY DESTROYED BY WIND**

State Farm Fire and Casualty Company ("State Farm") respectfully moves this Court for an *in limine* order precluding Plaintiff and his counsel from offering testimony or evidence, in the form of expert opinion or otherwise, to the effect that Plaintiff's residence was completely destroyed by the force of wind during Hurricane Katrina. Exclusion of such evidence is required because Plaintiff applied for, received, and retained policy limits in the amount of $250,000 under his flood policy for flood damage to his dwelling, and thus has judicially admitted that at least this amount of his loss was caused by storm surge flooding. In particular, as discussed below, the Court should enter an order precluding entirely the testimony of Plaintiff's expert witness Neil Hall or, in the alternative, limiting the balance of his testimony, if any, to that not contradicted by Plaintiff's judicial admission of $250,000 of flood damage.[1]

Plaintiff's Pass Christian home was destroyed during Hurricane Katrina. Plaintiff's home

[1] In the interests of judicial economy, State Farm respectfully requests that this Court waive the requirement of filing a separate brief inasmuch as all authority and arguments in support of this motion are set forth herein.

and contents were insured under a homeowners policy, and Plaintiff's home was insured under a flood policy. Plaintiff accepted benefits under his flood policy in the amount of $250,000 for flood damage to his dwelling. State Farm anticipates that Plaintiff will attempt to introduce evidence and testimony to the effect that Plaintiff's property was completely destroyed by wind prior to the arrival of storm surge waters. State Farm anticipates that that evidence will include proffered expert witness Neil Hall to so testify. Plaintiff should be precluded from offering evidence or testimony, including that from Mr. Hall, to the effect that Plaintiff's property was entirely destroyed by wind, because such evidence and testimony is inconsistent with the undisputed fact that Plaintiff's house had at least $250,000 worth of flood damage.

This Court has previously held that acceptance of flood policy benefits constitutes a judicial admission that at least that amount of a plaintiff's damage was caused by storm surge flooding. For example, in *McIntosh v. State Farm Fire & Casualty Co.*, this Court held that "the plaintiffs' receipt of flood insurance benefits constitutes a judicial admission that flood damage occurred and precludes the plaintiffs' denying that at least the amount of damage represented by the flood insurance payment was caused by flooding." *See* 2008 WL 1776409, *2 (S.D. Miss. Apr. 14, 2008); *accord Robichaux v. Nationwide Mut. Ins. Co.*, No. 1:06CV1165-LTS-RHW, 2007 WL 2783325, at *2 (S.D. Miss. Sept. 21, 2007) ("Once an insurance payment is made and accepted, this act establishes, as an admission by both the insurer and the insured, that the insured's losses were caused by an event covered by the policy under which the payment is made, at least to the extent of the amount paid and accepted."); *Mills v. State Farm Fire & Cas. Co.*, No. 1:07CV73-LTS-RHW, 2007 WL 1514021, at *5 (S.D. Miss. May 21, 2007) ("By offering and accepting the flood insurance policy limits, the parties have indicated their agreement that at least to the extent of these benefits the damage to the insured property was caused by flooding, and the parties are now judicially estopped from denying this."). The law provides that a judicial admission is "'conclusive'" and "binding on the party making [it]." *Martinez v. Bally's La., Inc.*, 244 F.3d 474, 476-77 (5th Cir. 2001) (citation omitted). It "has the effect of withdrawing a fact from contention" and may not be "controverted or explained by the party who made it." *Id.*

State Farm respectfully requests that this Court, in accordance with these prior rulings, instruct the jury before *voir dire* and after the close of evidence that Plaintiff's property was damaged by storm surge as a result of Hurricane Katrina in at least the amount of $250,000, and to preclude any introduction of any evidence at trial inconsistent with that fact.

For example, this Court should exclude Plaintiff's proffered expert witness Neil Hall, who opines that ***all*** of the damage to Plaintiff's property was caused by wind. Mr. Hall's draft and supplemental reports both purport to "reconstruct events during Hurricane Katrina in order to determine the extent of damage caused by wind and flood." Ex. A at 2; Ex. B at 2. However, neither report opines regarding any flood damage to Plaintiff's property at all. In his first report Mr. Hall opined that "the amount of damage caused by [wind] before the rise of storm surge already had rendered the building a total economic loss." Ex. A at 6. He also opined that wind *after* the arrival of storm surge would have "increased the total amount of damage," but he does not attribute any damage whatsoever to flooding. *Id.* In his purported supplemental report, Mr. Hall reworded his conclusions but nonetheless describes only purported "wind damage before the rise of storm surge" and "wind damage after the rise of storm surge," with no reference to any damage caused by flooding. Ex. B at 22-23. And at his deposition, Mr. Hall asserted that if there had been no flooding at all, Plaintiff's property would have experienced "***[a]ll*** the damage we've discussed," with one possible exception where a portion of Plaintiff's house may have collapsed because of wind pushing it over after a "flood component in the weakening of the building." Ex. C at 182:11-20.

Mr. Hall's opinion is that wind was the cause of ***all*** of the damage to Plaintiff's home. Yet, this opinion is flatly inconsistent with Plaintiff's judicial admission and impermissible under this Court's previous rulings on the effect of acceptance of flood policy benefits. *See McIntosh*, 2008 WL 1776409 at *2. His testimony that wind was the cause of ***all*** of the damage to Plaintiff's property should be excluded.

This Court has previously granted similar relief in other Katrina matters. For example, in *Dickinson v. Nationwide Mutual Fire Insurance Co.*, this Court held that plaintiffs were estopped from denying that their home had experienced some storm surge flooding because of their application for a flood damage grant, and precluded their expert witness from testifying that the home was completely destroyed by wind. *See Dickinson*, No. 06cv198-LTS-RHW, 2008 WL 2568140, at *1 (S.D. Miss. June 24, 2008). Likewise, in another Katrina case where plaintiffs accepted flood policy benefits for damage to their destroyed home, *Fowler v. State Farm Fire & Casualty Co.*, the court "prohibited [plaintiffs] from mentioning, submitting evidence, or eliciting testimony, in the form of expert opinions or otherwise, to the effect that Plaintiffs' property was completely destroyed by the force of wind." *See Fowler*, No. 06cv489, 2008 WL 3050417, *8 (S.D. Miss. July 25, 2008) (Ozerden, J.). A similar ruling is warranted here.

This fundamental incompatibility between Mr. Hall's opinions and Plaintiff's conclusive judicial admission of flood damage also warrants excluding his testimony under Federal Rule of Evidence 403. An expert opinion's "lack of reliable support may render it more prejudicial than probative, making it inadmissible under [Rule] 403." *Viterbo v. Dow Chem. Co.*, 826 F.2d 420, 422 (5th Cir. 1987). As Judge Weinstein has noted, "[a] false aura of scientific infallibility, coupled with low probative value, increases resistance to admitting evidence since it multiplies the hazards of misleading a jury." *In re Agent Orange Prod. Liab. Litig.*, 611 F. Supp. 1223, 1256 (E.D.N.Y. 1985), *aff'd*, 818 F.2d 187 (2d. Cir. 1987), *cert. denied*, 487 U.S. 1234 (1988). Clearly, Mr. Hall's testimony that Plaintiff's property was damaged entirely by wind has minimal probative value when it is undisputed that Plaintiff's property was damaged by flooding in the amount of at least $250,000. However, if permitted at trial this incompatible testimony would undoubtedly confuse the issues and mislead the jury. Thus, Mr. Hall's testimony should also be excluded under Federal Rule of Evidence 403.

**CONCLUSION**

Pursuant to this Court's rulings in other Katrina cases, Plaintiff should be precluded from proffering any evidence or testimony that his property was entirely destroyed by wind, because such testimony is irreconcilable with Plaintiff's conclusive judicial admission of flood damage. As a corollary to such an order, this Court should also preclude Plaintiff's expert witness Neil Hall from testifying at trial entirely; or, in the alternative, this Court should limit the balance of his testimony, if any, to that not contradicted by Plaintiff's judicial admission of $250,000 of flood damage.

Dated: December 5th, 2008

Respectfully submitted,

s/ John A. Banahan

JOHN A. BANAHAN (MSB #1731)
MATTHEW E. PERKINS (MSB # 102353)
BRYAN, NELSON, SCHROEDER,
CASTIGLIOLA & BANAHAN, PLLC
Post Office Drawer 1529
1103 Jackson Avenue
Pascagoula, Mississippi 39568-1529
(228) 762-6631
*Attorneys for Defendant*
*State Farm Fire & Casualty Company*

## CERTIFICATE OF SERVICE

I, **JOHN A. BANAHAN**, one of the attorneys for the Defendant, **STATE FARM FIRE & CASUALTY COMPANY**, do hereby certify that I have this date electronically filed the foregoing document with the Clerk of Court using the ECF system which sent notification of such filing to all counsel of record.

DATED, this the 5th day of December, 2008.

s/ *John A. Banahan*
JOHN A. BANAHAN (MSB # 1731)
MATTHEW E. PERKINS (MSB # 102353)
BRYAN, NELSON, SCHROEDER,
CASTIGLIOLA & BANAHAN, PLLC
Post Office Drawer 1529
1103 Jackson Avenue
Pascagoula, Mississippi 39568-1529
(228) 762-6631
*Attorneys for Defendant*
*State Farm Fire & Casualty Company*

NEIL B. HALL & ASSOCIATES, LLC
BUILDING PERFORMANCE · FAILURE ANALYSIS · DAMAGE ASSESSMENT
1923 Corporate Square Boulevard, Ste. B · Slidell, Louisiana 70458
Phone 985-690-6008 · Fax 985-690-6009 · neilbhall@gmail.com

# BUILDING DAMAGE ASSESSMENT

**(Initial Report)**

**RESIDENCE OF MICHAEL F. PAYMENT**
**5012 PAYMENT LANE**
**PASS CHRISTIAN, MISSISSIPPI**

**DATE OF LOSS:**
**AUGUST 29, 2005**
**(HURRICANE KATRINA)**

**PREPARED BY:**
**NEIL B. HALL, Ph.D.**
**American Institute of Architects**
**American Society of Civil Engineers**

**REPORT NUMBER 80107**

**DATE OF INSPECTION:**
**MARCH 16, 2008**

**DATE OF REPORT:**
**MARCH 17, 2008**

## INVESTIGATIVE METHODOLOGY

The purpose of this report is to reconstruct events during Hurricane Katrina in order to determine the extent of damage caused by wind and flood. The opinions in this report are based on available evidence including analysis of weather conditions, physical data collected at the site location and the investigator's knowledge, training and experience. When available, eyewitness accounts and anecdotal evidence are considered. The report was peer reviewed for consistency of data and use of a systematic approach desirable and necessary in the analysis of building failure. Aerial photographs, maps and other data referenced but not included in this report remain on file in the project folder.

## SYNOPSIS OF WEATHER CONDITIONS

Hurricane Katrina made its third landfall at the Louisiana/Mississippi border on August 29, 2005 with sustained wind at 125 mph in the eyewall. The central pressure at landfall was 920 mb, ranking 3rd lowest on record for U.S.-landfalling storms behind Camille (909 mb) and the Labor Day hurricane that struck the Florida Keys in 1935 (892 mb).

Maximum sustained wind in the Pass Christian area has been estimated by various researchers between 125-135 mph. Maximum wind gusts for the Pass Christian area as indicated by public domain maps are 130 mph for the ARA map and 120 mph for the NOAA wind gust map (with a 15% margin of error which allows for 138 mph peak wind gusts).

Included in Attachment C is a timeline summary of sustained winds, wind gusts and storm surge inundation specifically applicable to the Payment property at 5012 Payment Lane, Pass Christian, MS. The timeline was developed by Dr. Patrick Fitzpatrick at the request of Mr. Payment. The timeline shows that wind gusts of 100 mph began as early as 0600 CDT. Storm surge peaked at 24.0 feet at 1100 CDT.

A Certificate of Elevation (see Attachment C) indicates that the adjacent grade is 9.8-10.2 feet above sea level; the top of the bottom floor (in this case the elevated bottom floor of the 2-story structure) was at 13.2 feet above sea level.

On either side of the 2-story structure (which is supported by 3' masonry piers) are slab-on-grade additions. Assuming 10' grade, Dr. Fitzpatrick's timeline indicates that storm surge reached the slab-on-grade floors shortly before 0830 CDT at the same time that 95 mph sustained wind crossed from the east (with gusts 120-130 mph). Storm surge reached the finished floor of the 2-story building shortly after 0830 CDT.

## DESCRIPTION OF BUILDING

In an on-site interview on March 16, 2008, Mr. Payment indicated that the original home was a one-story wood-framed structure on 3' masonry piers constructed prior to 1930. The house is located generally north of Bayou Portage. The original structure was rectangular with the main axis running southeast (SE) to northwest (NW). Subsequently, a second-story was added as well as one-story den with fireplace and chimney on the east side of the two-story and a sunroom and kitchen on the west side of the two-story structure. The home was covered with metal-paneled roofing prior to Katrina; the roofing was screwed to the existing roof decks which were 1x6 tongue-and-groove planking. The front of the building (facing southeast) included four masonry columns supporting a second-story balcony. The roof over the two-story was hipped; the roof over the west sunroom was a low-sloped shed roof; the roof over the east den was a gabled roof with the gable end facing northeast.

A carport was added behind the kitchen on the west side. A bathroom addition was added at the rear of the east side. A cottage, boathouse, summer house and pool also are located on the property lot.

A "Uniform Residential Appraisal Report" was reviewed. The house consists of 9 rooms including 3 bedrooms and 3 bathrooms with 3,236 square feet of gross living area. The detached cottage consisted of 981 square foot of gross living area.

## DESCRIPTION DAMAGE AND ANALYSIS

### Site Inspection Photos

Attachment B includes photos taken on March 16, 2008 consisting of photos taken of the site location and copies of photos shown by Mr. Payment. Noteworthy, the tops of trees in the tree line west of the property lot are sheared at the top and denuded of limbs and bark. Mr. Payment pointed out that most of the felled trees have been removed. During a boat ride upstream and downstream along Bayou Portage, it was noted that this tree damage only occurred immediately west of the Payment residence.

The remaining structures of the residence and cottage were removed prior to the site inspection (Photo 5). Mr. Payment was interviewed in the field at which time Photos 6-13 were taken. These photos are views of building damage.

### File Photos

Attachment B also includes file photos provided for review. The photos include a "before Katrina" photo of the house as it faced the southeast and an additional view of the east side of the house. A "before Katrina" photo of the cottage was provided showing a wood-framed structure on short masonry piers with a gabled metal roof. Other photos show the boat house and summer house.

The photo titled "Main House After" shows that the 2 eastern masonry columns fell east while the 2 western masonry columns fell southwest. The second story of the building collapsed NNE. The metal roof over the two-story building remained intact. The columns supporting the carport roof remained erect. Other photos show that the metal roof over the sunroom was transported to the southwest and the metal roof over the kitchen (or carport – it is difficult to determine which) remained attached to the structure which collapsed to the NNE. The metal roof itself is "curled" in a manner suggesting wind uplifted and pulled the roof off the deck.

One file photo shows the steep-sloped roof of a residential structure totally demolished by wind. Another shows the roof missing from the summer house. There is no evidence of foundation straps holding the two-story building to the masonry piers.

**DISCUSSION**

1) Although the Payment residence most likely was not constructed to current code requirements for hurricane resistance, the recently installed 2-story metal roof appears to have been properly installed which is why it "rode out the storm" until the structure collapsed. The roof over the east den is missing, indicating that it was removed before the collapse (otherwise it would be seen in the photos under the collapsed two-story). From this we can assume that that gable roof over the east den was removed by wind before the two-story building collapsed. We can also assume that the building interior under this roof along with building contents were destroyed by wind and water after the roof was removed. Reasonably, the brick chimney also was destroyed by east wind.

2) Reasonably it can be assumed that windows on the east side of the two-story building were damaged by wind allowing wind and water to enter the second story structure.

3) The metal roof over the west sunroom landed south of the sunroom. It is difficult to determine if the roof floated to its resting place after being removed by wind; but it is reasonable to conclude that it first was removed by wind because flood load would not have detached the roof from the building structure.

4) The curled metal roof (most likely over the kitchen) on the west side of the 2 story suggests that wind did remove that particular roof structure. This in turn suggests (a) that south wind attacked the building shortly before storm surge reached the roof level or shortly after it receded below the roof level and (b) wind gusts from this direction were strong enough to remove the metal roof.

5) Two brick columns fell southwest counter to the flow of storm surge. The best explanation for the pattern of fall is wind: wind uplifted the protruding front of the second story, relieving the gravity load on the columns and allowing lateral force of wind to push the columns southwest. While it appears that the other two columns continued to support the 2$^{nd}$ story structure until the structure collapsed NNE, from the point that wind removed two columns, the integrity of the second story structure was compromised.

6) The timeline provided by Dr. Fitzpatrick shows that wind gusts of 120-130 mph crossed from east and ESE before water reached the finished floor of the 2-story structure. This adequately explains the loss of the chimney as well as the roofs over the east den and west sunroom.

7) The most problematic part of the analysis is the question "what force pushed the 2-story building to the NNE?" It is difficult to conclude that the sole cause is flood. Hydrostatic load alone would not have collapsed the building because water rose both outside and inside the structure, equalizing the flood load. Hydrodynamic load is not a satisfactory answer because the current was low velocity current. There was little to no wave action (Dr. Fitzpatrick allows for 2 foot wave activity). There is no indication of waterborne debris impacted with a force sufficient to collapse the building structure.

8) If not flood, this leaves wind. Wind attacking from south could have pushed the building to the NNE (wind direction derived from the timeline and building orientation derived from the damage photos both leave room for a margin of error around the azimuths assumed for this report) but the reported wind gust speed at this time (90 mph) is too low to collapse an undamaged building (according to the EF Scale, a threshold wind speed of 103 mph is needed to shift a building from its foundation). However, the absence of the metal roof over the east den is a sure indication that it was removed by wind. It is reasonable to assume that the east wall of the 2-story building was damaged. To what extent it was damaged is not known (the file photo showing wind damage to a neighboring building gives an indication of what may have occurred), but it can be inferred that the building's resistance to attacking wind was weakened.

**ENHANCED FUJITA SCALE (REV 2)**
**ONE- AND TWO-STORY RESIDENTIAL DWELLINGS**
**Table 1**

| DOD* | Damage description | Exp** | LB | UB |
|---|---|---|---|---|
| 1 | Threshold of visible damage | 65 | 53 | 80 |
| 2 | Loss of roof covering material (<20%), gutters and or awning; loss of vinyl or metal siding | 79 | 63 | 97 |
| 3 | Broken glass in doors and windows | 96 | 79 | 114 |
| 4 | Uplift of roof deck and loss of significant roof covering material (>20%); collapse of chimney; garage doors collapse inward or outward; failure of porch or carport | 97 | 81 | 116 |
| 5 | Entire house shifts off foundation | 121 | 103 | 141 |
| 6 | Large sections of roof structure removed; most walls remain standing | 122 | 104 | 142 |
| 7 | Exterior walls collapsed | 132 | 113 | 153 |
| 8 | Most walls collapsed in bottom floor, except small interior rooms | 152 | 127 | 178 |
| 9 | All walls collapsed | 170 | 142 | 198 |
| 10 | Destruction of engineered and/or well constructed residence; slab swept clean | 200 | 165 | 220 |

* DOD is degree of damage **Wind Speed values are in mph

## CONCLUSION

Damage occurring due to wind can be categorized by two events:

## EVENT ONE: WIND DAMAGE BEFORE THE RISE OF STORM SURGE

1) **Prior to the rise of storm surge,** wind removed the metal roof from the one-story addition (den) on the east side of the building. Water and wind penetrating through this opening destroyed the building interior and contents in the den. The chimney most likely was destroyed by ENE/E wind with 80-110 mph gusts about 0630 CDT. The gable end

of the den most likely was slammed by 120-130 mph wind about 0830 CDT causing the wall to collapse.

2) **Prior to the rise of storm surge,** wind damaged some of the 2-story windows on the east side of the building and ceiling drywall (as seen in the file photos).

3) **Prior to the rise of storm surge,** wind removed the metal roof from the one-story addition (sunroom) and the kitchen roof on the west side of the building. Water and wind penetrating through this opening destroyed the building interior and contents in the sunroom and kitchen.

4) **Prior to the rise of storm surge,** wind removed the 1-story cottage house from its foundation and destroyed the structure.

**SUMMARY FOR EVENT ONE:**

Before the rise of storm surge to the finished floor level of the residence, the metal roofs over the 1-story sunroom and 1-story den were removed by wind. Water and wind penetrated these areas. Wind destroyed the chimney on the east side of the building. Wind broke windows on the east side of the 2-story and collapsed drywall ceilings at the 2-story. Wind collapsed two masonry columns under the protruding 2-story balcony at the front of the building. The total amount of damage caused by wind before the rise of storm surge is estimated at 50% of the value of the building; further analysis and a "stick built" estimate is required to improve this estimate. The cottage house was economically totaled by wind.

**EVENT TWO: WIND DAMAGE AFTER THE RISE OF STORM SURGE**

1) **Some time after storm surge reached the building floor,** the 2-story structure collapsed to the NNE. Flood load does not account for this collapse whether or not the building was previously damaged. Wind load does not account for this collapse if the building was not previously damaged. However, if the building had been damaged (by wind as described above) before the rise of storm surge, repetitive wind gusts of 90 mph could account for the collapse of the building structure. The carport roof which remained attached to the 2-story structure was not damaged until this point in time.

**SUMMARY FOR EVENT TWO:**

After the time that storm surge reached the building floor, the 2-story structure collapsed to the NNE. In order for the building to collapse in this manner, it is assumed that it was damaged by wind before the rise of storm surge. Although the collapse of the 2-story structure increased the total amount of damage, the amount of damage caused by Event One before the rise of storm surge already had rendered the building a total economic loss.

## ATTACHMENTS

1) Attachment A provides maps and aerial photographs.
2) Attachment B provides file photos and photos taken during the inspection.
3) Attachment C provides wind and flood data,
4) Attachment D provides biographical sketches as recommended by the ASCE Technical Council for Forensic Engineering.

**END OF REPORT 80107**

Respectfully submitted,

Neil B. Hall, Ph.D.
American Institute of Architects
American Society of Civil Engineers

Reviewed by:

Giddings Emery, P.E.
Mississippi License No. 14397

WISE CARTER
WISE CARTER CHILD & CARAWAY, P.A.
ATTORNEYS AT LAW

M. KATHLEEN SULLIVAN
JACKSON OFFICE

MKS@WISECARTER.COM
DIRECT LINE: (601)968-5566
FACSIMILE: (601)968-5519

October 31, 2008

MEP

Matthew E. Perkins, Esq.
BRYAN, NELSON, SCHROEDER, CASTIGLIOLA & BANAHAN, PLLC
Post Office Drawer 1529
Pascagoula, MS 39568-1529

RECEIVED
NOV - 1 2008
BY:

Re: Michael Payment, M.D. v. State Farm Fire and Casualty Company

Dear Attorney Perkins:

Enclosed is a copy of Dr. Neil Hall's final Supplemental Building Damage Assessment Report on Dr. Payments property. We have filed a Notice of Service regarding same today.

Sincerely,
WISE CARTER CHILD & CARAWAY, P.A.

Kathy Sullivan
Kathy Sullivan
Legal Assistant

Encl.

# NEIL B. HALL & ASSOCIATES, LLC

BUILDING PERFORMANCE · FAILURE ANALYSIS · DAMAGE ASSESSMENT
1923 Corporate Square Boulevard, Ste. B · Slidell, Louisiana 70458
Phone 985-690-6008 · Fax 985-690-6009 · neilbhall@gmail.com

## BUILDING DAMAGE ASSESSMENT

**(Supplemental Report)**

**RESIDENCE OF MICHAEL F. PAYMENT**
**5012 PAYMENT LANE**
**PASS CHRISTIAN, MISSISSIPPI**

**DATE OF LOSS:**
**AUGUST 29, 2005**
**(HURRICANE KATRINA)**

**PREPARED BY:**
**NEIL B. HALL, Ph.D.**
**American Institute of Architects**
**American Society of Civil Engineers**

**REPORT NUMBER 80107**

**DATE OF INSPECTION:**
**MARCH 16, 2008**

**DATE OF REPORT:**
**MARCH 17, 2008**

**DATE OF SUPPLEMENTAL REPORT:**
**OCTOBER 28, 2008**

## DRAFT SUPPLEMENTAL REPORT

Dr. Michael F. Payment was re-interviewed on October 6, 2008 at the property location in Pass Christian. Additionally, information received subsequent to the Initial Report was received and reviewed. The purpose of this Supplemental Report is to integrate all newly received information into the findings, discussion and conclusions of the Initial Report. Attachments in the Initial Report not included in this Supplemental Report (referred to simply as "this Report") are incorporated by this reference.

Information reviewed subsequent to the Initial Report includes:

1) Assessment of Wind, Rain, and Storm Surge Flooding During Hurricane Katrina by Barry D. Keim, PhD.
2) Analysis of Probable Cause of Damage in Hurricane Katrina to the Payment Residence by David L. Kriebel, PhD, PE.
3) Investigation Concerning the Cause of Damage by Dr. Forrest Masters.
4) Structural Analysis of the Payment Buildings by Jenkins Engineering.
5) Deposition of Dr. Payment, September 9, 2008.

## INVESTIGATIVE METHODOLOGY

The purpose of this report is to reconstruct events during Hurricane Katrina in order to determine the extent of damage caused by wind and flood. The opinions in this report are based on available evidence including analysis of weather conditions, physical data collected at the site location and the investigator's knowledge, training and experience. When available, eyewitness accounts and anecdotal evidence are considered. The report was peer reviewed for consistency of data and use of a systematic approach desirable and necessary in the analysis of building failure. Satellite images, maps and other data referenced but not included in this report remain on file in the project folder.

## SYNOPSIS OF WEATHER CONDITIONS

Hurricane Katrina made its third landfall at the Louisiana/Mississippi border on August 29, 2005 with sustained wind at 125 mph in the eyewall. The central pressure at landfall was 920 mb, ranking 3rd lowest on record for U.S.-landfalling storms behind Camille (909 mb) and the Labor Day hurricane that struck the Florida Keys in 1935 (892 mb).

Maximum sustained wind in the Pass Christian area has been estimated by various researchers between 125-135 mph. Maximum wind gusts for the Pass Christian area as indicated by public domain maps are 130 mph for the ARA map and 120 mph for the NOAA wind gust map (with a 15% margin of error which allows for 138 mph peak wind gusts).

Included in Attachment C (initial report) is a timeline summary of sustained winds, wind gusts and storm surge inundation specifically applicable to the Payment property at 5012 Payment Lane, Pass Christian, MS. The timeline was developed by Dr. Patrick

Fitzpatrick at the request of Mr. Payment. The timeline shows that wind gusts of 100 mph began as early as 0600 CDT. Storm surge peaked at 24.0 feet at 1100 CDT.

A Certificate of Elevation (see Attachment C, Initial Report6) indicates that the adjacent grade is 9.8-10.2 feet above sea level; the top of the bottom floor (in this case the elevated bottom floor of the 2-story structure) was at 13.2 feet above sea level.

On either side of the 2-story structure (which is supported by 3' masonry piers) are slab-on-grade additions. Assuming 10' grade, Dr. Fitzpatrick's timeline indicates that storm surge reached the slab-on-grade floors shortly before 0830 CDT at the same time that 95 mph sustained wind crossed from the east (with gusts 120-130 mph). Storm surge reached the finished floor of the 2-story building shortly after 0830 CDT.

## DESCRIPTION OF BUILDING

### As stated in Initial Report:

In an on-site interview on March 16, 2008, Mr. Payment indicated that the original home was a one-story wood-framed structure on 3' masonry piers constructed prior to 1930. The house is located generally north of Bayou Portage. The original structure was rectangular with the main axis running southeast (SE) to northwest (NW). Subsequently, a second-story was added as well as one-story den with fireplace and chimney on the east side of the two-story and a sunroom and kitchen on the west side of the two-story structure. The home was covered with metal-paneled roofing prior to Katrina; the roofing was screwed to the existing roof decks which were 1x6 tongue-and-groove planking. The front of the building (facing southeast) included four masonry columns supporting a second-story balcony. The roof over the two-story was hipped; the roof over the west sunroom was a low-sloped shed roof; the roof over the east den was a gabled roof with the gable end facing northeast.

A carport was added behind the kitchen on the west side. A bathroom addition was added at the rear of the east side. A cottage, boathouse, summer house and pool also are located on the property lot.

A "Uniform Residential Appraisal Report" was reviewed. The house consists of 9 rooms including 3 bedrooms and 3 bathrooms with 3,236 square feet of gross living area. The detached cottage consisted of 981 square foot of gross living area.

### Additional Information from Dr. Payment Interview and Deposition:

Dr. Payment stated the original structure may have been built in the 1800s and purchased by family members in 1930. In 2003, metal roofs were installed on the existing one-story additions. Trusses were added over the flat roof of the sun room and the den to provide additional slope. Dr. Payment asked Mr. Gene Mitchell, the roofer, to build a second story over the existing one-story original building. The rafter connections of the second story were strapped but there is no indication that a load-path connection was established between the new second story and existing first story, making that connection the weakest connection in the building structure. At the same time, the bearing wall between the one-story and the den was removed and apparently replaced with a beam and two slender columns. The bearing wall between the one-story and the sun room was removed and apparently replaced with a beam without column support. The interior stairwell wall was cut back.

## REPORT BY DR. KEIM

Assessment of Wind, Rain, and Storm Surge Flooding During Hurricane Katrina (May 2008) by Dr. Barry D. Keim, PhD was reviewed subsequent to the Initial Report. The following comments pertain:

1) Dr. Keim offers a timeline compiled from the Army Corps of Engineers IPET report (for New Orleans), "POST STORM Assessment of the Hurricane Research Division of the Atlantic Oceanographic and Meteorological Laboratory (sustained winds) and (for the time of maximum sustained wind) "other [uncited] sources". The timeline is reproduced below.

**TIMELINE OF WIND AND STORM SURGE (KEIM)**

| Time LDT (UTC) 29 August 2005 | 5012 Payment Lane, Pass Christian, Mississippi | | | |
|---|---|---|---|---|
| | Wind Speed, in knots | Wind Speed, in mph | Wind Direction | Surge |
| 0100 (0600) | 38 | 44 | NE | |
| 0200 (0700) | | | | 5 |
| 0300 (0800) | | | | |
| 0400 (0900) | 48 | 55 | ENE | |
| 0500 (1000) | | | | 7 |
| 0600 (1100) | | | | 8 |
| 0700 (1200) | 74 | 85 | E | 10 |
| 0800 (1300) | | | | 10 |
| 0900 (1400) | | | | 15 |
| 0945 (1445) | 89? | 102* | | |
| 1000 (1500) | 88 | 101 | SSE | 21 |
| 1100 (1600) | | | | 25 |
| 1200 (1700) | | | | 24 |
| 1300 (1800) | 54 | 62 | SSW | |
| 1400 (1900) | | | | |
| 1500 (2000) | | | | 14 |
| 1600 (2100) | 43 | 49 | SW | |
| 1800 (2300) | | | | 8 |

2) In reference to the Texas Tech towers, Dr. Keim uses the raw data reported immediately after Katrina: "At Stennis, measured data show sustained winds of only 67 mph, whereas AOML maps are closer to 97 mph. At Slidell, Texas Tech measured wind data show a 1-minute sustained wind of 69, while AOML suggests a value closer to 87 mph." This raw data (Giammanco, Schroeder & Hirth, 2006) was corrected to Exposure C (Giammanco, Schroeder & Hirth, 2007) giving 90.1 mph sustained for Stennis (112.8 mph

3-second gust) and 78.6 mph sustained for Slidell (98.5 mph 3-second gust). Although Dr. Keim does not avail himself of this data, using other data he concludes that the maximum 1-minute sustained wind in the vicinity of 5012 Payment Lane was 102 mph, with a higher 3-second gust near 122 mph.

3) Dr. Keim states he has "interacted with personnel from the NWS [over the issue of tornado damage in Mississippi], and there were efforts on their behalf to investigate tornado claims, though obviously none were formally filed. Dr. Keim does not say who he spoke to at the NWS, who exactly investigated tornado claims "on behalf" of NWS personnel nor what were the preliminary findings of these (trained or untrained?) field investigators. Leaving these questions unanswered, he provides a satellite image of a 2003 tornado track in Oklahoma City and opines that "no tornado tracks like this were documented anywhere in the coastal counties of Mississippi". Certainly not! The clarity of a tornado track (which one would expect to find in Oklahoma City) was destroyed by the large-scale pattern of tree damage and flood debris which followed.

4) Dr. Keim states that the ground elevation at 5012 Payment Lane was "approximately 8 feet". A Certificate of Elevation referenced in my Initial Report indicates that the adjacent grade is 9.8-10.2 feet above sea level and the top of the bottom floor (in this case the elevated bottom floor of the 2-story structure) was located at 13.2 feet above sea level.

5) Dr. Keim states that "regional estimated surge" was 23-24 feet above mean sea level and the closest FEMA-measured outdoor high water mark was 24.1 feet above mean sea level. (My Initial Report assumed 24 feet above mean sea level.) Dr. Keim places initial flood inundation at 0600 LDT (which is CDT) at which time 1-minute sustained wind was "hurricane strength" (i.e. minimally 75 mph). Dr. Keim states that peak storm surge occurred at 1100 LDT according to the IPET report, but notes that the IPET estimate of surge height was higher than "a nearby measured high water mark". What he means to say is that the IPET estimated 25 feet while the nearest water mark says 24.1 feet. Dr. Keim claims that if storm surge reached "near 24 feet" then the property (assuming an elevation of about 8 feet) was inundated with "near 16 feet of water". Correcting for errors in ground elevation, more likely storm surge rose between 13.9-14.3 feet above the adjacent grade. Only 10.9 feet of water rose above the finished floor at the bottom level of the 2-story section.

**REPORT BY DR. KRIEBEL**

Analysis of Probable Cause of Damage in Hurricane Katrina to the Payment Residence by David L. Kriebel, PhD, PE. was reviewed subsequent to the Initial Report. The following comments pertain:

1) Dr. Kriebel correctly calibrates the Elevation Certificate showing 9.8-10.2 ft NGVD to 9.9-10.3 ft NAVD88. This also places the finished floor elevation of 13.2 ft NGVD (13.3 ft NAVD88). Dr. Kriebel assumes that the second floor elevation was 23 ft and the first floor elevations at den and sun room were 12 ft.

2) Dr. Kriebel notes that the guest house was a one-story ranch-style home elevated roughly 2 feet above grade. He assumes that the floor elevation was located at 12 ft and the roof at about 20 ft.

3) Dr. Kriebel states that maximum sustained wind peaked at 104 mph and storm surge peaked at 25 ft NAVD88.

4) Dr. Kriebel notes that large sections of the carport roof were "peeled back or flipped over" in a direction "opposite to, or at a large angle to, the peak wind directions". He states that the only wind directions that can explain the direction that these roof panels moved are those that occurred during the waning of the storm.

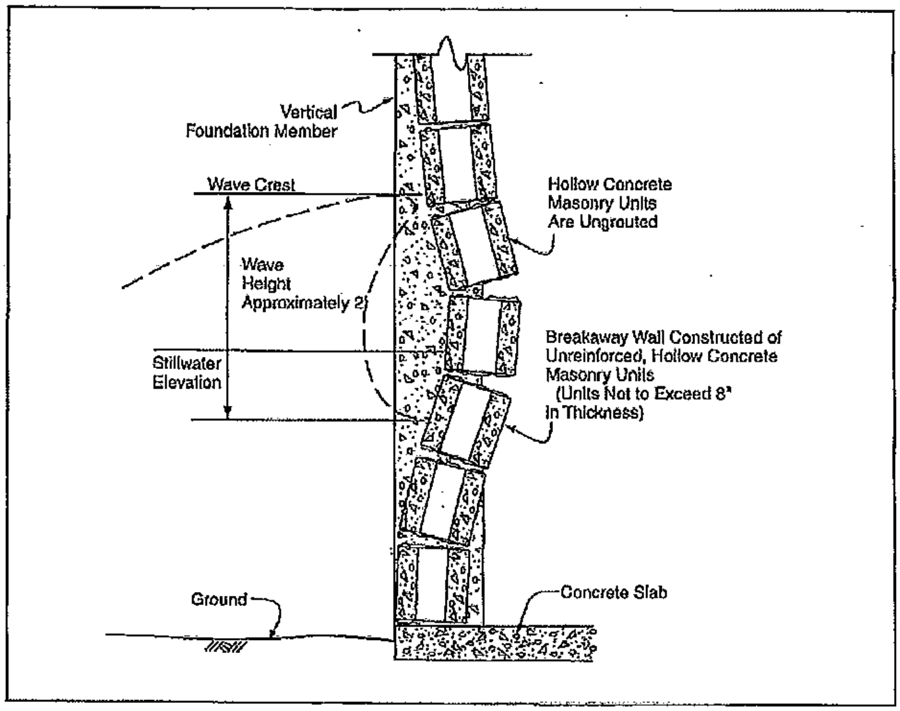
5) Dr. Kriebel notes that a large section of the sun room remained upright and was found a short distance ("in an up-wind direction") southwest of the home. This is in agreement with the Hall Initial Report, but as Jenkins points out, Payment 00099 photo shows the sun room roof still attached to the main structure – that is if Jenkins is correct that the kitchen roof was gabled.

6) Dr. Kriebel argues that the photographs show that wind was not strong enough to cause major damages to the building envelope of the second floor because the "strongest section of the house was at the highest elevation".

7) Dr. Kriebel indicates that only one window on the right side of the second floor survived intact and that "the only major window loss on the second floor occurred to the front left corner, the region that would have [been] subjected to both hurricane-strength winds and waves".

8) Dr. Kriebel argues that the second floor was raised vertically by buoyancy "and then drifted as a unit on the flood waters to the north or northeast, coming to rest well off its original position". In the next paragraph he argues that the flooring of the central section of the home also was lifted vertically off its foundation supports. Since this would have occurred before the second story could raise vertically from the first story, there is problem with the time sequence. If the first story floated, why didn't it clear the debris on the east side of the building? Why (instead) is the first story destroyed? If the first story was destroyed by waves, why didn't it collapse to the west or north, taking the second story with it? If the second story floated off the first story, how did this happen when buoyancy would have lifted both stories together? Kriebel's argument begs too many unanswered questions.

9) Dr. Kriebel argues that the sun room brick fell outward to the southeast "counter to the wind direction". Anticipating the question "didn't they also fall counter to the direction of surge?", Dr. Kriebel argues that because "waves are cyclic and oscillatory", they load a wall...in both the direction of wave advance and in the opposite direction". The argument is flawed. Why didn't this mode of failure occur at the den where even the fireplace collapsed in the direction of wind? If wave action collapsed the wall (there is reason to believe it did not) then why didn't at least the lower portion of the brickwork collapse inward as suggested by FEMA 55 Coastal Construction Manual (see figure below). Unless Dr. Kriebel is arguing that after impacting the wall, receding waves created a negative pressure coefficient which sucked the brick outward (an argument however which can be made for wind), his argument only is valid if waves attacked the wall from both sides. There is no compelling reason to believe that waves attacking the sun room wall could have collapsed all the brick outward as seen in photographic evidence.




**"Expected failure mode" of unreinforced masonry breakaway wall (FEMA 55)**

10) Dr. Kriebel notes that "large pine trees were uprooted or snapped...tall trees have been decapitated and snapped at an elevation well above the ground level...remaining trees have been denuded and stripped of small limbs and foliage". He then states that "it is clear that winds [north and west of the Payment home] were more violent than those to the north *(sic)* and east of the home". (This ambiguous reference to "north" on p. 12 may not be a typo as it occurs again on p. 14). He further states that "while most downed trees fell to

the west and northwest, in the direction of the strongest winds, many trees were downed at other angles and indicate winds with high levels of direction spreading and turbulence". This is correct. What Kriebel fails to say is that the pattern of wind damage is typical of tornadic and microburst activity (the latter bringing high wind speed to surface level, notwithstanding Dr. Kriebel's final comment that snapped trees indicate "higher speeds aloft and lower speeds near ground level". Dr. Kriebel concludes that "the main home was therefore in a transition area between...two wind regimes [of different wind speed]". If true, a major characteristic of this "transition area" would be turbulent and rotational wind

11) Although he concedes that the cottage was located closer to the areas of more severe tree damage indicating "a higher probability of wind damage to the cottage than to the main house", he cannot "state with certainty" whether the cottage collapse was caused by wind or flood because in addition to the proximity of "localized severe winds" the cottage was "completely overtopped by the surge". Although severe wind preceded the surge, Dr. Kriebel still makes no attempt to arrive at a conclusion based – not on "certainty" – but "more likely than not".

12) Dr. Kriebel notes that the bayou "opens sufficiently to have allowed modest wave action to approach the home" but makes no attempt to quantify significant wave height. He argues that when surge submerged low trees an "open fetch" would have extended to the southwest allowing wind to generate waves which would have impacted the home site. Dr. Kriebel does not discuss the fact that wind-stressed waves are not only height-limited but time-limited. There was limited time after wind changed direction for ~50 mph 1-minute sustained wind to "build" wave height. Kriebel uses the Army Corps of Engineers Shore Protection Manual (1984) which is out of print. The new Corps of Engineer manual is EM 1110-2-1100 Coastal Engineering Manual (2006). The calculations which Dr. Kriebel made based on the Shore Protection Manual have not been made available for review. It is unclear if his wave height of 1-2 feet considers vegetative marsh and whether waves approaching from the southwest would have broken over the bulkhead.

13) Dr. Kriebel provides information such as wave frequency = 2.9 seconds. The source of this information is unclear. However, a frequency of 2.9 seconds allows for the push of only a small amount of water in front of the wave crest. As FEMA 55 points out "the duration of the wave pressures and loads [although substantial] is brief; peak pressures probably occur within 0.1 to 0.3 second after the wave breaks against the wall". Waves did not "crash" against the building, rather they involved small instantaneous loads and relatively small amounts of water.

14) Dr. Kriebel states that wave height $H_{10}$= 1.7 ft occurred at the time of peak wind (1000 CDT) and since surge rose to 22 ft [above mean sea level] at this

time, then these waves attacked the roof line of the ground floor areas (den, sun room and guest house) and the base of the second floor.

15) Dr. Kriebel's use of ASCE 7 must be understood in the context that ASCE 7 is a design manual inherently conservative in its application of load factors.

16) The argument that ground floor levels always experience wind speeds lower than at a higher building height is generally true for straight-line wind. For turbulent wind and wind delivered to a site by downburst activity this may not be true. It is also important to consider, in relation to load factors, the resistance factors of the building structure. For example, if the roof is designed to withstand lateral force generated by 130 mph wind and the unreinforced brick wall is designed only to withstand lateral force generated by 80 mph wind, the resistance factors overweigh the load factors in determining the mode of failure. In the case of the Payment residence, the ground floor walls of unreinforced masonry brick were weaker than the upper floor building envelope.

17) Dr. Kriebel refers to a "Kevin Abraham video" which shows a home which floated off its foundation, presumably a masonry pier foundation. The location of the home is not provided but it is assumed that the home is closer to the Mississippi Sound than the Payment residence. Dr. Kriebel uses the video to show that the house floated about 10 minutes before it stopped floating. The video also shows that (a) the house adjacent to it never floated and (b) the house that floated was not destroyed by waves. Dr. Kriebel seems to be arguing that the Payment residence was watertight (if not, the utility of the Abraham video is null). If the Payment residence was watertight and achieved buoyancy, how did waves destroy the lower story? And if waves destroyed the lower story, would not the upper story have collapsed directly on top of the lower story? And if waves did not destroy the lower story, are we to assume that they pushed the upper story to the northwest in the absence of a current velocity?

18) Dr. Kriebel uses charts that predict wind and wave pressures acting on the Payment residence and quotes ASCE-7 to the effect that "the magnitude of wave forces...acting against buildings or other structure can be 10 or more times higher than wind forces or other forces during design conditions. Thus is should be readily apparent that elevating above the west crest elevation is crucial to the survival of buildings and other structures". However, it appears that the buildings in the Abraham video survived. For that matter, practically every building in St. Bernard Parish, Louisiana (which took 8-12 feet of flood water) survived. One reason that waves did not destroy the Payment residence is because they were 0.5-1.0 feet in height (see Fitzpatrick). Another reason is that the current velocity was minimal – to the extent that Dr. Kriebel himself decides not to consider hydrodynamic load due to current velocity (see page 40).

19) Dr. Kriebel notes that "there are no direction measurements of waves acting near the Payment home during Hurricane Katrina. The IPET report predicted wave fields for the Mississippi Sound and St Louis Bay, but these do not extend to the bayous or tidal tributaries. As a result, there are no published estimates of wave heights for a setting like that at the Payment residence" (page 29). To the contrary, the IPET report does display wave field data for the bayous. However, the scale and color resolution on the IPET report (Vol IV, Figure 38) makes it difficult to grab information concerning St Louis Bay and its bayous.

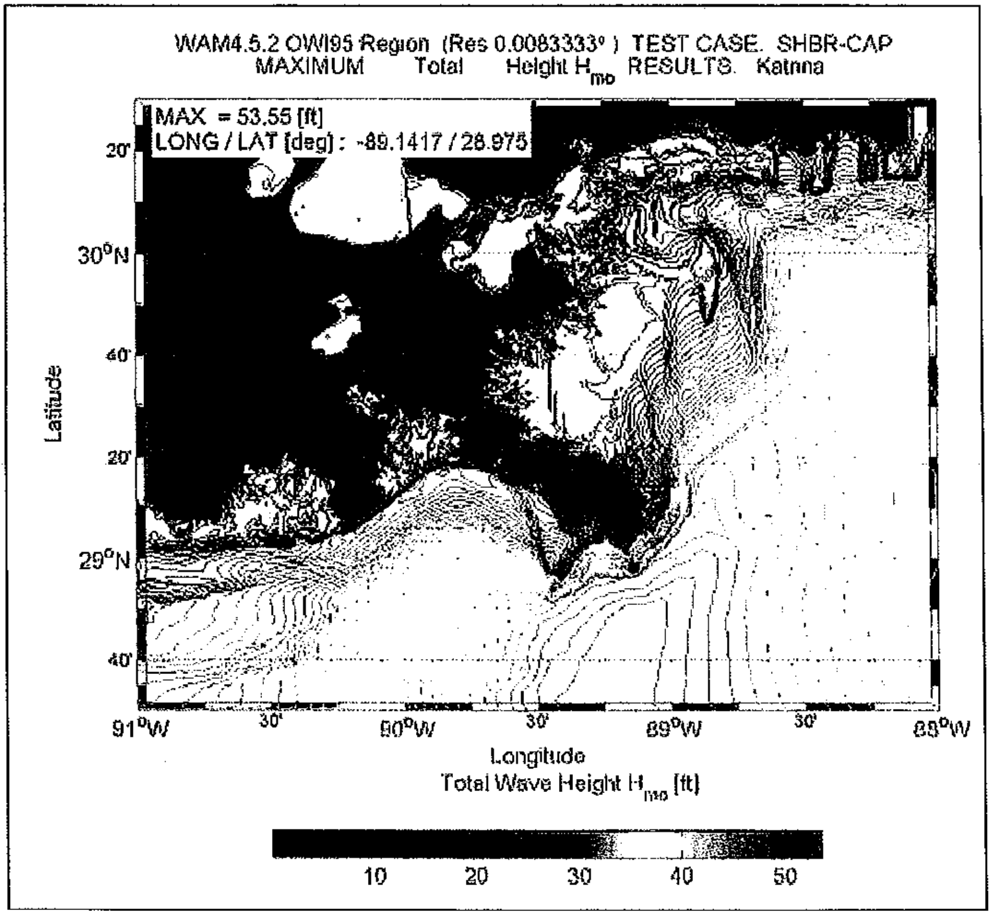



Figure 38. Color contour of the maximum wave height conditions in the region domain.

**WAVE FIELD DATA FOR BAY ST LOUIS AS FOUND IN IPET**

20) Figure 30 in the Kriebel report (below) shows a detailed prediction of wave height over time. The source of this data is unclear. Similar presentations of wave height appear in reports authored by Dr. Kriebel for the Jourdan River Estates on the south shore of St Louis Bay, in which case Dr. Kriebel relied on ADCIRC and SWAN models provided by Dr. Don Slinn from the University of Florida. For example, his analysis for the Tully Residence at 105 Edith

Drive, Bay St Louis, MS (dated September 14, 2007) states that "Detailed estimates of wind speeds, water levels, and wave conditions at the Farrell site have been provided by Professor Don Slinn from the University of Florida. Professor Slinn uses the same wind fields used in the IPET study, applies the same storm surge model used in the IPET study (ADCIRC), and applies a refined shallow water wave model (SWAN) which is similar to the models used in the IPET study. Professor Slinn provides wind speeds, water levels, and wave conditions at 15 minute intervals, in contrast to coarser the 3-hour intervals for IPET winds and 1-hour interval for IPET storm tides." It is unclear if Slinn's model contains information useful to the analysis of the Payment residence and if so, if this information was used by Dr. Kriebel.

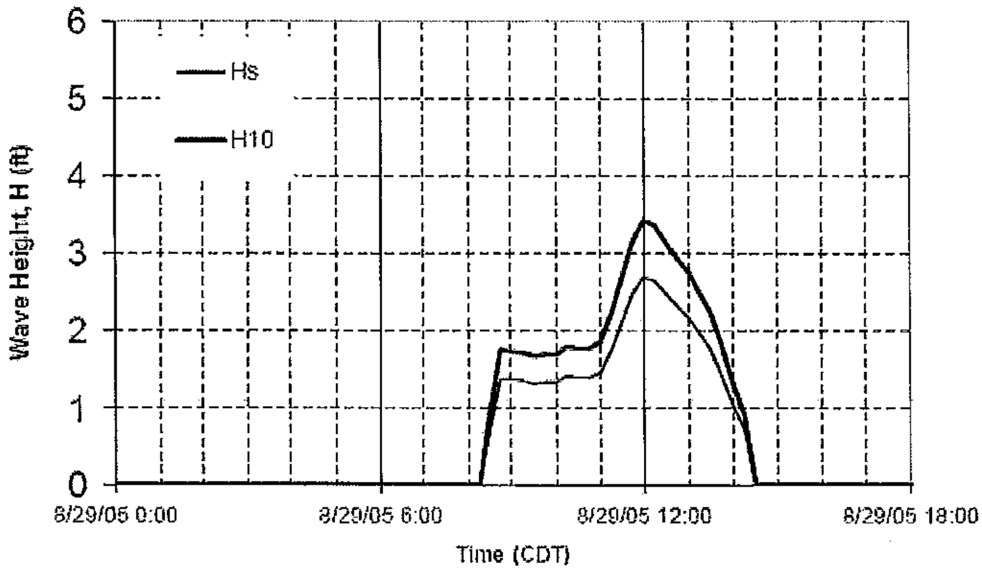


Figure 30. Predicted wave heights at Payment residence

21) On pages 44-45, Kriebel assumes for a hypothetical calculation the assumption that a 160 mph wind with 200 mph gusts is needed to cause structural collapse, because the Saffir-Simpson scale correlates structural collapse with a Category 5 wind speed. The premise is false. The following is a quote from an interview with Dr. Simpson that first appeared in NWS Mariners Log, April 1999:

"The scale as devised, expresses what the extreme conditions can be expected from a hurricane of a certain type and a certain category. It doesn't mean that everyone that a hurricane moves over, and the worst part of that hurricane, is going to receive that kind of damage or that kind of hazard. In other words, it's a study in probabilities-the probability of being hurt. And why is that? It's a great big storm, why isn't there a uniform amount of damage that you get? And if you've ever surveyed damage after a hurricane you know that one block of houses may be almost totally destroyed, and two blocks to either side there will be little damage at all. It's almost like a tornado. It's not a tornado, but what is happening is it's not a uniform bowl of pudding that's circulating around here. It's something that has lots of streaks in it, and the streaks are made by the cumulus clouds that are embedded in this great big storm. And as these cumulus clouds circulate around, they're relatively small. Some of them are no more than a couple of kilometers across and maybe four of five kilometers long. That means that just a few blocks to one side or to the other side of where this cumulus cloud is providing the extreme wind, you have much less than the extreme, and therefore get no damage at all that's comparable on either side of it. So, there are several problems. The problem is first, expressing to the people who have to leave that it's a matter of probabilities, but if they don't believe that they're going to be in the worst sector and receive the worst damage or hazard, then they're playing Russian Roulette. They have to assume the worst and act accordingly. Others are engineers who brag about the fact that the house or building that they engineered received no damage, and another engineer whose building received a lot of damage tries to explain why it did, because he knows he engineered it right. There isn't that understanding, and it's difficult to understand that it's the difference in the hurricane, not the difference in the engineering that caused the difference in the amount of damage received."

From this interview, it is clear that Dr. Simpson had no intention for the scale to be used in the manner proposed by Dr. Kriebel.

22) Dr. Kriebel cites ASCE-7 to the effect that the magnitude of wave forces acting against buildings or other structures "can be 10 or more times higher than wind forces or other forces during design considerations". The operable words in this assertion are "can" and "during design considerations". For example, designers assume out of an abundance of caution that all wave forces against a building shall be breaking waves. That does not mean that during the course of a specific hydraulic event that a building will be or has been subject to breaking waves. And it does not mean that wind force can be trivialized. In testimony before the House Committee on Science (October 11, 2001) Dr. Stephen L. McCabe, Professor and Chair of the Department of Civil, Environmental & Architectural Engineering at the University of Kansas, said:

"Little is known about the structure of the wind in a hurricane and how it changes as it passes over land. ...The design wind speed and gust factors used in all building codes and standards (including ASCE-7) are based on a set of assumptions that hurricane winds have similar properties to winds from other events, which we know to be untrue".

This was said in 2001 and the Profession has made remarkable gains since then. However, the Payment residence was built long before 2001 at a time when the set of assumptions for building construction did not properly account for the actual behavior of hurricane wind.

23) Concerning the second story, Dr. Kriebel concedes that wind loading at the second story was more robust than suggested by wind analysis for the lower floor. Dr. Kriebel already has suggested that as water covered vegetation this opened a wider fetch. It also reduced surface roughness allowing wind speed to increase. In considering scenarios for damage to the second floor, Dr. Kriebel does not consider damage due to wind preceding the collapse. Concerning the roofs, while the metal roofs were installed at the same time, the roof/wall connections at the second story were modern connections while

the roof/wall connections at the first story were older, less wind-resistant. This important fact is not discussed in the Kriebel report.

24) Dr. Kriebel's entire criticism of my report is based on the assumption that the structural integrity of a building originally constructed in 1930 could resist wind loads to the same degree as assumed in his design calculations. This is not true. Also, Dr. Kriebel's hypothesis that buoyancy separated the second floor from the first floor is problematic, since he also has the first floor floating off the foundation.

**REPORT BY DR. MASTERS**

Investigation Concerning the Cause of Damage by Dr. Forrest Masters was reviewed subsequent to the Initial Report. The following comments pertain:

1) Dr. Masters estimates that the subject project property experienced open terrain 125-130 mph wind gusts. As previously noted, Dr. Kriebel attacked my use of "unsubstantiated wind speeds" of 125-135 mph, although I cited Dr. Fitzpatrick with 130 mph gusts and the NOAA wind speed map with 138 mph gusts.

2) Dr. Masters allows for open exposure 115 mph wind gusts in advance of storm surge at 0900 CDT.

3) Dr. Masters conducted a survey (I assume from satellite imagery) of 490 single family homes "above the surge wrack line" and concluded that 92% of the houses had lost 0-20% of the roof covering. The problem with the analysis is that it excludes from consideration buildings "below the surge wrack line", i.e. it ignores the probability that buildings were damaged by wind before they were subsequently destroyed by storm surge. As pointed out in NOAA's Post Storm Data Acquisition Aerial Wind Mapping Mission for Hurricane Ivan (2004):

   "Ivan's storm surge, and its associated damage, increased the uncertainty of the wind estimates along the coastline. Considering these uncertainties, [aerial wind mapping] analysis should be considered as only one input to a final wind analysis of Hurricane Ivan."

4) Regarding the use of the EF Scale as a means to estimate damage:

   a) I am aware of the biographies of the experts who participated in the EF project. I have full respect for their opinions; however no one expert speaks for the community of wind engineers.

   b) It should be remembered that the purpose of the EF Scale was to enhance the original Fujita Scale. The original scale – albeit Fujita in his Memoirs amended the scale to include building damage indicators -- was first proposed by Fujita in 1971 under the title "Proposed characterization of tornadoes *and hurricanes* by area and intensity" (Satellite and Mesometeorology Research Project Report 91, the University of Chicago, 42 pp.) [italics added]. In fact, the citation is referenced in the EF Scale report.

c) Tim Marshall (Lessons learned from analyzing tornado damage,1993) informs us "Damage surveys by McDonald and Marshall (1983) after tornados and Savage (1984) after hurricanes have revealed the same types of building response regardless of the phenomenon creating the wind."

d) Arguably one important difference between tornados and hurricanes exists. The translational velocity of a Plains tornado is 30-60 mph; a typical Plains tornado crosses a suburban property lot in 2-5 seconds. Phan and Simiu (1998) found that the 1997 Jarrell, TX tornado which wiped residences from their foundation slabs traveled slowly at 5-10 mph and concluded that the tornado was not an F5 event with tornadic winds between 261-318 mph as originally calculated but rather an F3 event with tornadic winds between 158-206 mph. From this it is concluded that wind events of longer duration result in greater damage to building structures than the same wind events of shorter duration (Marshall, 2002). Since Hurricane Katrina wind attacked most coastal residences for hours before the arrival of storm surge during which time hundreds if not thousands of debilitating wind gusts impacted the building structure, it follows that the wind speeds used in the EF-Scale (which are based on empirical observations of tornado damage) represent 3-second wind gust speeds higher than those necessary to cause equivalent building damage during a hurricane with repetitive gusts.

e) Masters offers an additional critique that a tornado creates sudden violent loads in a few seconds while turbulent hurricane wind rides on a mean wind speed that fluctuates for hours. In a previous deposition testimony on August 22, 2008 a State Farm attorney asked me to assume that Tim Marshall had written a paper on this very subject, concluding that the EF Scale could be used for hurricane analysis if the wind speeds were changed by a factor to account for the violent rate of change of tornadoes. I replied (a) Tim Marshall has written two post-Katrina papers in which he used the EF Scale for hurricane analysis and neither one mentioned this factor, (b) I am aware of the sudden load requirement (rate of pressure change) as used in the design of nuclear power plants, it is generally ignored by ASCE-7 for residential and commercial structures because equalization generally is achieved because the interior compartments are not airtight, (c) further I am aware of the problem of rate of pressure change by virtue of training courses in Nuclear Blast design and (d) the invocation of sudden loading for residential structures sounds remarkably like the "myth of exploding buildings" laid to rest by FEMA and accepted by most researchers and practitioners. If there is any new research on this matter, I request that such research be presented for review at this time.

f) Dr, Masters argues that the EF Scale damage is attuned to the application of a given wind speed at a particular component on the building structure. This does not appear to be correct. For example, the residential degrees of damage discuss damage at the top of a two-story building and at the bottom of an overhead garage door in the context of the same wind speed. The sophistication that Dr. Masters wishes to apply to the EF Scale does not seem to have been embedded in the EF Scale by the experts who developed the methodology.

g) I note that Dr. Masters makes no specific attack that the EF Scale cannot be used in what has been called the "reverse application", i.e. using a given wind speed to determine the degree of damage for a structure not available for investigation. I further note that HURRTRACK (a software program designed for Emergency Managers) now allows users to determine damage predictions using the EF Scale Degree of Damage indicators for residential construction as opposed to the Saffir-Simpson description of damage.

5) Dr. Masters attempts to correct wind gust speed for a variety of factors. It is difficult to follow his text because the graph reviewed was in black-and-white and the text refers to color lines. He points out that the area surrounding the Payment residence is not "open terrain", but in fact as shown by Dr. Kriebel's Figure 32 (below), wind at 0600 CDT crossed a 2,000+ ft wind fetch with water +6.8 feet above sea level. Arguably not only was this an area of Exposure C, but the reduction of drag coefficient (a water surface with little to no waves) may have approached Exposure D (in reality if not by the rules of ASCE-7). The assessment assumes straight-line wind and not turbulence or downburst activity as proposed by Dr. Fitzpatrick.

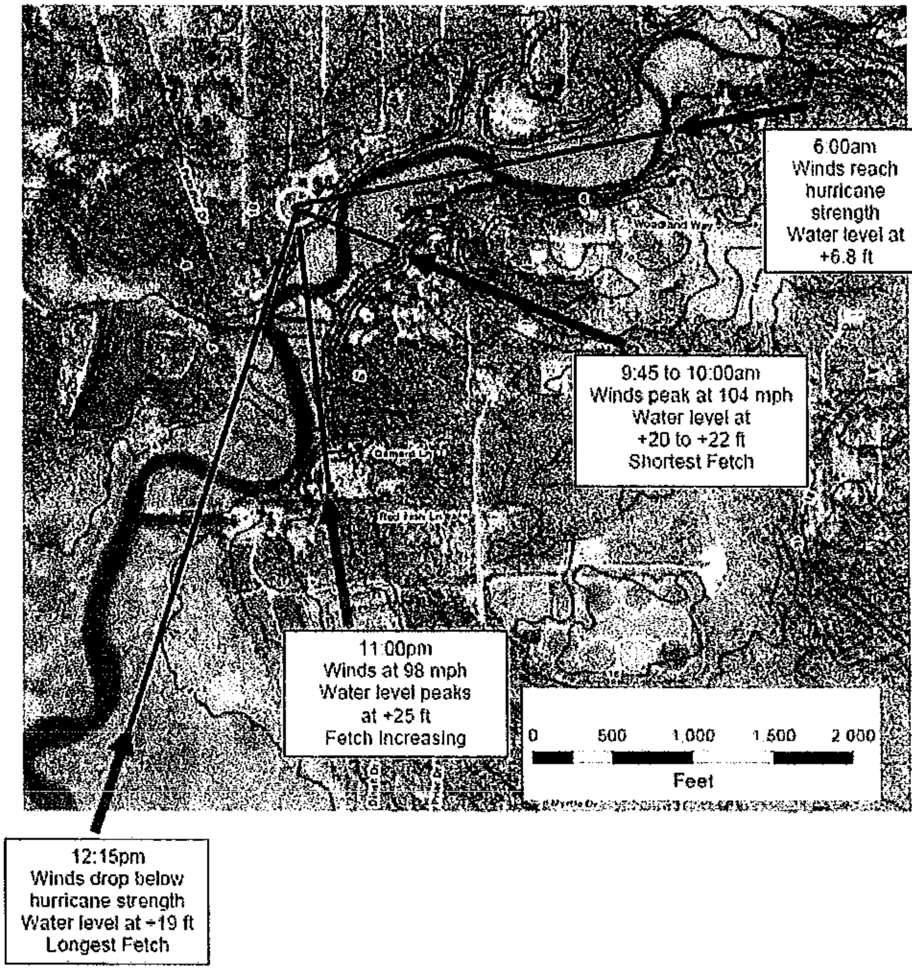



Figure 32. Timeline of wind and water level, showing wind direction and fetch for wave generation.

## REPORT BY JENKINS ENGINEERING

Structural Analysis of the Payment Buildings by Jenkins Engineering was reviewed subsequent to the Initial Report. The following comments pertain:

1) Jenkins incorporates wind speed information and storm surge "effects" from Dr. masters and Dr. Kriebel.

2) Jenkins states that the 1999 Standard Building Code "has been the predominant building code in Mississippi until recently". This is debatable. Unincorporated Hancock County enforced NO code before Katrina. Tupelo – where Jenkins maintains its headquarters – enforced the 1997 Standard

Building Code. It has not been determined what code, if any, was enforced in unincorporated Harrison County and Pass Christian.

3) Commenting on my Initial Report, Jenkins notes that the home survived Camille without referencing local wind speeds and storm surge conditions.

4) Jenkins indicates that the den roof is located under the debris. The reference photo in the report (Figure 13) is a close-up showing no more than one rafter (which actually may be the floor joist under the second-story of the adjacent framing) and about 6 bricks. Several more bricks are seen in Jenkins Figure 14.

5) Photos of the east side of the two-story building were not available for review at the time of the Initial Report. Jenkins is correct that my assumption that "windows" on the east side were damaged by wind is exaggerated. There is only one broken window pane on the east side and my assumption incorrectly assumes at least two.

6) It was unclear, even in conversation with Dr. Payment, if the curled roof was over the kitchen or the carport. However, upon re-evaluating the photos, it appears that Jenkins is correct: the curled roof is over the carport.

7) Jenkins states that the metal roof I refer to a sun room roof (located southwest of the structure) actually belongs to another structure. This is interesting because Dr. Kriebel (page 11) states "a large portion of the sunroom roof remained upright and was found a short distance southwest of the home". On this issue I originally agreed with Dr. Kriebel's position. It is not clear which roof is which, although the hip cut on the roof section southwest of the main residence doesn't seem to "fit" anywhere with the as-built condition. Jenkins seems to think the kitchen gable is located under a flipped portion of the carport roof (Jenkins Figure 20) although that must be surmised from the positioning of the flipped roof.

8) Jenkins claims I do not understand "how wind forces affect a building", arguing that the roof must have been removed by progressive failure. However, as I will show in conclusion, the building was breached on the east side allowing wind pressurization to uplift the roof over the sun room. Figure 17 in the Jenkins report shows that if the east side of the building was breached, wind and wind-driven water would pass through the den, into the first floor of the two-story building and (since the wall between the first floor of the two-story building and the sun room had been removed during renovation) into the sun room where pressurization would uplift the roof.

**FIGURE 17**

**From Jenkins Report**

9) Jenkins uses the anomaly of the Abraham video to conclude that the exact same condition occurred at the Payment residence, He states that "later in the video, Mr. Abraham has retreated to the attic space and is panicking as his home and another are literally slamming into each other". The video received by my office was video only without sound. It is unclear if this information is available on the original video or if Jenkins received other information.

10) Granted the home could have been lifted by buoyancy "without hydrodynamic force (from low velocity current), without waterborne debris impact, and with very little wave action" as Jenkins states. But how then does Jenkins explain (a) the collapse of the den, (b) the collapse of the lower story of the two-story building and (c) the translation of the top floor of the two story 20 feet to the northwest. If we use the Abraham video as "ground truth", then absent the required current velocity and wave activity, the two-story Payment building should have "bobbed up and down" (like the Abraham building) until it stabilized due to flooding inside the building structure. Instead what we have with the Payment residence is a building which toppled over on top of a previously collapsed brick building. Storm surge – as seen in the Abraham video, which appears to be closer to the Mississippi Sound – does not explain the degree of damage sustained by the Payment residence. If storm surge with wave action at the coastline did not destroy the Abraham house, why should storm surge with less wave action in a bayou destroy the Payment house? Jenkins refers to a "plaintiff provided photograph" showing a house "completely intact" after it floated off its foundation. Exactly the point. The house is undamaged except for having shifted off its foundation.

11) The calculations performed by Jenkins appear to be from a "canned" software program (note the output for earthquake loading). The wind load calculation

simply takes a wind speed and converts it to a pressure coefficient to be used for building design. This represents an analysis of load factors. There is no analysis of resistance factors (by comparing load factors to resistance factors it can be determined if the structure could resist the loads). Jenkins alludes to "structural analyses" of the rafter connections (not provided with the report) which indicate that assuming Dr. Kriebel's 130 mph wind gusts, the cottage gable ends would have failed. Then Jenkins recants the 130 mph wind gust quoting Kriebel to the effect that " while [126-132 mph] wind speeds are adopted [in this report], it should be kept in mind that they are higher than any wind measurements made in Katrina near the Payment home site". Changing the rules after loosing the game, Jenkins then tests for 110 mph and concludes that the building did not fail due to wind load after all. Jenkins did conclude that the roof framing over the screened pavilion, boathouse and open rear carport failed due to wind.

## DESCRIPTION DAMAGE AND ANALYSIS

### Site Inspection Photos

Attachment B (Initial Report) includes photos taken on March 16, 2008 consisting of photos taken of the site location and copies of photos shown by Mr. Payment. Noteworthy, the tops of trees in the tree line west of the property lot are sheared at the top and denuded of limbs and bark. Mr. Payment pointed out that most of the felled trees have been removed. During a boat ride upstream and downstream along Bayou Portage, it was noted that this tree damage only occurred immediately west of the Payment residence.

The remaining structures of the residence and cottage were removed prior to the site inspection (Photo 5). Mr. Payment was interviewed in the field at which time Photos 6-13 were taken. These photos are views of building damage.

### File Photos

Attachment B (Initial Report) also includes file photos provided for review. The photos include a "before Katrina" photo of the house as it faced the southeast and an additional view of the east side of the house. A "before Katrina" photo of the cottage was provided showing a wood-framed structure on short masonry piers with a gabled metal roof. Other photos show the boat house and summer house.

The photo titled "Main House After" shows that the 2 eastern masonry columns fell east while the 2 western masonry columns fell southwest. The second story of the building collapsed NNE. The metal roof over the two-story building remained intact. The columns supporting the carport roof remained erect. Other photos show that the metal roof over the sunroom was transported to the southwest and the metal roof over the kitchen (or carport – it is difficult to determine which) remained attached to the structure which collapsed to the NNE. The metal roof itself is "curled" in a manner suggesting wind uplifted and pulled the roof off the deck.

One file photo shows the steep-sloped roof of a residential structure totally demolished by wind. Another shows the roof missing from the summer house. There is no evidence of foundation straps holding the two-story building to the masonry piers.

**Additional Review of Photos**

With the benefit of additional information by Dr. Payment and in response to positions taken by opposing experts, the following additional review of photos is provided:

1) Payment 00093 shows the summer house ("screened pavilion") roof on the ground southwest of the building structure. It probably blew off when wind traveled east-to-west, but remaining tethered to the building by electrical wires, floated to a position of rest as shown in the photo.
2) Payment 00094 shows a portion of a metal roof southwest of the main residence. The hip cut suggests it is part of the den roof, but it is not certain where this roof was located.
3) Payment 00099 shows the porch steps and in the background what appears to be the remainder of the sun room roof. Note the built-up wood frame to support the newer metal roof.
4) Payment 00100 shows the SE-facing 2$^{nd}$ story collapsed over the rubble of the den brick walls.
5) Payment 00104 shows the den brick walls collapsed west, which is not a direction suggesting collapse by storm surge but rather collapse by wind.
6) Payment 00105 shows a rafter and a strip of metal from the den buried under the collapse. The fact that the rafter is visible indicates that wind removed the metal roof before the collapse.
7) Payment 00106 shows the NE corner of the building; note that the gable end is blown out.
8) Payment 00098 shows the interior of the collapsed 2$^{nd}$ story. There is no water line on the raised east wall.
9) Payment 00110 shows breakage of softwood tree trunks. The lack of proximity to the Payment residence is only because the Payment residence was constructed in a clearing where there are no trees to exhibit such damage.
10) Payment 00146 shows the BEFORE photo.
11) Payment 00147 shows the AFTER photo.
12) Payment 00149 shows the BEFORE photo.
13) Payment 00150 shows the upstairs, kitchen and cottage.
14) Payment 00151 shows interior and exterior views.
15) Payment 00159 shows the view of the boathouse and trees felled in different directions.

16) Payment 00162 shows tree fall.
17) Payment 00173 shows the peeled back roof of the carport.
18) Payment 00197 shows the summerhouse.
19) Payment 00346 shows the den looking towards the sun room.
20) Payment 00236 shows the damaged carport roof.
21) Payment 00239 shows the interior of the 2nd floor level.
22) Payment 00243 shows the foundation of the two-story building and the foundation slab for the sun room.

## DISCUSSION (NEW INFORMATION ITALICIZED)

1) Although the Payment residence most likely was not constructed to current code requirements for hurricane resistance, the recently installed 2-story metal roof appears to have been properly installed which is why it "rode out the storm" until the structure collapsed. The roof over the east den is missing *(except for narrow strips of metal visible in a few photos)* indicating that it was removed before the collapse (otherwise it would be seen in the photos under the collapsed two-story). From this we can assume that that gable roof over the east den was removed by wind before the two-story building collapsed. We can also assume that the building interior under this roof along with building contents were destroyed by wind and water after the roof was removed. Reasonably, the brick chimney also was destroyed by east wind *and with it portions of the brick walls at the east end of the den. Once the den was breached, the SE end of the 1st story and the sun room were attacked by wind and wind-driven rain entering at the breach.*

2) *Reasonably it can be assumed that window on the east side of the two-story building was damaged by wind allowing wind and water to enter the second story structure.*

3) *Photos of the sunroom show that all the brick collapsed outward, indicating that neither storm surge nor wind attacking from the exterior was responsible for the damage. Interior pressurization resulting from the den breach and suction caused by east wind before the rise of storm surge is the cause of damage.* The metal roof over the sun room remained attached to the main building because the roof and its connections were stronger than the brick mortar. (Dr. Payment's description of "chalkiness" is a description of efflorescence and mortar deterioration).

4) The curled metal roof (most likely over the *carport*) on the west side of the 2-story suggests that wind did remove that particular roof structure. *The peel-back indicates that wind from the SSW (shortly after 1300 CDT) overturned the carport roof. This damage, although it occurred after the carport was inundated by flood, is damage caused by wind. Note that wind gusts at this time were lower than 80 mph and lower than wind speeds which could account for the damage (see EF Scale). It follows that some wind gusts were higher than the reported wind speed due to gustiness.*

5) Two brick columns fell southwest counter to the flow of storm surge. The best explanation for the pattern of fall is wind: wind uplifted the protruding front of the

second story, relieving the gravity load on the columns and allowing lateral force of wind to push the columns southwest. While it appears that the other two columns continued to support the 2nd story structure until the structure collapsed NNE, from the point that wind removed two columns, the integrity of the second story structure was compromised.

6) *The timeline provided by Dr. Fitzpatrick shows that wind gusts of 120 mph crossed from east before water reached the lower floor levels and 130 mph before water reached the lower floor level of the 2-story structure. This adequately explains the loss of the chimney as well as the roofs over the east den and west sunroom.*

7) The most problematic part of the analysis is the question "what force pushed the 2-story building to the NNE?" It is difficult to conclude that the sole cause is flood. Hydrostatic load alone would not have collapsed the building because water rose both outside and inside the structure, equalizing the flood load. Even if the 2-story achieved buoyancy, it would do no more than bump into the additions as suggested by the Abraham video. Hydrodynamic load is not a satisfactory answer because the current was low velocity current (with which Dr. Kriebel agrees). There was little to no wave action (Dr. Fitzpatrick allows for *0.5 foot* wave activity). There is no indication of waterborne debris impacted with a force sufficient to collapse the building structure (with which Dr. Kriebel agrees).

8) *If not flood, this leaves wind. Wind attacking from SSW (the same wind gusts which apparently peeled back the carport roof and flipped a portion upside-down) could have pushed the building to the NNE. There are minimal load path connections in the 2-story building and the structural integrity had been compromised by renovations. The breach in the den may have caused additional damage, to what extent is not known but it can be inferred that the building's resistance to attacking wind was weakened prior to the collapse.*

**ENHANCED FUJITA SCALE (REV 2)**
**ONE- AND TWO-STORY RESIDENTIAL DWELLINGS**

| DOD* | Damage description | Exp** | LB | UB |
|---|---|---|---|---|
| 1 | Threshold of visible damage | 65 | 55 | 80 |
| 2 | Loss of roof covering material (<20%), gutters and/or awning; loss of vinyl or metal siding | 79 | 63 | 97 |
| 3 | Broken glass in doors and windows | 96 | 79 | 114 |
| 4 | Uplift of roof deck and loss of significant roof covering material (>20%); collapse of chimney; garage doors collapse inward or outward; failure of porch or carport | 97 | 81 | 116 |
| 5 | Entire house shifts off foundation | 121 | 103 | 141 |
| 6 | Large sections of roof structure removed; most walls remain standing | 122 | 104 | 142 |
| 7 | Exterior walls collapsed | 132 | 113 | 153 |
| 8 | Most walls collapsed in bottom floor, except small interior rooms | 152 | 127 | 178 |
| 9 | All walls collapsed | 170 | 142 | 198 |
| 10 | Destruction of engineered and/or well constructed residence; slab swept clean | 200 | 165 | 220 |

* DOD is degree of damage **Wind Speed values are in mph

## CONCLUSION

Damage occurring due to wind can be categorized by two events:

### EVENT ONE: WIND DAMAGE BEFORE THE RISE OF STORM SURGE

1) ***Prior to the rise of storm surge,*** *wind removed the metal roof from the one-story addition (den) on the east side of the building. Water and wind penetrating through this opening destroyed the interior and contents in the den, the SE end of the lower two-story residence and the sun room. The chimney most likely was destroyed by ENE/E wind with 80-110 mph gusts about 0630 CDT. The gable end of the den most likely was slammed by 120-130 mph wind about 0830 CDT causing the wall to collapse.*

*2)* ***Prior to the rise of storm surge,*** *overpressurization in the sun room and suction along the exterior wall collapsed the SE-facing brick wall.*

*3)* ***Prior to the rise of storm surge,*** *wind breached second-story windows (one on the NE side and all on the SE side), allowing wind and water to damage the interior.*

*4)* ***Prior to the rise of storm surge,*** *wind removed the 1-story cottage house from its foundation and destroyed the structure.*

### EVENT TWO: WIND DAMAGE AFTER THE RISE OF STORM SURGE

**1) After storm surge receded,** wind peeled back and overturned the carport roof. This damaged not only the carport roof, but the kitchen roof impacted by the carport roof.

**2) After storm surge receded,** wind pushed the 2nd story of the 2-story building to the NNE. Renovations prior to the hurricane and the probability of wind damage before the rise of storm surge had reduced the structural integrity of the building.

**END OF REPORT 80107**

Respectfully submitted,

Neil B. Hall, Ph.D.
American Institute of Architects
American Society of Civil Engineers

Giddings M. Emery
REGISTERED PROFESSIONAL ENGINEER
14397
STATE OF MISSISSIPPI

Reviewed by:

Giddings Emery, P.E.
Mississippi License No. 14397