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

THOMAS C. and PAMELA McINTOSH — **PLAINTIFFS**

VERSUS — **1:06-CV-1080-LTS-RHW**

STATE FARM FIRE & CASUALTY COMPANY, FORENSIC ANALYSIS & ENGINEERING CORPORATION, AND E.A. RENFROE & COMPANY, INC. — **DEFENDANTS**

STATE FARM'S MOTION TO ENFORCE THIS COURT'S APRIL 14, 2008 ORDER [1180] AND EXCLUDE THE TESTIMONY OF PLAINTIFFS' EXPERT WITNESS RALPH SINNO OR, IN THE ALTERNATIVE, TO LIMIT HIS TESTIMONY

State Farm Fire and Casualty Company respectfully submits this motion to exclude the testimony of Plaintiffs' expert witness R. Ralph Sinno (who has opined that ***all*** of the damage to Plaintiffs' house was caused by wind) or, in the alternative, to limit the balance of his testimony, if any, to that otherwise properly disclosed pursuant to Federal Rule of Civil Procedure 26(a)(2)(b).[1]

In its April 14, 2008 Order [Doc. 1180], this Court granted State Farm's "Motion in Limine No. 11: To Preclude Plaintiffs From Introducing Testimony or Evidence That The Damage To Their Home Was Caused Entirely By Wind" [Doc. 1014]. In that motion, State Farm noted that Plaintiffs received full policy limits under their flood insurance policy in the amounts of $250,000 for flood damage to their dwelling and $100,000 for flood damage to their contents. *See* Doc. 1014 at 2. In granting State Farm's motion, 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

[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.

damage represented by the flood insurance payment was caused by flooding." *See* Doc. 1180 at 3. 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.*

Notwithstanding Plaintiffs' acceptance of flood payments and their corresponding judicial admission, Plaintiffs' structural engineering expert Ralph Sinno opines that ***all*** of the damage to Plaintiffs' house was caused by wind:

> Most of ***the damage*** you see from pictures, I – I would suspect about 99 percent is really – 99 percent, I would say that ***is wind damage***, no question about it. The water did only washout. ***The word "damage" should not be used with the water at all in this case.***

Deposition of R. Sinno at 78:4-8 (Ex. A). Likewise, in his report, Dr. Sinno opines that there is "no justification whatsoever for the water surge to be blamed to have caused ***any*** structural damage to the wall framing and the envelope of the house." Report of R. Ralph Sinno at 19 (Ex. B) (emphasis added).

Dr. Sinno's opinion, as expressed in his Rule 26 report and deposition, is that wind was the cause of ***all*** of the damage to Plaintiffs' home. Yet, this opinion is flatly inconsistent with Plaintiffs' judicial admission and impermissible under the Court's ruling. *See* Doc. 1180 at 3. Indeed, State Farm previously and specifically referred to Dr. Sinno's report and testimony in its motion [Doc. 1014 at 2] and its reply in support of the motion [Doc. 1101 at 4-5], which this Court granted [Doc. 1180 at 3]. His testimony that wind was the cause of ***all*** of the damage to Plaintiffs' house must 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-HSO-RHW, Order at 16-17 (S.D. Miss. July 25, 2008) [Doc. 372]. A similar ruling is warranted here.

CONCLUSION

Pursuant to this Court's April 14, 2008 Order [Doc. 1180], Dr. Sinno should be precluded from testifying at trial entirely because his opinion is irreconcilable with the Plaintiffs' conclusive judicial admission of flood damage. In the alternative, this Court should limit the balance of his testimony, if any, to that otherwise properly disclosed pursuant to Federal Rule of Civil Procedure 26(a)(2)(b).

Dated: August 26, 2008

Respectfully submitted,

/s/ John A. Banahan

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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 on 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 2nd day of September, 2008.

/s/ John A. Banahan
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THOMAS C. AND PAMELA MCINTOSH PLAINTIFFS

VS. 1:06-cv-1080-LTS-RHW

STATE FARM FIRE AND CASUALTY COMPANY;
and FORENSIC ANALYSIS & ENGINEERING CORP.;
and E.A. RENFROE & CO., INC. DEFENDANTS

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VIDEO DEPOSITION OF R. RALPH SINNO, PH.D, P.E.

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Taken at the Instance of the Defendants
at the office of Scruggs Law Firm
120-A Courthouse Square, Oxford, Mississippi
on October 11, 2007
Commencing at 9:30 a.m.

Reported by: Libby A. Furr
CSR # 1724

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ALSO PRESENT:

SAM NABORS -- VIDEO SOUTH VIDEOGRAPHER

HARRY RAYBURN

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MR. NABORS: This is the video deposition of Ralph Sinno taken in the matter of Thomas C. and Pamela McIntosh versus State Farm Fire and Casualty Company, et al, in the United States District Court for the Southern District of Mississippi, Southern Division, Cause No. 1:06-cv-1080-LTS-RHW. Today's date is October 11th, 2007. The time is 9:44 a.m. Will the attorneys please introduce themselves on the audio?

MS. SANDERS: Valerie Sanders for State Farm Fire and Casualty Company.

MR. WEBB: Dan Webb for State Farm.

MS. LIPSEY: Christine Lipsey for E. A. Renfroe & Company.

MR. CANADA: Larry Canada for FAEC.

MR. SCRUGGS: Zach Scruggs for the plaintiffs, Chris and Pam McIntosh.

MR. NABORS: Will the reporter please administer the oath.

R. RALPH SINNO, PH.D.

having been duly sworn, testified as follows:

EXAMINATION BY MS. SANDERS:

Q. Good morning, Dr. Sinno. Am I pronouncing that right, Sinno?

A. Correct.

Q. Okay, thank you. My name, again, is Valerie Sanders. I represent State Farm Fire and Casualty Company. Have you had your deposition taken before, Dr. Sinno?

A. Yes.

Q. How many times?

A. About ten times.

Q. Was that always in -- in a capacity as an expert witness?

A. Yes.

Q. Did all 10 of those cases concern Hurricane Katrina?

A. No. Only the only last two.

Q. Do you remember the names of those two cases that did concern Hurricane Katrina?

A. The Beauvoir case. That's the only one I did deposition. I'm sorry. That's the only one. Deposition.

Q. Okay. In Beauvoir?

A. Yes.

Q. And did you serve as an expert witness in another case involving Hurricane Katrina in which you were not deposed?

A. Yes, I did.

Q. What was the name of that case?
A. That's the one, the Superdome in New Orleans.
Q. And in each of those two cases, were you retained by the plaintiffs or by plaintiff's counsel?
A. One time it was the plaintiff. One time it was the defendant. Superdome is defendant.
Q. Do you recall who -- which defendant, what the name of that defendant was in the Superdome case?
A. No, I don't really remember. I know the lawyers are the Hamlin group.
Q. Okay, thank you. You mentioned that -- I think you said you have been deposed ten times. One in the Beauvoir case. The other nine, were those -- can you describe to me what sort of cases those other nine depositions were in?
A. Well, I cannot recall all nine right now, but basically in civil engineering-related work. One of them was on the airport in Gulfport. There were problems with the pavement and the concrete. One case which was an accidental case in which they were driving a reinforced -- a prestressed concrete pile, and the piece of concrete got chipped off and fell on a McDonald guy, and he got killed. One case was in Jackson, Mississippi, in which they had a problem with the brick and concrete construction. That case I was hired, really, by the

Court as an expert witness. One case concerned the insulation refrigeration units which the framing itself was Styrofoam with metal sheeting. I did a lot of research on metal buildings and roofing and all related to that. The other cases really are kind of old now, but the civil engineering part is -- nothing has to do with Hurricane Katrina, as such.

Q. Okay, thank you. Did -- did any of those -- other than Beauvoir and the Superdome case, have you served as an expert witness in any other case involving a weather event?

A. No.

MR. SCRUGGS: Are you talking about in -- in terms of being deposed?

THE WITNESS: Yes.

MS. SANDERS: Yes. Yeah. We had talking about the ten depositions.

THE WITNESS: We're talking about deposition, not experience, not background, not research, not applications, no.

Q. (Ms. Sanders) Okay. I understand. And have there been other cases in which you have served as an expert witness but have not been deposed other than Beauvoir and the Superdome case --

A. Oh, yeah. There were --

Q. -- that involved weather events?
A. No.
Q. Okay.
A. Not weather events.
MR. SCRUGGS: Yeah, the -- and you-all might be -- I think you-all are trying to be on the same page. It might be apples and oranges. He's been an expert witness in cases that have not either settled or he wasn't deposed in.
THE WITNESS: Oh, yeah, I have been involved --
MS. SANDERS: Okay.
THE WITNESS: -- in cases.
MR. SCRUGGS: If that was what you were asking. I don't want to --
Q. (Ms. Sanders) Yeah. Yeah. Thank you for that, Mr. Scruggs. Let me clarify a little bit. Have you served as an expert witness, whether or not you ever were deposed or went to court, in any cases other than Beauvoir and the Superdome that had to do with weather events?
A. Oh, definitely. I am involved with the Scruggs groups in about at least 10 different other cases related to the Hurricane Katrina.
Q. Okay. And -- okay. So is it -- is it true

then that all of the cases in which you have been involved as an expert that had to do with weather events, all of them were Hurricane Katrina-related as opposed to some other hurricane?

A. Only Hurricane Katrina-related, yes.

Q. And have you been engaged by the Scruggs group in each of those cases?

A. Yes.

Q. Okay.

A. There is one case, also, Hurricane Camille, you see. I was involved in that but on the sideline.

Q. Okay. Yes. No. I'll -- I'll talk about that. Is it -- is it -- is it true that you did not serve as an expert in any litigation relating to Hurricane Camille?

A. No, no litigation.

Q. Okay. And I think you mentioned you had been retained by the Scruggs group in each of the Hurricane cases. Is it your understanding that in each of those cases the Scruggs group represents the plaintiffs?

A. I really don't know the details, how Scruggs groups operate because I know they have Scruggs group. They have Scruggs by themselves. I don't know how they operate. I really don't know.

Q. Do -- do you have a -- I'm sorry. Mr. Scruggs, did you --

MR. SCRUGGS: No. No. I just wanted to clarify that he had -- and, again, I don't want to get in the middle of the deposition here -- that he had also had some capacity in the Superdome case. We're not involved in that case.

MS. SANDERS: That's right. Okay.

MR. SCRUGGS: I just wanted to make sure everybody was clear.

MS. SANDERS: No. I appreciate that.

Q. (Ms. Sanders) So I'm focusing on the ten or so in which you have been retained as an expert by the Scruggs group. Is it your understanding that you are serving in each of those cases as an expert for the plaintiffs as opposed to the defendants?

A. Right.

Q. Okay. You mentioned a moment ago that you have an area of expertise in the -- in -- with the subject of metal construction? Have I got that right?

A. Metal buildings, yes.

Q. And I believe you've done some work and published some studies on the subject of metal roofs?

A. Correct.

Q. Do metal roofs react differently to stress than other kinds of roofs?

A. No. They do not react differently to stress.

Q. Why then would you focus a paper or a research project on metal roofs specifically?

A. Well, mainly that -- in this specific case I was involved in metal roofs because the sponsor was the MBMA and other groups with MBMA, including an insurance company.

Q. And so it was the sponsor's decision that the research focus on metal roofs?

A. Exactly. They were putting in a little money, and that's what they wanted to do testing on. Plus, if you know anything about metal roofs basically, primarily, the only load on a metal roof is wind load. There's no dead load by itself. It doesn't weigh anything.

Q. Whereas a wood roof does weigh more than a metal roof?

A. Yes. There's a reasonable difference in between.

MS. SANDERS: Okay, thank you. Let's go ahead and mark this Defendants No. 1.

(Exhibit 1 is marked.)

Q. (Ms. Sanders) Dr. Sinno, the reporter has handed you what has been marked Defendant's Exhibit 1. Could you take a look at that document and tell me if you can identify it for me?

A. This is my report in the case of the McIntosh.
Q. Okay. This is -- so this is the expert report you have submitted in this case.
A. Correct.
Q. Have you ever visited the McIntosh residence?
A. Yes, at least two times.
Q. When were those visits?
A. One of them is a week ago. One of them is around probably the first or second week of March, 2007.
Q. And was that second visit you mentioned, the earlier visit, did you conduct that visit before completing your report in this case?
A. The one in March?
Q. Yes.
A. Yes, of course.
Q. And at the risk of stating the obvious, the visit last week was after you had completed this Exhibit 1.
A. Correct.
Q. Okay. I'm going to have some questions as we walk through the report. If I could ask you first to look at the first page in the introduction section.
A. Okay.
Q. At the very beginning there, it refers to, "The following," quote, "summary report." Is this the only

report you have prepared with respect to the McIntosh residence?

A. Yes, that's the only report.

Q. Okay. So it isn't that this is a summary and there's a fuller one --

A. No.

Q. Okay. And it -- it -- that sentence goes on, "is prepared in reference to your request to assess the interaction of the high velocity wind forces from Hurricane Katrina with the structure of the residential property owned by Mr. and Mrs. Thomas and Pamela McIntosh, and then it gives the address.

A. Correct.

Q. Okay, it mentions there high velocity wind force. Is that the only force you assessed in connection with your study of this property?

MR. SCRUGGS: Object to the form.

THE WITNESS: Well, I think we are talking about hurricane, and that's the primary force in a hurricane is the high velocity wind.

Q. (Ms. Sanders) Let me ask this. Did you analyze at all the effect, if any, of storm surge on the McIntosh property?

A. Yes, of course.

Q. Now, you mentioned here that you had been

requested to assess the interaction of high velocity wind forces with the structure. Did you understand your objective to be to offer an opinion about the cause of any damage to the structure?

A. Well, when you assess the interaction, you have to take it from A to Z. If it is damage, you talk about it. If there's no damage, you talk about it. This is what assessment is all about, in my understanding, start to finish.

Q. Okay. So if I understand you correctly, your assessment of that interaction would involve assessment of damage and opinions as to its causation?

A. Of course.

Q. Okay. Okay. And then if you will look, the next sentence, right after the address of the residence there, it begins, "An assessment of the structural damages." What do you mean by that phrase, "structural damages"?

A. Well, I'm a structural engineer, and I should really, more or less, talk about the structural system, and that's what the Scruggs group really were interested with, knowing about the structural interaction between the high velocity wind of the hurricane and the house itself. Whatever comes with the high velocity wind, they want to know how do the house respond to that.

Q. Okay. My question, really, is whether there could be -- in your -- in your opinion, in the use of your phrase, "structural damages," do you consider there could be some damages to a residence from a hurricane that were damages but not structural damages and then other damages that you would consider, quote, "structural damages"?

MR. SCRUGGS: Object to the form.

THE WITNESS: Well, there is a primary structure. There is a secondary structure. This is understood by all experts in engineering and building construction. There's a structural framing that will transfer the load all the way to the foundation. There's secondary, called C&C, that's components and cladding that's really create an envelope to the structure. These are the enclosures, the envelope of the structure. All of these really make a house. And so, when you assess the high velocity wind, you take the structural, like the backbone of the house as the structural system. Then all the cladding and the components that enclose the -- make the envelope of the structure are really part of the structure, but they're not primary.

They're secondary. So we have primary structure. We have secondary structure.

Q. (Ms. Sanders) Okay.

A. So we have to differentiate between the two when we talk about structures. But I am involved in this report here in covering all aspects of the structure, the primary and the secondary.

Q. Okay, I think I've understood you to say that you would consider, quote, "structural damage" to include damage to either what you have defined as the primary structure or the secondary structure.

A. Correct.

Q. Okay. Could there be other damages to the house that would not fall in either category?

A. Yes, there could be. In this case here, I recall them talking about some water pipes being broken, and this could cause some damage, which is not my department.

Q. Okay. Is there any wind damage? Did -- did -- did you observe any damage at the house that you attributed to wind that you would consider damage but not structural damage?

MR. SCRUGGS: Object to the form.

THE WITNESS: Well, I really don't understand your question correctly. I would --

I think you should really rephrase it again.

Q. (Ms. Sanders) Okay. If wind from a hurricane were to dislodge slightly a shutter on the outside of a house, would you consider that structural damage?

A. If that shutter is a structural element, it will be structural damage, yes, of course.

Q. Okay. And --

A. If it's not a structural element, then it will be a secondary.

Q. Okay. But --

A. But it will still be damage to a secondary item in the structure.

Q. Okay. I think you told me a moment ago that you would consider damage even to a secondary structure --

A. Sure.

Q. -- to be, quote, "structural damage."

A. Yeah. If it is -- if it is part of a structure, yes.

Q. Okay. So in the example of a shutter on the outside of the house coming loose in the wind, would you or would you not consider that structural damage, or would it depend on something? And please explain how it would depend on something.

MR. SCRUGGS: Object to the form.

THE WITNESS: Okay. This is secondary element. It's part of the structure. So it is structural damage but it is a secondary element. It's not a primary. It's not that important.

Q. (Ms. Sanders) Okay.

A. It will not influence the stability and the framing of the structure.

Q. I understand that. I guess my question --

A. Do I consider it structural element, this -- a component of the structural system? Yes.

Q. Okay. Can you think of any wind damage that you would not consider, quote, "structural damage"?

MR. SCRUGGS: Object to the form.

THE WITNESS: Well, other -- well, I don't know. I really don't know your question. I don't -- I don't understand the question.

Q. (Ms. Sanders) Okay.

A. I don't understand the question.

Q. I -- I think I've phrased it probably as well as I can, and I -- I'm not sure I've gotten a response to it, but let's move on and see if we can find a meeting of the minds elsewhere.

A. All right.

Q. Let's look at the beginning of the second

paragraph of the introduction which begins, "This report is based upon the evidences made available to me."

MR. SCRUGGS: I think you're -- let's stop for a minute -- you're covering up the --

MR. NABORS: Yeah.

MR. SCRUGGS: Yeah. Keep that free so they can --

THE WITNESS: Oh, okay.

MR. SCRUGGS: -- they can hear you.

MS. SANDERS: Gosh, thanks Mr. Scruggs.

Q. (Mr. Sanders) Okay, if you would look at that first sentence again of the second paragraph, "This report is based upon the evidences made available to me." Could you tell me what that evidence was or at least -- strike that. What evidence are you referring to there?

A. The pictures provided to me.

Q. By whom?

A. Before I went -- well, I got some pictures from the Scruggs, just a very few in the beginning. Then I went to the site. I got a whole bunch of pictures from the owner himself.

Q. Okay. So do I understand correctly that first you received some pictures from someone at the Scruggs group, and then you later visited the site. Would that be the visit in March?

A. Correct.
Q. Okay. And at that point obtained --
A. A whole bunch of pictures.
Q. From the homeowner?
A. Yes, sir. Yes, ma'am. I'm sorry.
Q. I will answer to either.
MR. SCRUGGS: I will, too.
Q. (Ms. Sanders) Had you -- was it your understanding -- or do you know who took the pictures that you examined?
A. I understood that the owner took the pictures, but I have no proof.
Q. And is that your understanding, also, as to the pictures you received from the Scruggs group?
A. Correct.
Q. When you visited the house in March 2007, was it in the process of being repaired?
A. It -- very minor repair was going on. I -- I don't remember. It was more cleaning up.
Q. Okay. Do you have a -- did you come to any conclusion as to whether the condition in which you observed the house in March of 2007 was the same condition in which it had been soon after Hurricane Katrina?
MR. SCRUGGS: Object to the form.

THE WITNESS: I have no way of knowing.

Q. (Ms. Sanders) I think you said first you received a set of pictures from someone at the Scruggs group, not as many as you would later obtain. Do you recall how many photos you received from the Scruggs group in that --

A. Just one envelope. I think four or five --

MR. SCRUGGS: Object --

THE WITNESS: -- pictures.

MR. SCRUGGS: Object to the form of that, but go ahead.

THE WITNESS: Yeah, four or five pictures, I think.

Q. (Ms. Sanders) Do you recall whether they were internal views, external views, or both?

A. They're both.

Q. And then about how many photographs did you subsequently receive from the homeowners?

A. Oh, I've got about maybe 50 or 60 pictures.

Q. And I know your report includes some pictures of the McIntosh residence.

A. Correct.

Q. Are those pictures you received from the Scruggs group or directly from the homeowner or both?

A. Directly from the homeowner.

Q. So all of the pictures that appear in your -- in your report were received from you directly from the homeowner?

A. Correct.

Q. But you have not included all 50 or 60 or so that you received.

A. No.

MR. SCRUGGS: Included in the report.

Q. (Ms. Sanders) Included -- yes. Included -- published in the report. That's correct?

A. Correct.

Q. How did you decide which of the 50 or 60 pictures to reproduce in the report?

A. It depends on the topic I'm talking about, is number one. Number two is really to stress the structural damage that I'm talking about, the interaction.

Q. Do you believe that all the photographs you have seen of the site are consistent with your conclusions in this report?

A. I would think so. There are some more pictures that I did not include because there's a limit to how much you can use.

Q. But you did find them all to be consistent with your conclusions, whether you included them -- published

them in the report or not.

A. Correct.

Q. Okay. When you visited the McIntosh property in March of 2007, did you go inside the house?

A. Yes, of course. I spent three hours over there.

Q. Was there any water in the house?

A. What do you mean?

Q. When you visited it.

A. What do you mean water in the house? Running water?

Q. No. Was there any water built up from the floor up, any external water, other than one would desire to have from modern plumbing, in the house?

A. No, I did not see any water in the house.

MR. SCRUGGS: I like the way you phrased that.

MS. SANDERS: I try.

Q. (Ms. Sanders) Okay. Did you walk through with the homeowner on that visit?

A. I went on my own and with the homeowner, both.

Q. Okay. And it's a multistory residence, correct?

A. Correct.

Q. Did you go inside each story?

A. Correct.

Q. Okay. I'm going to turn back to this first page of your report, the very last sentence on the first report where it says -- there is a reference there, and I just want to find out what it means. In the last full line it refers to "refereed findings from physical situations in the field." What do you mean by that?

A. Yes. That means there's no assumptions, no computer modeling, no garbage in, garbage out type programs. Everything is hard evidence, either testing in the lab, physical data collected, and findings. I do not believe in theoretical modeling in hurricanes unless it's substantiated with physical calculations and physical data collection. All other stuff is just, in my book, is fiction of assumptions that should be taken with a grain of salt. I'm a practical civil engineer. I believe one test is worth a million theory, and all other assumptions and calculations and computer junk that a lot of people are coming up with should be considered with a grain of salt unless it is proven with refereed publications, with substantiated test results in the field. Otherwise, we should not be talking about it and we should really clarify it and say very clearly this is all pure theoretical. This is all pure imaginative. This is all computer garbage in, garbage out computer output unless

it is proven with test results.

Q. Okay. But you didn't actually run field tests on the McIntosh residence, did you?

A. No. But I ran a lot of wind test data for 15 years in my lab to see what wind will do to structures.

Q. Okay. But you didn't -- did not have occasion ever to do a lab test in which you attempted to simulate precisely the conditions at the McIntosh property during Hurricane Katrina.

MR. SCRUGGS: Object to the form.

THE WITNESS: Yes, I have simulated the wind loading, the footprints of typical wind loading. I have simulated this in the lab, and I did observe what happened with structures, how the structures will respond to true simulated -- true simulated wind loading on full scale structure, not models or miniature small examples and trying to extrapolate that to full scale structures. I ran tests on full scale structures, real live structures, real live wind loading simulated 100-percent, testified, as certified by wind experts.

MR. CANADA: Object to the responsiveness.

Q. (Ms. Sanders) I'll have the same objection, but let me ask another question. You didn't actually run

any tests with a full scale model of the McIntosh residence, did you?

A. Not the McIntosh residence, no.

Q. And when -- do I understand that you set about in -- in your lab to recreate conditions of Hurricane Katrina?

A. Recreate --

MR. SCRUGGS: Object to the form.

THE WITNESS: -- conditions of typical hurricanes, primarily Hurricane Andrew.

Q. (Ms. Sanders) Okay. So you have not attempted to recreate the precise conditions of Hurricane Katrina.

MR. SCRUGGS: Object to the form. Asked and answered.

THE WITNESS: There is very little difference between hurricanes to hurricanes when it comes to wind loading on the structure. There is a difference in the details of the hurricanes but in the -- all the statistical figures and structural response and loads applied, the wind loading, they are the same.

MR. CANADA: Object to the question.

MS. SANDERS: Yeah, I've got the same -- I'll object to the --

MR. CANADA: Object to the responsiveness.

MS. SANDERS: -- responsiveness of that, as well.

Q. (Ms. Sanders) Would you describe for me -- I believe I asked you a moment ago whether you had done lab testing with respect to the McIntosh residence. And I think you said to me that you did.

A. No, I did not do testing on the McIntosh, no, I did testing on simulated wind loading.

Q. Okay. And how did you determine what winds you were going to simulate?

A. I did not decide on that, but the University of Western Ontario, the number two wind testing laboratory in the world, after the one in Colorado, told me exactly what to do.

Q. Okay.

A. And I did exactly what they told me to do.

Q. When did this occur that the University -- that you performed the exercise in conjunction with the University of Western Ontario?

A. It's from 1992 until today. It's still going on.

Q. Okay. And when you say that someone at the University of Western Ontario told you what to do in terms of the simulation, are you constantly getting instructions from that entity? What is the nature of

your interaction with them?

A. There is a committee, big committee, headed by David Surrey, S-U-R-R-E-Y. He is the leading expert on wind loading from the University of Western Ontario. Before him was Davenport. He is the father of wind loading worldwide, recognized by everybody. They are the one really giving me instructions continuously up to date. And now is the head of the committee, is a man by the name Ho, H-O, Eric Ho.

Q. Does this project that you have in conjunction with that University have a name?

A. Yeah. A simulation of wind loading in the lab, a full scale testing.

Q. Is there a sponsor of that effort?

A. Yes, it's sponsored by the MBMA with some other cosponsors, including one major insurance company, which I cannot think of its name right now. The number one insurance company. I can't think of its name.

Q. And what is the -- strike that. Let's move -- I think you said a moment ago that you -- you have at least some qualifications in your mind with respect to using a computer simulation model.

A. Correct. I have reservation on that unless it's proven with test results, test data.

Q. Okay. Your report does cite the ADCIRC model,

correct?

MR. SCRUGGS: Object to the form.

THE WITNESS: Yeah, I -- I relied on it. I did mention it.

Q. (Ms. Sanders) And the ADCIRC -- do you understand that the ADCIRC product is a computer modeling system?

A. Yeah, but is it a refereed publication? There's a lot of reference to it. I said either tested or a refereed publications. Have to be a refereed, have to be evaluated by experts in the field. And more or less, consensus say that it is a valid approach.

Q. "It," being ADCIRC.

A. Yes.

Q. Okay. Let's turn to the next page of your report, if you would.

A. Okay.

Q. And I'm going to go down to that section, 3.0, "Forces from High Velocity Wind and Structures."

A. Good.

Q. Let's go to the last paragraph beginning at the bottom of that page. It's -- it begins -- well, actually, it's -- it's the sentence that begins on the last line. "In our case in question, the McIntosh residence (house), these pressures acted on both the

external and internal surfaces of the envelope of the house, as it will be discussed later." And the reference there, I think, you have spoken in the first sentence of "uplift forces on the roof and suction on the sides and leeward walls."

A. Yeah, correct.

Q. Okay. And you say then those are the forces you refer to when you say the McIntosh house -- with respect to the McIntosh house, these pressures acted on both the external and the internal surfaces of the envelope of the house?

A. Correct.

Q. Okay. Let's turn on to Page 4, if we could. And I would like to look at the full paragraph just below -- I'm sorry, the final paragraph. In the middle of the paragraph it begins, "The McIntosh residence did not have x-bracings or shear walls." Do you see where I am?

A. Yes.

Q. And then it says, "This approach is seldom used in wood framing to a house."

A. Correct.

Q. Do you have an understanding as to why that is the case?

A. Because wood framing of houses, generally speaking, they are designed or constructed away from

hurricane areas, and they were -- there's no building code that require to have cross bracing unless you go to the State of Florida now. They require that you have to have some wind loading resistance.

Q. Okay. And let's turn back, actually. I'm sorry to back up and go out of sequence here, but the sentence I read a moment ago where you said, beginning at the bottom of Page 2, "In our case in question, the McIntosh residence, these pressures," referring to the uplift forces and suction, "acted on both the external and internal surfaces of the envelope of the house."

A. Correct.

Q. What is the basis for that statement in your report?

A. What do you mean, what is the basis?

Q. Well, what caused you -- what evidence caused you to come to that conclusion?

A. When I went to the site and I looked at the house to see what's going on at the site, I immediately concluded that the wind forces we're talking about are not restricted to the outside of the house. But they have -- did penetrate to the inside of the house, and the causes of the wind forces was not restricted only to the outside, but it has impacted the inside of the house, also.

Q. Okay. So anything else upon which that assertion is based, other than those observations you just described?

MR. SCRUGGS: Object to the form.

THE WITNESS: You have to include interaction of the structure to the wind. I mean, that's basically the same thing. It is inside and outside.

Q. (Ms. Sanders) Okay. So is it fair to say that the basis for that statement that we've been talking about here is your observations at the site as you have just described?

MR. SCRUGGS: Object to the form.

THE WITNESS: Well, yes. Correct. It's related to that, yes.

Q. (Ms. Sanders) Okay. Is there anything else you did or saw or considered that I should know about, which would be anything, that supports that statement?

MR. SCRUGGS: Object to the form.

Q. (Ms. Sanders) Yeah, let me rephrase. Can you think of anything else as you sit here today that supports this conclusion that we've been talking about, other than the observations of the residence you have just described to me?

MR. SCRUGGS: Same objection.

THE WITNESS: The observation of the house -- this is a unique house. This is not a standard house. This house is built different than a classical house. And it has to be treated accordingly. It is not a typical house in its construction. So the interaction of the wind with this house is -- stands out as a special case that really need to be looked upon very carefully by any structural engineer.

Q. (Ms. Sanders) Okay. I'll object to that as nonresponsive, and I'll move on. You say this house is built differently than the typical house. In what respect?

A. The fact that it is two-story house. The second house -- the second floor is part of the attic. It is not a one-story, two-story, and a roof on top. This is a different house. This is the first floor, ground floor. Second floor is part of the attic. The second floor braced and fixed the attic in place. It is part of the attic, so the roof is a special case in here. It is fully anchored, fully braced, fully supported by the second floor.

Q. And that is unusual.

A. Yes. It's not common.

Q. Okay.

A. Not unusual. It's not common.

Q. Let's turn back to the bottom of Page 4 of your report. You say, "The external walls for the McIntosh house are extremely weak structurally by the fact that they are almost transparent with excessive lines of windows." Did you actually observe those windows --

A. Yes.

Q. -- when you went to the site?

A. Of course. You cannot miss them.

Q. How many of them were broken?

A. I think just about every one was broken except for, maybe, on the ground floor, maybe one or two.

Q. I just want to be sure I understand you. Do you mean -- you believe all windows in the house were broken --

A. On the ground floor.

Q. -- on the ground floor, okay. Except for maybe one or two.

A. Yeah.

Q. And were they all, in your observation, similarly broken, or were some affected differently than others?

A. No, they were similarly broken.

Q. I know you refer at one point in your report to a window being blown out, or words to --

A. Yes.
Q. -- that effect. Is it your testimony that all but these one or two windows were blown out?
A. Yes, all of these windows were blown out, no question about it. Now, let me explain something just for the records in here. When I say "blown out," it does not mean direct pressure. You could blow a window by suction. And it's easier to blow a window by suction than direct pressure.
Q. Have you reached a conclusion as to what caused the blowing out of these windows at the McIntosh residence?
A. Suction. The initial failure was suction. It's easier to pull structurally than push.
Q. Q.And so, the suction was a force applied from the inside side of the window?
MR. SCRUGGS: Object to the form.
THE WITNESS: No. No.
Q. (Ms. Sanders) Well, what do you mean by suction? What force did you conclude caused that suction?
MR. SCRUGGS: Objection.
THE WITNESS: This is something you have to understand wind forces. Wind forces come in and hit the structure, or the structure really

try to stop the wind from blowing. It get direct pressure. While the wind lines try to go around the structure, it create vacuum in the back or the sides. This vacuum is suction. This is more powerful, the suction forces, from a structural damage point of view, than the direct pressure. A lot of people think of wind as something that's hitting, trying to break something. This is not as bad as if you have suction. If you try to suck something out, that's what really will break a lot easier, suction, than direct pressure.

Q. (Ms. Sanders) Okay. Is --

A. Through your vacuum.

Q. Is it your testimony -- well, what is your conclusion as to what caused the vacuum that you say resulted in this suction?

MR. SCRUGGS: Object to the form. Asked and answered.

THE WITNESS: The aerodynamics. Aerodynamics of the air running around the structure. The aerodynamics create the vacuum all around. All around. If you can see the picture here, it create vacuum all around. See the forces in here are pulling out. If you

look at the picture, Figure 2, the wind is coming from the left. And all three sides you have suction sucking out. You can pull out. This is something that people who don't know much about wind loading, they do not understand that.

Q. (Ms. Sanders) Okay, so the --

A. I want to show you another picture. That's interesting picture. That's funny. You see this picture here (indicating).

Q. I do.

A. What happened to the umbrella in here?

Q. You tell me.

A. It's pushed up. I'm going to tell you, this -- this umbrella here pulled up. Why it pulled up was the suction on top of it, this vacuum. The wind go around the umbrella and suck it up. This is uplift. This is what uplift is all about.

Q. Okay. Ummm --

A. That's what happens to structures when they are hit by high velocity wind. If you go to -- if you go to 2, my report speaks for itself. This from ASCE. I did not make this figure. This is a photocopy from the ASCE-7. You have wind coming from the left. All three sides of the room here or the house is in suction. And

to pull out is fairly easy. Like you know, you can drive a nail in a piece of wood, and it stay there. You push on it, nothing happen to the nail. You try to pull the piece of wood, the nail will pull out. That's what happened to glass. That's what happened to all the windows. They can pull out easier than you push them in. So when I talk about failure now or you are going to ask about failure later on, let's keep in mind suction.

Q. Okay. Well, let me ask you with respect to this Figure 2, do I understand you to say -- and I'm looking at Figure 2 on Page 4 of your report, and there are actually two drawings there, and I'm looking at the first one, the one to the left. Do I understand you to say that the wind we see there on the left is pointing directionally at the house, what would be due east if north were up? And I'm just using that to show you what I'm looking at. Are you testifying that the outward arrows, that the arrows pointing outward from the other three sides of the house represent suction?

A. Correct.

Q. Okay.

A. Now you got it.

Q. Okay. On these ground floor windows that you observed, all of which but two or three, or one or two -- I can't remember -- all of which but a handful you say

had been blown out, did they have no glass left in them, or did they have glass that was cracked? What did you observe in those --

A. Had no glass left in them. Completely pulled out.

Q. Did you observe any glass on the ground suggesting where it had fallen?

A. No. I did not see any glass. I saw some brick that was pulled out in suction and falling away from the house. I didn't see any pictures that -- as you go on, you have a whole stack of pictures in this case that I have looked at. You can see brick all the way around the house falling away from the house, from suction. Brick.

Q. And do you -- do you -- are these observations about the windows having blown out, are these based on your visit to the site in March of 2007 or on pictures you looked at or both?

A. On pictures.

Q. Okay. So what was the state of the ground floor windows when you visited the property in March?

A. It was cleaned -- it was in the process of being cleaned up.

Q. Are the pictures -- so it's from pictures of the residence that -- it is upon pictures of the residence that you based your conclusion that all but a

couple or a few had blown out.

MR. SCRUGGS: Object to the form.

THE WITNESS: This is only one aspect. The pictures are only one aspect on which I base the conclusions. The conclusions have other elements in it.

Q. (Ms. Sanders) Well, I'm really just referring to what you told me a minute ago, which was that you observed that all but a couple of windows had blown out with no glass left.

A. Correct.

MR. SCRUGGS: Object to the form.

Q. (Ms. Sanders) Okay. Is -- is that, what you just told me in that vein, based on review of pictures or a visit to the house in person?

MR. SCRUGGS: Same objection.

THE WITNESS: Both. Review of the pictures and observe what's going on in person, on site.

Q. (Ms. Sanders) But you did tell me that when you went in person, the windows were fixed.

A. No, there were no windows. Still broken.

Q. Okay.

A. But they were cleaning up.

Q. Okay. So there were -- all but a couple of the

ground floor windows were missing and gone when you visited the site in March of 2007.

A. Correct.

Q. And you believe, also -- you have -- you have also seen pictures from which you concluded that all but a couple of the ground floor windows were blown out.

A. Correct.

Q. Are those pictures, do they appear in your report?

A. I think so. I intentionally put one picture to show the front window is still there. Yeah here, Figure 10. I intentionally put that, Figure 10. I don't know if you can see it in color here. You see the two windows completely blown out? There's -- one window to the left is still boarded.

Q. Okay. What about Figure 8? There are some windows on the left-hand side of that picture. Are those blown out or intact? Oh, that's before.

A. That's before.

Q. Okay, got you. Okay. And we -- what about -- what about the second story windows, what I might call those dormer windows on the second story?

A. These are little baby windows.

Q. So were they blown out?

A. No, they cannot be blown out. They are baby

windows. The span length is too short to be blown out. Plus, they're under direct pressure. You see, direct pressure is not as serious as suction. Here again is an example of how direct pressure is not as serious as suction. These were direct pressure. The wind was coming from the east. These were on the east side. They have direct pressure. That's very low pressure-wise. The span is very short, small baby windows. They are not going to break as easy as the big windows. That's why I said from the beginning when you were talking about being transparent, this house is transparent as far as wind load is concerned.

Q. Okay. So I think I've understood you correctly that you did not observe, either in person or in pictures, that the windows on the second story of the McIntosh residence were blown out.

A. I didn't see them, yes.

Q. They were blown out, or they were not blown out?

A. They were not blown out.

Q. Okay. Were they damaged?

A. No, they were not -- well, there were a little damage in the corners, yes. I did go look. There were little stress damage. Not in the sense of devastation of failure as being displaced and blown out, no.

Q. The glass was intact.

A. The glass was intact, yes.

Q. Okay. And I think I've understood you -- your testimony to be that you believe that is because the windows were smaller than the ground floor windows and, also, because those windows were subject to --

A. Direct pressure. And they had shutters behind them.

Q. The ground floor windows did not have shutters behind them?

A. No.

Q. And were the ground floor windows not also subject to direct pressure?

A. Yes, the front windows, they were.

Q. And did those blow out in your estimation?

A. Yeah. In time after the wind get higher and higher, they did get blown out. But I'm pretty sure on the suction early in the game. Early in the game they were sucked out and blown out.

Q. On what do you base your conclusion as to the timing of those events?

MR. SCRUGGS: Object to the form.

THE WITNESS: If you look at the wind pressure history with time, you will see how the wind just keep picking up with time to get

to the peak, and for the span length of this kind of windows that far out, that big and that thin, they will be sucked out in no time.

Q. (Ms. Sanders) So do I understand correctly that when you told me a moment ago that you had concluded that the -- well, I won't paraphrase your testimony. But you offered a conclusion as to the sequence of events with respect to the windows --

A. Correct.

Q. -- what might have happened first and then later.

A. Correct.

Q. Do I understand -- you didn't actually observe the hurricane damaging the McIntosh residence personally.

A. No.

Q. Do I understand that your conclusions as to timing are based on your knowledge as an engineer applied to what you have seen in this situation?

A. Correct.

MR. SCRUGGS: Object to the form.

THE WITNESS: I would say my experience and testing and knowledge of forces and stresses is the basis of my conclusion, yes.

Q. (Ms. Sanders) Okay, and not direct observation of that sequence of events occurring at this residence?

A. Correct.

MR. SCRUGGS: Object to the form.

Q. (Ms. Sanders) Let's go now to the next page, Page 5 of your report. I want to look at the first sentence of the full paragraph there beginning at the middle of the page, and it says, "The structural stability of the framing of the McIntosh house was not lost during Hurricane Katrina, but the roof did get uplifted and clearly damaged at several locations and all around the house envelope."

A. Correct.

Q. Okay, now, I want to break that up into its two clauses separated there at the comma. First you say, "The structural stability of the framing of the McIntosh house was not lost during Hurricane Katrina." What does that mean?

A. It means it stayed in place. It was not picked up, and the wind did not walk away with it. It stayed exactly where it was supposed to be because it was framed properly and correctly, from a stability point of view.

Q. And when you say it stayed in place, what do you mean by --

A. The roof itself. From a stability point of view, it stayed in place.

Q. It did not become detached from the rest of the

house.

A. Correct.

Q. Okay. So when you say, looking at the next clause, "but the roof did get uplifted," what do you mean by that, "uplifted"?

A. Because for the wind pressure, wind uplift pressure, 120 miles an hour -- well, 100 miles an hour or even 80 miles an hour or even 70 miles an hour is a lot higher than the dead load weight of the roof itself. The roof itself as built is, what, 13 pounds per square foot. At 70 miles an hour wind you will have an uplift force in the neighborhood of about 20, 25 pounds per square foot, which is two times the dead load. And if you have an uplift pressure higher than dead load this is, by all philosophy, all engineering, all talk, even laymen, that's uplift.

Q. Okay.

A. Because -- because the pressure up is higher than the weight down, so this is uplift.

Q. So it is your testimony that the roof was subjected to an uplift force.

A. Correct.

Q. But not that it became detached from the house?

A. Correct.

MR. SCRUGGS: Object to the form.

THE WITNESS: It got loosened but did not get detached.

Q. (Ms. Sanders) Okay. On what do you base the conclusion that it was loosened?

A. Because wind load is a dynamic effect. It is a repetitive effect. It is a cyclic effect. In the life history of a hurricane, you have 27 million times of push and pull, push and pull. This is what wind load is. I have a figure in here to show you what wind looks like, which very few people really would like to talk about. I've had to live with it for 15 years. You see the picture on Page 14? This is what wind load looks like. It is not uniform pressure. It is not something pushing. It is not somebody pulling. It's push, pull, push, pull, push, pull, just like the seismic effect. You have in the life history of a hurricane 27 million times some of this pushing back and forth, back and forth, back and forth (indicating). You're telling me that the nails are not going to get loose? That is not true. You are telling me the uplift pressure at 70 miles an hour is higher than the weight of the roof, and you are going 27 million times doing like that (indicating).

The roof is not uplifted? Yes, it is uplifted. Is -- can it weaken? Yes, it can weaken. You want to fix it, you got to retrofit it, just like you retrofit a

structure after earthquake.

Q. Okay. But you did not actually observe any separation of the roof from the house.

A. Oh, yes. Yeah. I took some pictures, too. I have them here.

Q. Where are those? Are they in the report?

A. Yes. Look at picture on Figure 5. This is easier to see. See you got to take picture from a distance. Again, people that give you aerial photo and try to write what aerial photos and damage from aerial photos, they are just pulling your leg. But get it close and look at it. See this picture in here, see how the roof is uplifted? You see how the roof -- the shingles are pulled out, the fact that some shingles on that roof completely are loose? See all the blue covering of the roof in here? Why they have the blue covering? What is this covering for? Because something got uplifted.

Q. So Figure 5 depicts the loosening you referred to earlier.

A. Correct.

Q. You mentioned a few moments ago some -- some wind speed figures. Well, let me ask you another thing. When you referred me to Figure 13 which has to do specifically, I believe, with Hurricane Andrew, according to the caption, you say you had to live with that for 14

years. Are you referring to your own personal experience with hurricane damage?

A. No, in the lab trying to simulate this wind load second by second. Well, fraction of a second by fraction of a second, 20 readings per second. Have to duplicate this back and forth, back and forth.

Q. Okay. So that has been your work in the lab, attempting to duplicate that effect.

A. Exactly.

Q. Okay. Okay. Let's go back to Page 5, if we could. Looking at the last sentence, you say, "This roof damage is due to high wind velocity and occurred most definitely early in the timing of the hurricane history and way before any water surge occurred on the ground level."

A. Yeah.

Q. What is the basis for that conclusion?

A. Because I said at 70 miles an hour, you have uplift, and this is way, way before water surge really ever got even close to this house. At 70 miles an hour, at that time, the water still was 14 feet away -- below the house.

Q. How do you know that?

MR. SCRUGGS: Object to the form.

THE WITNESS: Well, this is from the Pat

Fitzpatrick report, Hennings report, Blackwell report, your report, other reports. Every report on the site when you put the time sequence of this surge and the hurricane will tell you that the water did not get to the house until after the wind peaked. I'm talking about peaked at 110, 120 miles an hour.

Q. (Ms. Sanders) Okay, so, to clarify, you are not a meteorologist.

A. No.

Q. Okay. So to the extent your report or your testimony here today cites a wind speed, is that based on your review of reports by the meteorologist offered in this case?

A. Correct.

Q. You didn't do anything to independently verify that meteorological information.

MR. SCRUGGS: Object to the form.

THE WITNESS: I didn't verify it. I just compared it from more than one source to make sure I have consistent reports of -- I took more or less -- more than one reference to come up with a conclusion what the wind load is.

Q. (Ms. Sanders) Okay. But you didn't do any independent investigation other than your review of the

meteorological reports?

A. Correct.

MR. SCRUGGS: Same objection.

Q. (Ms. Sanders) Looking still at that last sentence on Page 5, you talk about roof damage due to high wind velocity and then say it occurred most definitely early in the timing of the hurricane history. Did you reach a conclusion as to what direction the winds were blowing in when that damage occurred?

A. Yes, I did reach that conclusion because I looked at all the reports to see where the wind coming from. It was coming from the east, southeast, and I said at 70, 80 miles an hour wind, you have an uplift force higher than the dead load of the roof. So it has to have happened way before the water surge even got close to the house.

Q. Is it your testimony that the damages you showed us in Figure 5, is there a particular speed of wind at which you say those would have occurred?

A. They will start at about 70-miles-an-hour wind. They'll start.

Q. And is it your testimony that a 70-mile per hour wind could itself cause these damages?

A. It will initiate these damages as it -- I'm just repeating myself, really. Start, initiate, whatever

you want.

Q. Sure. And my question is whether it would finish them.

MR. SCRUGGS: Object to the form.

THE WITNESS: Oh, we never know when it's going to finish until we finish the whole hurricane.

Q. (Ms. Sanders) So you do not have an opinion as to whether if the winds were to remain at 70 miles per hour the damage depicted in Figure 5 would have occurred.

MR. SCRUGGS: Object to the form. Incomplete hypothetical.

THE WITNESS: It would not be to the extent you see in Figure 5 unless, you know, the wind get higher than 70-miles-an-hour wind.

Q. (Ms. Sanders) Okay. Thank you. Let's turn over to Page 7 of your report, Section 3.2. And I'm actually going to look down to the second paragraph there, penultimate sentence which begins, "The presence of excessive openings."

A. Yes.

Q. Okay. It says, "The presence of excessive openings, windows and doors, in the envelope of the McIntosh house that are highly susceptible to breakage by flying debris made it easy to speculate premature failure

in C&C," which I believe you have earlier defined to stand for components and cladding?

A. Correct.

Q. Okay. A couple of questions about that sentence. First, you mentioned flying debris. Is it your testimony that any of the windows you say were broken were broken by flying debris?

A. It's highly possible.

Q. Why do you say that?

A. Because they're glass, and they're big span, big glass windows, and if you have got flying debris to hit, the limb of a tree or a piece of wood, you could break them.

Q. Okay. Is it your belief that that might have -- I think you told me earlier that you believe suction forces resulted in the blowing out of all but a couple of the ground floor windows.

MR. SCRUGGS: Object to the form.

THE WITNESS: Well, that's one cause. Flying debris -- if you have flying debris, then this would be premature failure.

Q. (Ms. Sanders) So you think -- tell me if this is your testimony. Is it your testimony that flying debris may have caused some of those ground floor windows to blow out even before, in your view, suction would have

done that?

MR. SCRUGGS: Object to the form.

THE WITNESS: It's possible. If you have flying debris to happen earlier, it could happen, yes.

Q. (Ms. Sanders) Okay, and do I take it that you do not have an opinion with respect to any specific blown out window, whether it was blown out by suction or debris.

A. I have no proof. I was not there.

Q. Okay. So you believe either could have occurred, but you don't know.

MR. SCRUGGS: Object -- object to the form.

THE WITNESS: Well, that's -- yeah. I've -- I've answered that question, I think, correctly, yes.

Q. (Ms. Sanders) And your answer is?

MR. SCRUGGS: Same objection. It's asked and answered.

THE WITNESS: Yeah, this is just repeating ourselves. If there is a flying debris hit the windows early in the game, it could break the windows. If we do not have flying debris, then the suction will cause failure to these

windows.

MS. SANDERS: Okay. Thank you. Did you-all want to take a break?

MR. CANADA: I think your dad was asking you for a short break.

MR. SCRUGGS: Oh, he was? Okay. Well, it's -- is this a --

MS. SANDERS: Yeah, this is perfectly fine. I'm just wondering how my dad found me. But, yeah, you must be talking to Mr. Scruggs.

MR. NABORS: Off record.

(Following a break, the deposition proceeded as follows:)

MR. NABORS: This is Tape 2. Back on the record.

Q. (Ms. Sanders) Okay, Dr. Sinno, we're back on the record, and before we took the break, we had been talking about window breakage, and you mentioned that blowing out of windows could possibly, in your view, have occurred due to suction or maybe due to flying debris. Have I got that right?

MR. SCRUGGS: Object to the form.

THE WITNESS: Well, correct. We were talking about the timing.

Q. (Ms. Sanders) Okay. But -- but it is your

opinion that at some point by some cause, all but a couple of the windows were blown out.

A. Correct.

Q. Would the absence of windows, the blowing out of the windows, the opening of the windows, affect the wind dynamics in and around the house?

MR. SCRUGGS: Object to the form. Assumes facts not in evidence.

THE WITNESS: It will affect the dynamics of the house, of course.

Q. (Ms. Sanders) Okay. And would it -- would the effect on the wind dynamic of the house be different depending on when during the storm the windows blew out?

MR. SCRUGGS: Object to the form. Incomplete hypothetical.

THE WITNESS: It is hypothetical, but it is -- what you are say is not farfetched. It's correct.

Q. (Ms. Sanders) And you have reached no conclusion as to the exact timing of the blowing out of the windows.

MR. SCRUGGS: Object to the form.

THE WITNESS: What do you mean by timing, compared to what? The blowing out of the windows occurred early in the game if that's

what -- yes, I did say that, and I will stand by that.

Q. (Ms. Sanders) Okay. And I think you told me that was based on your review of the meteorologic reports and your engineering knowledge about what is likely to happen with various forces.

MR. SCRUGGS: Object to the form.

THE WITNESS: Correct.

Q. (Ms. Sanders) You did not actually witness the blowing out of the windows.

A. No.

Q. I'd like to go back to the sentence we had -- had looked at before the break, which is on Page 7 of your report, towards the end of the second paragraph, and says, "The presence of excessive openings, windows and doors, in the envelope of the McIntosh house that are highly susceptible to breakage by flying debris made it easy to speculate premature failure in C&C."

A. Uh-huh (affirmative response).

Q. Now, you've used the phrase "speculate premature failure." Is it your conclusion that there was premature failure in C&C at the McIntosh house?

A. No, it's speculating. It's guess work.

Q. Okay. And the next sentence says -- well, let me follow up on that just a moment. So you have reached

no conclusion as to whether there was premature failure in C&C --

MR. SCRUGGS: Object.

Q. (Ms. Sanders) -- at the McIntosh house?

MR. SCRUGGS: I apologize. Object to the form.

THE WITNESS: I just answered that. It's just guess work. We're speculating. I have no proof.

Q. (Ms. Sanders) Okay. But -- but whether or not you would characterize it as guess work or subject to proof, have you -- is it your opinion that there was, in fact, premature failure in C&C?

MR. SCRUGGS: Object to the form.

THE WITNESS: I have --

MR. SCRUGGS: Asked and answered.

THE WITNESS: I have just answered that. I have no proof that there were premature failure, but it's easier to speculate because when you have high velocity wind, flying debris is common occurrence all the time. As a matter of fact, now the State of Florida require that you have a test set up in which flying debris takes place and see what happens to the glass, to metal, to sheetrocks. Flying debris is part

of wind loading.

MS. SANDERS: Okay. I'll object to that as nonresponsive, but let me see if I can ask it a better way.

THE WITNESS: Yeah, ask a better way, please.

Q. (Ms. Sanders) Did you observe anything, either in person or in photographs, at the McIntosh residence specifically that caused you to conclude, based on your observations, that there had been premature failure in C&C?

MR. SCRUGGS: Object to the form.

THE WITNESS: I did not say there were premature failure. I said we speculate. We guess. We assume there is flying debris with a hurricane. With high velocity wind, there is flying debris, so there is a speculation, guess work, that this could have happened. I did not see it. I was not there. I am not saying it happened. I have no proof it happened, but I could speculate. I could guess that it could have happened.

Q. (Ms. Sanders) Okay. And if it -- if it had happened, would you expect there to be -- I mean, I don't know -- let me ask this. What do you mean by premature

failure in C&C?

A. I mean, when you have flying debris, a piece of rock, a piece of wood hit the glass, it will break. Of course, through damage from just, like, vandalism, if somebody just hit it with a piece of rock, piece of wood. So this is not really failure from actual pressure of suction or direct pressure from wind.

Q. Okay. So would you consider blowing out of a window to be a failure in C&C?

A. Yes.

Q. Okay. Let's look at the next sentence in your report which says, "Failure of the C&C is often but not always followed by catastrophic structural failure of the MWFRS."

A. Correct.

Q. Now, remind me what MWFRS stands for?

A. Main wind force resistance system.

Q. Okay. Is it -- have you reached a conclusion as to whether in this case the McIntosh residence experienced catastrophic structural failure of the MWFRS?

A. No, it did not. That's what the first sentence states that a while ago we talked about, that the structural stability of the system was not compromised in this house.

Q. Okay. Thank you. Now, I want to look at

Paragraph 4.0 which begins about the middle of this Page 7, which is titled, "Wind Field from Hurricane Katrina at Biloxi, Mississippi." This section includes what I would characterize as meteorological data. Would you agree with that?

A. Correct.

Q. Is the source of that what you told me earlier, the meteorologist reports in this case?

A. Correct, several references, yes.

Q. Okay. And I understand you looked at more than one meteorologic report.

A. Correct.

Q. But when you say things like the residence, quote, was exposed to hurricane force winds for many hours, that's based on your review of the meteorological reports?

A. Correct.

Q. Okay. And that's true for all the meteorologic observations in your report?

A. Correct.

Q. You say at the end of that first paragraph, "Due to field failures of some critical instrumentations, the entire picture of the wind forces, especially the extremely high instantaneous gust of wind loading, was not recorded." What field failures are you referring to

there?

A. I'm talking about the failure of the instrumentation in the Trent Lott Airport and in Biloxi, Mississippi at the EOC Center failure, 137-miles-an-hour wind, which I refer to in my report.

Q. And how did you come to a conclusion that those instruments had failed?

A. I got the affidavit of the director of the EOC. He had an affidavit in writing, talking about its failure at 137-miles-per-hour wind and the failure at Trent Lott Airport I think was reported by a lot of people, a lot of researchers that were -- clearly concur this failure, and that's how I know.

Q. Okay. So you didn't do a firsthand analysis of those instruments.

A. No.

Q. Okay. I'm going to look at the second paragraph there in Section 4.0 which says, "An outer core band of strong thunderstorms from a second eyewall impacted the Biloxi area." What is the source of your assertion there that there was a second eyewall?

A. This is from a report from either Blackwell or Hennings or both of them. I don't recall right now. They do talk about this second eyewall. Plus there's a paper came out -- I think it was about that same time --

by Pat Fitzpatrick with Blackwell on that respect.

Q. Okay. Do you know whether the National Hurricane Center has indicated that there was a second eyewall in Katrina?

A. No, I don't know.

Q. Let's go back -- or down to the third line up from the bottom of that paragraph where you say, "National Weather Service radar data indicates many tornados, and satellite shows mesovortices on the inner edge of the eyewall capable of extreme wind damage that were similar to the damage caused by the mesovortices in Hurricane Andrew."

A. Yes.

Q. And what -- what is the source of your observations there?

A. Well, that's what Hurricane Andrew is really known for, which I have simulated in my lab. It has spikes in loading, and the reports I read, the meteorology reports, all talks about spikes in loading in Katrina. Now, how correct is that, I really don't know, but I relied upon that in my report.

Q. Okay. Is it your understanding that National Weather Service radar data can -- can actually confirm the presence or absence of a tornado in a specific location?

MR. SCRUGGS: Object to the form.

THE WITNESS: I assume they do. I have no other -- I have no proof either way. I assume they do.

Q. (Ms. Sanders) Okay. And when you say that these meteorologic factors would have been capable of extreme wind damage that were similar to the damage caused by the mesovortices in Hurricane Andrew, that's based on what you have gleaned about the meteorology from the meteorologist's reports?

A. Yes.

Q. And I think you said you have yourself had occasion to simulate in the lab at least some of the conditions of Hurricane Andrew?

A. Correct, the spikes in it, yeah.

Q. Have you done that for Hurricane Katrina?

A. No. I don't have footprint of Hurricane Katrina yet.

Q. Okay.

A. It's not out yet.

Q. Okay. Let's turn over to Page 8, and I want to look at the very last paragraph of Section 4.0. We talked briefly about ADCIRC earlier, and you say here, "At the McIntosh residence, the sustained wind speed is estimated by the ADCIRC simulation at 100-110 mph with

the 3-second gust wind to reach 120-130 mph"?

A. Correct.

Q. Is it your understanding that the ADCIRC product estimates wind speeds?

A. I don't know the details of what do they estimate or not, but it was reported by more than one meteorological expert, and I relied upon that.

Q. Okay. Let's go down to Section 5.0, also there on Page 8. You go through some various, what you call, factors. Using your words, "factors that determine the magnitude and distribution of high velocity wind forces." So the first one you've listed there is location. And you talk a little bit there about the McIntosh residence. And then you say at the -- the last sentence, you conclude, "It," referring, I believe, to the McIntosh residence, "is therefore expected to face greater wind damage from Hurricane Katrina than houses further inland away from the water and on dry land locations."

A. Correct.

Q. Have you actually personally observed whether the residence, in fact, faced greater wind damage from Katrina than houses further inland?

MR. SCRUGGS: Object to the form.

THE WITNESS: I did visit the whole area of the sites. I did see damage from hurricane

wind loading in that house compared to other houses. I did see some houses further inland that were not damaged, yes.

Q. (Ms. Sanders) So is it your testimony that there were no houses further inland that were equally damaged or more damaged than the McIntosh residence?

A. Oh, yeah.

MR. SCRUGGS: Object to the form. Mischaracterizes --

THE WITNESS: Of course. There are all kind -- all kind of damage, all kind of houses. Every house have to be evaluated on its own merits. And there were some worse, some better, some -- it depends how they were built.

Q. (Ms. Sanders) Okay. So simply the location inland -- the degree -- strike that. Simply the position of the house with respect to the coastline does not allow you to make an assessment of damage.

MR. SCRUGGS: Object to the form.

THE WITNESS: No. The location is an -- is an element, is a factor in the magnitude. This location of this house on the cliff, on the edge of the water, is not obstructed by any trees or -- to diminish the wind loading is a factor.

Q. (Ms. Sanders) Okay. Leading into that, the next factor you list there is you've -- you've called exposure. And you say, "The McIntosh residence is in open land spaces adjacent to a large body of water. The effects of high velocity winds are not shielded or partially shielded by adjacent structures, and thus, no unusual increase in design velocities is to be expected." And then you've got a cite to ASCE 7-02. Your reference there that it's not shielded or partially shielded by adjacent structures, are there no neighboring houses?

MR. SCRUGGS: Object to the form.

THE WITNESS: No, there must be -- could be neighboring houses. But ASCE-7 talks about open water. You could have neighboring houses. No big deal. Neighboring houses do not do that much protection.

Q. (Ms. Sanders) Okay, so when you refer to adjacent structures, you don't mean neighboring houses when you say there were no adjacent structures?

A. Well, adjacent major structures or high structures or something that will obstruct the wind, yes. But there were adjacent structures.

Q. Okay. And then when you refer there, you use the phrase "design velocities." What does that mean to you?

A. That's the minimum design velocity of ASCE. I'm referring to the ASCE-7 which a lot of people try to use it and refer to it. But that's what I'm talking about.

Q. Is ASCE-7, are those specifications to be considered in constructing a house?

A. As a minimum, yes.

Q. Okay. So when you referred here to the design velocity citing ASCE-7, you're referring to the velocity that in your opinion should be considered in designing or constructing the structure.

A. As a minimum.

Q. I understand that.

A. Well, this has to be important. Because ASCE-7 says if you know anything that makes you or requires you or give you the feeling or the idea that you should use more than the minimum, you must, and you should. And they will give you leeway every other sentence that if you know that you should use more, you are supposed to use more. This is the bare minimum. And ASCE-7 changes every three to four years and has been changing for the Gulf Coast. It's getting stricter and stricter. They're requiring more and more with time comes. As they learn and understand, they learn, they do testing, they do lab research and they find out what's going on, they are

going to go higher and higher in wind loading as time goes by.

Q. Okay. And when you say here that the McIntosh residence -- I think you say, no -- you are saying, "No unusual increase in design velocities is to be expected." What does that mean?

A. As you go in, go to Exposure Category C, ASCE-7.

Q. And is -- Category C is defined in ASCE-7?

A. Correct.

Q. Okay. I'd like to go now to the factor you've listed there, you've called "Shape"?

A. Yes. That's important.

Q. Let's go back to the -- I want to look at the final two sentences of that paragraph. You say, "A tunnelling effect is created that ripped through the house from right to left causing internal damages and inviting flying debris into the house." Is it your testimony that there was a, in fact, a tunnelling effect in the McIntosh residence during Hurricane Katrina?

MR. SCRUGGS: Object to the form.

THE WITNESS: There is no doubt about that.

Q. (Ms. Sanders) Okay. And is there similarly no doubt that it ripped through the house from right to

left?

A. There's no doubt about that.

Q. Okay. And what do you base that -- those conclusions on?

MR. SCRUGGS: Object to the form.

THE WITNESS: The architectural geometry of the windows, line of windows on the right and left of the house, and they were broken both, and the wind is coming from the east to the west. It has no other explanation but that.

Q. (Ms. Sanders) Okay. And since I asked a bit of a compound question, that's the basis both for your conclusion that a tunnelling effect was created and that it ripped through from right to left?

A. Correct.

Q. Okay. You say then that that caused internal damages. Did you actually observe those damages?

A. I don't have to. This is what the definition of tunnelling effect is. You know, how they simulate wind loading in the tunnel. They create a tunnel to get high velocity wind. I'll give you a simple little example that probably you will understand what tunnelling effect is. If you take a balloon and you blow it up. Then you take the neck of the balloon and you let the air

out, it's going to come out at a very, very high velocity. This is the bottling effect, necking effect, tunnelling effect. Call it whatever you want, but it is known as the tunnelling effect in wind engineering. You get high velocity wind as you block air, then you let it escape through a narrow opening.

Q. Okay. I will object to that as nonresponsive. And I understand --

MR. SCRUGGS: And I'm going to object to the extent that on all these objections, he's trying to answer your questions the best way he knows how. So you can state whatever objection you want on the record, but his answer is his answer.

Q. (Ms. Sanders) Okay. So I asked you whether you actually observed internal damages, and you said you didn't have to, to come to your conclusion, and I understand what you've said there.

A. I was not there to observe it. You see, you are asking me the question did you observe it, you know? And we have gone over it and over it and over it again. I was not there. But you want an expert witness. This is my expert witness. I can tell when I look at things now as an expert, I could tell if there is an opening and a passage of wind, the wind would go through the opening

and would create a tunnelling effect.

Q. Okay. Well, let me try to -- maybe this will be a better question. When you visited the house -- and I understand you weren't there when the storm actually occurred. When you visited the house, did you see anything in the house that you believe were these damages caused by the tunnelling effect?

MR. SCRUGGS: Object to the form. Asked and answered.

THE WITNESS: Yes. The damage I saw on the house, no question about it, most of it was really damage from the wind blowing through -- high velocity wind through a tunnelling effect. That wind probably inside the house was extremely high. It was high -- it could go as high as -- I have no proof but it could go as high as 200 miles an hour through the tunnelling effect, and you could see the damage all around the internal and the external of the house from the tunnelling effect.

Q. (Ms. Sanders) Could you describe the internal damage that you saw?

A. It was a lot of partition walls completely ripped apart. There is a lot of walls on the outside completely ripped apart all the way to the roof. And

this is created from suction, again, because of the high velocity tunnelling effect. You create suction behind it. And you can see it ripped off. Look at the pictures. You can tell from the pictures. You have pictures in the record that show you damages all the way to the roof.

Q. Could you direct me to the figure that you'd like me to look at?

A. This is one of the pictures in your records but -- you cannot really see it clearly in here but you -- I don't know if I have one in my record here. Yeah, you can see it on Figure 11, for example, you can see a little bit there. Here's one from the record. How do you explain all this damage in here other than it being suction from high velocity tunnelling effect?

Q. Okay. My -- my question actually had to do with damage inside the house. Is there a figure to which you would direct me that -- that shows that damage?

MR. SCRUGGS: Object to the form.

THE WITNESS: I might not have it in my report but -- I don't believe I have it in my report. There's a lot of pictures on the record for this case that you're aware of that would show that. If you show me some pictures for the record, I will show them to you. I

will --

Q. (Ms. Sanders) Do you remember if you thought--

A. -- do that.

Q. Oh, I'm sorry. Go ahead and finish.

MR. SCRUGGS: I think he's finished.

MS. SANDERS: Okay. If I do jump in, and your weren't finished, please let me know.

MR. SCRUGGS: MR. SCRUGGS: Absolutely.

Q. (Ms. Sanders) Do you know -- do you remember whether you noticed any bookcases in the ground floor of the house when you visited the house?

A. Yes, I did.

Q. Were there any books on the shelves?

A. If they were protected, yes.

Q. Protected how?

A. From the tunnelling effect.

Q. How -- how were they protected from the tunnelling effect?

A. If they are not in the passage of window to window where the wind is blowing from left to right and they are protected, that's fine. Because it will have high velocity wind there just streaking through, and this is on the side, so they will be still there.

Q. Okay. This tunnelling effect that you concluded had occurred, was that only on the ground

floor?

A. Yes. Because that's where the windows, left and right, are broken on the ground floor, yes.

Q. Okay. You then -- and let's continue on with where we were in the report. The next sentence says, "This open space allowed later on to be --"

A. What page are you on?

Q. Oh, I'm sorry. I'm still on Page 9 and under the factor you have called "Shape," in about the middle of the page, the last sentence. "This open space" -- are you with me?

A. Yes.

Q. Okay. "This open space allowed later on to be inundated by floating debris from the water surge." You mentioned water surge. Did you analyze the effect of water surge on the property?

MR. SCRUGGS: Object to the form. Asked and answered.

Q. (Ms. Sanders) Could you show me where in your -- if you analyzed it, could you show me where in your report you analyzed it?

A. What do you mean by "analyzed it"? I don't understand the question. What do you mean by "analyzed it"?

Q. Well, did you develop any conclusions about

whether any damage had been done to the residence by the water surge you referred to here?

MR. SCRUGGS: Object to the form.

THE WITNESS: You need to ask the question a little bit different, if you don't mind, so I can understand it.

Q. (Ms. Sanders) Well, do you have any belief one way or the other as to whether water surge caused any damage to the McIntosh residence?

MR. SCRUGGS: Object to the form.

THE WITNESS: The water surge did not cause damage in the sense you -- I don't know what you are talking about damage. The water surge did not cause any damage categorically. The water surge caused a washout to the house, yes. You are telling me did it cause a washout? Yes.

Q. (Ms. Sanders) How do you -- what do you mean by washout?

A. I mean after the wind finished destroying the house, after the wind finished doing the damage, the water surge came in and washed whatever is left.

Q. And you don't know what was left.

MR. SCRUGGS: Object to the form.

THE WITNESS: Not much left, but you could

leave some marks or see some marks in there. I don't believe there's much left.

Q. (Ms. Sanders) Okay.

A. Most of the damage you see from pictures, I -- I would suspect about 99 percent is really -- 99 percent, I would say that is wind damage, no question about it. The water did only washout. The word "damage" should not be used with the water at all in this case.

Q. Okay. And the -- have you already described for me the basis for your conclusion that the water did no damage?

MR. SCRUGGS: Object to the form.

THE WITNESS: I said the water did washout. The water did not do any damage.

Q. (Ms. Sanders) Okay. Well --

A. There is no sign whatsoever that would make me to conclude that there is damage from water. There was a washout from water, yes. No damage.

Q. You did not observe a waterline in the residence?

A. No.

MR. SCRUGGS: Object to the form.

THE WITNESS: Not in the residence.

Q. (Ms. Sanders) Did you observe a waterline somewhere else?

A. They told me about a waterline somewhere else, yes, at 11 or 18.6 feet.

Q. Okay. But when you visited the house, you saw no waterline.

A. No, not inside the house.

Q. Did you see any difference in damage between the lower two, three feet of the house and the rest of the house?

MR. SCRUGGS: Object to the form.

THE WITNESS: All of it is wind damage, the lower two, three feets or the rest of the house. When you have tunnelling effect, wind will go at a high velocity at low levels, not high levels. And it will do damage at low levels. And that's why I said the water -- the wind damage is really what caused all the damages that you're calling damages.

Q. (Ms. Sanders) Okay. Well, I'm -- I'm really just trying to understand what led you to that conclusion. What features, what specific things that you saw led you to the conclusion that it was wind damage and not water damage?

MR. SCRUGGS: Object to the form. Asked and answered. We've been through this.

THE WITNESS: I have answered that before,

and I will repeat again. This suction all around the house at higher levels, this is definitely wind. There is damage at lower levels inside and outside the house from tunnelling effect because when you have tunnelling effect, this will go at lower level to high level at high speed, very high speed velocity, and it could damage the inside and the outside at lower levels. For this reason, you cannot -- you cannot tell me water did any damage. The only way I could believe there's water damage, if you show me a picture that tell what happened. Give me a picture between the wind at high velocity. Then the water comes lately, after the high wind. Then we can tell what the water did. If you don't have a picture in between, how can you talk about water damage? There's no water damage. There's water washout.

Q. (Ms. Sanders) Okay. And I -- I don't actually want repetition anymore than anyone else does, so simply to be clear for the record, have you already explained to me your reasons for concluding that the damage you observed was wind rather than water? My question really is going to -- and I understand Mr. Scruggs' point that

you've testified about this, but is there something else you need to tell me on that front to give me a complete answer, or have you told me the answer already?

MR. SCRUGGS: Other than -- let me object. Is the question other than his report and what's set out in his report? I mean you can ask him --

Q. (Ms. Sanders) You're -- with that. I mean, I see what's in your report, and I know -- and you have told me here today you see wind damage and not water damage. And given what you've told me here today and what you've put in your report, is there anything else on top of that that you need to tell me that -- strike that -- not that you need to tell me but that led you to your conclusion that it was wind damage, not water damage. Do you understand my question?

A. I --

MR. SCRUGGS: Object to the form.

THE WITNESS: I understand your question--

Q. (Ms. Sanders) Let me rephrase. It was a messy question.

A. Okay.

Q. I am interested in knowing the entire basis for your conclusion that there was wind damage and not water damage. I see what's in your report, and I know what you

have told me already today. Is there anything else that led you to that conclusion that you haven't already put in your report or testified about today?

MR. SCRUGGS: Same objection.

THE WITNESS: I think I have answered that question. Everything in my report I stand behind, and I have given you additional explanation, if you call that additional. I stand behind it too.

Q. (Ms. Sanders) You have nothing more to tell me on that.

MR. SCRUGGS: Same objection.

THE WITNESS: Not that I think of right -- not that I can think of right now.

Q. (Ms. Sanders) Okay, thank you. Let's go to the paragraph on No. -- Page No. 9 of your report that begins "Natural period."

A. Yes.

Q. And I want to look at the second sentence which says, "The McIntosh residence, whose natural periods are expected to be near the natural periods of the energy contained in the wind gusts, should feel the effect of the wind more than other houses whose natural periods are not near those of the energy contained in the gusts." Have I read that correctly?

A. Correct.
Q. Okay. What is the natural period of the McIntosh residence?
A. You want a number, do you mean?
Q. Yes.
A. It's about 4.5 to 7 cycles per second.
Q. And how did you come up with that number?
A. Oh, it was from my testing and research on structural systems and the period of wind loading.
Q. Did you do any such testing specifically on the McIntosh residence?
A. No, not specifically the McIntosh residence.
Q. Okay. Let's turn over to Page 10, if we could. I want to look at the sentence that begins in about the middle of the paragraph that says, "The internal structure of the house." Are you with me?
A. Yes.
Q. "The internal structure of the house was severely damaged by this open harsh wind environment and the open roof for rainwater to enter the attic and destroy the false ceiling and the interior partitions of the house." You refer there to -- you use the phrase "open roof." What do you mean by that?
A. Oh, there was some penetration of the roof. There was some damage to the roof. There were shingles

blown out. There was some rainwater gone through the roof and damaged the false ceiling and damaged the second floor and went all the way down to the first floor. And this is all reports, not only my report. Even your reports talk about damage on the roof.

Q. So when you say "open roof," I believe you testified earlier it is not your testimony that the roof had become detached.

A. No.

Q. Is it your testimony that there was a hole or holes in the roof?

A. Correct.

Q. Okay. How many?

A. I don't know how many, but I can look at the covers -- the covers they put on the roof here. You have pictures. You see all the blue covers? That's to cover the holes.

Q. Did you actually see any holes in the roof?

A. I did see the covers.

Q. But not the holes.

A. No.

MR. SCRUGGS: Object to the form.

Q. (Ms. Sanders) Okay. Let's turn over, if you would, to Page 13 of your report, and this is now picked up in a section, Section 6.2, which you have entitled

"Sustained Wind Speed."

A. Yes.

Q. I want to look at -- around the middle of the first paragraph on Page 13 you say, "Based on the most recent research conducted at Mississippi State University at the Kelly Cook Structural Wind Simulation Laboratory" -- and I understand you're at the -- on the faculty at Mississippi State, correct?

A. Correct.

Q. And you work in this laboratory.

A. Yes.

Q. Okay, "it was established beyond any shadow of a doubt that structures respond fully, 100 percent of the time, to one second instantaneous gust wind loading." Have I read that correctly?

A. Correct.

Q. Okay. What do you mean there when you say "structures respond fully"?

A. You see, ASCE-7, they don't know when the structures will respond to wind loading, at what gust velocity in time. Is it two seconds, three seconds, four seconds, five seconds? They don't know. So they finally came up with a conclusion in 1995 to use a three-second. Before that, they used to use the fastest wind load. But in 1995, they said, no, fastest wind load -- because they

know wind varies in speed in time. They used to use the fastest wind load. In 1995 ASCE-7 got together and said we're going to use a three-second gust. Because at that time they concluded that the structure will respond, will react to three seconds. Anything less than three seconds, the structure will not feel. It's so fast. So they asked me through the University of Western Ontario to do in my lab testing to see at what speed level in seconds the structure will respond. So we start testing structures at very, very low speed, .1 of a second, .2, .3, .4, .5, and we get the response. Then when it got to one second, whatever we put in the structure we got a response, 100 percent. So now we know -- under ASCE, now we know, and those people just reading it, they know that the structure will respond to one-second gusts.

Q. And when you say "respond" --

A. Yes.

Q. -- what does it do? What does the structure do?

A. That means if you put 100 pounds, it will feel 100 pounds.

Q. Okay. Does it have to be damaged to respond?

A. No.

Q. Okay. How large an area responds to that one-second instantaneous gust?

A. Well, in our testing in the lab, we use one square foot.

Q. Okay. And did that whole area respond?

A. Yes.

Q. You didn't use any larger areas?

A. Oh, no. We used full scale roof. But you apply the load at one square foot.

Q. Okay. So the area to which you subjected the one-second instantaneous gust was one square foot.

A. Correct.

Q. And no larger.

A. No larger, no.

Q. And that area, it's your testimony, all of it responded to that one-second instantaneous gust.

A. Correct.

Q. Let's turn over to Page 15, picking up with Section 6.3 of your report entitled "Instantaneous Gust Wind Speed at the McIntosh Site."

A. Correct.

Q. Look at the second paragraph of that section, you have said, "The instantaneous wind gusts played an important role at the McIntosh site by the fact that the roof and all the windows and the structural framing got severe wind damage." Is the basis for your conclusion the evidence you've already described for me here today

and put in your report?

MR. SCRUGGS: Object to the form.

THE WITNESS: Is this a question?

Q. (Ms. Sanders) Yes.

A. Would you say it again?

Q. Well, I am tempted to ask you what is the basis for the conclusion you have reached in the first sentence of the second paragraph there. If it is things you have already told me and put in your report, you need not repeat them. If it is something new, I would ask that you tell me.

MR. SCRUGGS: Same objection.

THE WITNESS: Let me try to answer this question, although, it is not very clear. But what I am trying to say in my report is fairly clear. The instantaneous wind gust is definitely higher than a three-second gust. And the structure did respond to that by the evidence we see in the field.

Q. (Ms. Sanders) Okay. So when you refer to the evidence you see in the field, that is the evidence you have cited in your report and told me about here today.

MR. SCRUGGS: Same objection.

THE WITNESS: Yes.

Q. (Ms. Sanders) Okay. Is there any more

evidence that you have not already described, either in your report or in your testimony?

MR. SCRUGGS: Same objection.

THE WITNESS: Well, it is described in my report. If you don't mind, just to stress something, just -- that Figure 14 in my report, show you what I'm talking about.

Q. (Ms. Sanders) Okay. Now, the next sentence says, "The entire" -- I'm back in that last paragraph on Page 15. "The entire structure of the house shifted away and deflected from its original location causing separation from encased brick columns and horizontal shear cracking was evident in these columns, see Figure 14 for a typical failure." Is there any image in your report other than that Figure 14 that you contend demonstrates that shifting away and deflection that you refer to?

MR. SCRUGGS: Object to the form.

THE WITNESS: Understand truly, Figure 14 speaks for the whole case. Figure 14, that's all you need to really sit down and be relaxed and conclude that it is nothing but wind, wind, wind that did all the damage to the house. If you look at Figure 14, you can see the wind is hitting the house on top, overturning the

house. The crack in the brick here at 45 degrees, the shifting of the house away from the column, this is nothing but wind damage.

Q. (Ms. Sanders) And just for the record, the photo you are holding up there is reproduced at Figure 14 in your report?

A. Exactly. This is clearer here. It's a little bigger.

Q. Okay. But it is the same photo that you have reproduced.

A. Correct.

Q. Okay. Oh, let's stick with that paragraph for just a moment, if you would. I want to talk about the 20 to 30 percent -- I'll read what you have written there, but I'm referring to the part where you say, "It is also a well known fact by all wind engineering researchers and related studies as acknowledged by the ASCE-7 that the 3-second gust wind factors are between 20 to 30 percent higher than the one minute sustained wind speed. ASCE-7 uses the three seconds gust." And then I want to focus on this next sentence. "The instantaneous wind speed, one second gust, is another 20 to 30% higher than the three second gust wind speed." So I -- if I understand, the ASCE specifies that a three-second wind factor is between 20-to-30-percent higher than the one minute.

Correct?

A. Correct. Correct.

Q. Does the ASCE also specify that the one second is another 20-to-30-percent higher than the three second?

A. The ASCE-7 did not know as of today the details of the instantaneous wind, what's going on, if the structure will respond to it or not. Now they know. However, ASCE-7 mentioned the instantaneous wind speed in their appendix to the ASCE-7, and they talk -- they talk about instantaneous wind speed, and they do mention that you should take it into consideration. Not until they get some test data to see if the structure will respond to one second, then it will be included in the ASCE-7.

Q. Okay.

A. But it is mentioned in their appendix.

Q. So it -- I think I've understood you correctly that the appendix mentions the one-second gust and says it should be taken into consideration but does not prescribe the 20-to-30-percent factor for converting three seconds to one second?

A. Oh, yes, they do.

MR. SCRUGGS: Object to the form.

Q. (Ms. Sanders) Okay. It's your testimony that ASCE --

A. They have an appendix, again, a graph to show

how you can transform wind speed from sustained to three seconds, one second, whatever it takes.

Q. Okay. And I understand -- and I apologize if I'm just not understanding. But I understand that the ASCE says if you want to go from one-minute sustained to three seconds, you use 20 to 30 percent.

A. No. They do not mention the 20 to 30 percent. This is just based on what kind of wind you have, what kind of vortices you have, what kind of spikes. You see, this is really explained in detail in the figure after that. Here, on Figure 12 on Page 12. This explains to you the averaging process in which we can transform wind velocity into pressure. If you take one hour wind -- you take the average of one hour, you get one answer, 10 minutes, one minute, three seconds. You go to one second, you get spike, and the spike will give you higher pressure.

Q. Okay. But does the ASCE specify a percentage by which you would multiply a three-second figure to get a one-second figure?

MR. SCRUGGS: Object to the form.

THE WITNESS: No. They have not got into that detail. They give you a graph in which you can do it.

Q. (Ms. Sanders) Okay. So is your -- is your

employment of the 20-to-30-percent coefficient in going from three seconds to one second, that's based on your own research and work in the lab?

MR. SCRUGGS: Object to the form.

THE WITNESS: No, that's based on a lot of wind engineering experts. You talk to Pat Fitzpatrick, you talk to Hennings, you talk to Blackwell, you talk to your own wind experts, they will tell you that the gust factor is at least 20 to 30 percent, and they could go as high -- recent research on Katrina, a lot of papers came up, since my report on Katrina, they take -- they talk about the gust factor, three-second gusts as high as 100 percent. From 30 to 100 percent. 30, 40, 50. You can see all those reports coming out now higher than 30. If you use 20 to 30 in my report in here, that's on the low side. ASCE recognized at least 20 to 30.

Q. (Ms. Sanders) And when -- with respect to the answer you just gave me, were you referring to the conversion from one minute to three seconds or from --

A. From one minute to three seconds.

Q. Okay. It is, is it not, another step to go then from three seconds to one second.

A. Correct.
Q. And you also employed a 20-to-30-percent range in making that second conversion from three seconds to one second.
MR. SCRUGGS: Object to the form.
THE WITNESS: I did not use the one second in my conclusions here. I did not need to. The three seconds is plenty enough for me to conclude that the McIntosh house was damaged by the wind.
Q. (Ms. Sanders) Okay. Well, you do say, looking at the last sentence on Page 15, you say, "The instantaneous -- instantaneous wind speed at the McIntosh house that needs to be used in the assessment of initial structural response based on 110 mph sustained wind speed is then equal to 160 - 180 mph." I read that as indicating that 160 to 180 is meant to be an instantaneous wind speed. Am I wrong about that?
MR. SCRUGGS: Object -- object to the form.
THE WITNESS: It's correct, yeah.
Q. (Ms. Sanders) Okay. So is it your testimony that you did or did not use that figure as an instantaneous wind speed in arriving at your conclusions in this report?

A. No, I did not use --

MR. SCRUGGS: Object to the form.

THE WITNESS: -- the instantaneous wind speed.

Q. (Ms. Sanders) Okay.

A. But if I used instantaneous wind speed, it's more reinforcing my conclusions.

MS. SANDERS: Okay. Do you-all want to take a quick break? I don't know that I have a whole lot more.

MR. SCRUGGS: Yeah.

MR. NABORS: Off the record.

(Following a break, the deposition proceeded as follows:)

MR. NABORS: Back on the record.

Q. (Ms. Sanders) Dr. Sinno, I've just got one thing I wanted to follow up on from earlier. Some other folks may have questions. But if you would turn to Page -- back to Page 7 of your report for me for just a moment, I'm going to look at the last paragraph on that page. The sentence beginning about on the third line down, the end of the third line, it says, "Structural damages to many residential areas in the neighborhood to the McIntosh residence are noted to reflect this localized catastrophic failures known only to occur in

severe wind vortices and downbursts." You mentioned there "residential areas in the neighborhood to the McIntosh residence." Did you visit other residential areas in that McIntosh neighborhood?

A. Yes, I did visit the houses in the neighborhood. There's a Church house completely blown out, and there is a -- his name is Muchk, Ron and Linda, house had some roof damage. And there's all kind of levels of destruction in the area.

Q. Okay. And was this -- did this -- did you visit those other sites at the same time you visited the McIntosh site in March of 2007?

A. Did I visit -- will you say that again?

Q. Well, you mentioned that you had seen some other structures in the neighborhood. Was that during that same visit in March of --

A. Exactly.

Q. Okay. You also mentioned you had returned to the McIntosh site as recently as last week?

A. Correct.

Q. Was that in connection with your work in this case?

A. Correct.

Q. Did you observe anything there that would cause you to change any of the conclusions in your report?

A. Not to change my conclusions in the report, no.
Q. Okay.
A. But I did get some new information that really supports and back up my report.
Q. What was that new information?
A. That they had to retrofit a lot of things on the house. Had to repair a lot of beams that were displaced and had to jack them back up in place. And after they finished putting everything back together, retrofitted, they still had some more cracks comes in. This is, again, an indication that the house was damaged from the wind, even from the roof down. They had cracks appear all over the place again, even in the attic, and had to brace the roof and the attic, restiffen it. Had to do a lot of renailing to keep attachments of the roof to the wall.
Q. And does your understanding about those repairs and retrofittings come from your conversations with the homeowners?
A. No. I did go observe it myself.
Q. You -- you actually watched these repairs taking place?
A. No, I did go and inspect these repairs and see what they have done. I went to the attic and walked every bit of it.

Q. Okay. And you saw that these repairs or retrofittings had already taken place.

A. Correct.

MS. SANDERS: Okay. I've got nothing further at this time.

THE WITNESS: That's it?

MS. SANDERS: Some other folks may have questions.

MR. CANADA: Yeah, I do. Do I need to move down there?

MS. SANDERS: I think you need the microphone.

MR. CANADA: I've got to move all of my stuff then. It won't take me long.

MS. SANDERS: Thank you, Dr. Sinno.

THE WITNESS: Thank you.

MR. SCRUGGS: Thank you.

THE WITNESS: Oh, one -- can I add something here? Is it too late?

MR. SCRUGGS: Yes. If you -- if you need to --

MS. SANDERS: However you want to do it, Zach.

THE WITNESS: Yeah, I need just to put something for the record. It's really an

oversight in my proofreading in here. On Page 5 on the second paragraph it says, "Part of the roof plywood sheets were uplifted and roof shingles blown away." The word "roof shingles" need to be added there.

MS. SANDERS: Thank you.

MR. CANADA: He's going to let me do it from right here, so you can stay there.

EXAMINATION BY MR. CANADA:

Q. Doctor, my name is Larry Canada, and I represent FAEC. I think I introduced myself to you earlier today.

MR. SCRUGGS: Make sure I'm not in the camera.

MR. CANADA: I'm sorry?

MR. SCRUGGS: I was just making sure I wasn't in the picture.

Q. (Mr. Canada) Sir, the report that you are reviewing that you-all have been talking about for a good while now, does that contain all of your opinions that you believe are relevant to this case?

MR. SCRUGGS: Object to the form. Asked and answered.

MR. CANADA: What's the basis of the objection to form?

MR. SCRUGGS: It's been asked and answered.

MR. CANADA: Okay.

MR. SCRUGGS: She's asked -- she's asked that question about numerous parts of his report numerous times, and he's given the same answer so --

MR. CANADA: Okay.

MR. SCRUGGS: -- if you want to ask the same thing again --

MR. CANADA: That's fine.

MR. SCRUGGS: -- I'm going to object.

MR. CANADA: Understood.

THE WITNESS: My answer is I stand by -- behind my report, everything I said in my report. And if I said anything extra over and above my report today in this deposition, I stand behind it, too.

Q. (Mr. Canada) Understood. I just -- all I have to go on as to what your opinions are related to this case are what this report says. And I just want to make sure that the opinions that you hold in this case are contained in this report. That's true, correct?

MR. SCRUGGS: Excuse me. The same objection. Asked and answered now by you as

well as Valerie. So if you have anything to add or --

THE WITNESS: Everything else I said today in the deposition that adds to this report, I stand behind it, too. It is my opinions, it included my opinion. It's part of my opinion. Just like the repairs and the retrofitting they have done, this is really reinforced my conclusions, and it is part of my opinion as a reinforcement to my opinion.

Q. (Mr. Canada) Okay. You haven't issued any supplemental reports, have you?

A. No.

Q. And does this report contain all of the resources and documentation photographs that you believe are relevant or important to backing up your opinions?

MR. SCRUGGS: Same objection.

THE WITNESS: No. There are other -- a whole bunch of pictures, really, that helped me in reaching my conclusion which I could not put them in my report all at one time. It's just -- they're part of the record, though.

Q. (Mr. Canada) Other than those photographs, anything else?

MR. SCRUGGS: Same objection.

THE WITNESS: Well, I stand by how -- my report, everything I said.

Q. (Mr. Canada) So I take it that other than those photographs and the information today -- the photographs you have in your report there's nothing else that you find relevant to support any of your opinions.

MR. SCRUGGS: Same objection. Asked and answered.

MR. CANADA: He didn't answer the last time.

MR. SCRUGGS: He answered that in three hours of deposition testimony he answered before you. If you have anything to add or -- you can tell him but --

THE WITNESS: Everything I said as a result of my last visit last week related to the retrofitting and the repair of the house, which really reinforce and support my report, is part of my opinion.

Q. (Mr. Canada) Understood. What publications have -- have you offered -- excuse me, authored, if any, that relate hurricane damage to storm surge or flooding?

A. I am not doing any research on storm surge or flooding, but I have done research in the past on wave actions in the wave basin at Mississippi State

University, water wave basin.

Q. Did any of that research result in peer-reviewed publication?

A. Not -- no.

Q. Do you teach any courses related to damage related to hurricane, flood, or storm surge?

A. No, I do not. We do not offer courses in this regard in Mississippi State. But I have made a lot of papers and presentations on this topic.

Q. Non-peer-reviewed?

A. All peer-reviewed. I don't publish unpeer-reviewed.

Q. And your peer-reviewed publications or presentations have been on storm surge and flood damage?

MR. SCRUGGS: Object to the form.

THE WITNESS: No, they are not. They are concerned with wind loading.

Q. (Mr. Canada) Okay. And that -- that was my question specifically. The last two have all -- both been related to storm surge or flooding damage from hurricanes. And as I understand it --

A. No, I did not publish any papers on water surge or water.

Q. Now, I want to talk about this hurricane or wind tunnelling effect. You gave a nice illustration of

a balloon and the opening of the balloon, the restriction causing a wind force greater than the pressure inside the balloon. Did I understand that correctly?

A. The velocity would be higher.

Q. Okay. So does that velocity directly correlate any way with -- with force or pressure?

A. The pressure is to the square of the velocity.

Q. Okay. And what would be the force?

A. Huge.

Q. But is there a --

A. Depends on the velocity.

Q. -- linear relationship?

A. Square --

Q. A square?

A. -- of the velocity.

Q. Okay. Now, is there any kind of change in the velocity or force over distance from the aperture?

A. As you move away?

Q. Yes, sir.

A. Of course.

Q. Okay. And explain that relationship to me.

A. It all depends who is going to stop this wind from hitting what. You see, the force is generated or created by blocking the wind flow. If you don't block it, it just keep going.

Q. Okay. What I'm talking about is generally wind tunnelling and the forces that you were talking about in that balloon.

A. Well, the wind --

Q. And --

A. The wind tunnelling would impact the internal partitions of the house. She was asking me -- the question was internal damage from the wind. This tunnelling effect will damage the internal partitions of the house.

Q. Okay. I'm -- I'm talking about wind tunnelling in general right now, not the effect inside the house. My question to you, sir, is relating to that opening, that aperture. Can we call it an aperture? Do you understand what I'm talking about?

A. Bottleneck, yeah.

Q. Right. Okay. And that's what creates the increased velocity or changes the pressure of the wind as it's coming through, right?

A. Correct.

Q. All right. Now, tell me, as you get one meter, two meters, three meters away from that opening, without any obstructions or anything else, is there any type of diminution of the force or the velocity of the wind coming out of that aperture as distance increases?

MR. SCRUGGS: Object to the form. Incomplete hypothetical.

THE WITNESS: I think I've answered that and will repeat again. If you have an opening on one side and the air goes inside and it's blocked, then this is called partial opening or partial enclosure. When you have partial enclosure, the wind go in and get trapped, and you create, really, an explosion there. Or you damage the other window. It will blow out, and then you have the tunnelling effect if they are on the same line.

Q. (Mr. Canada) Okay. I --

A. So -- so I don't --

Q. -- will object as not responsive.

A. Well, I -- because I do not --

MR. SCRUGGS: I object to that categorization.

THE WITNESS: -- understand your question. If you would rephrase it, maybe I will --

Q. (Mr. Canada) I'm talking about your balloon hypothetical here, sir. I'm not talking about the inside of the house. Okay? I'm talking about in general. When you have an aperture and air is forced, through it, all right, is there any type of effect, a diminution or an

increasing of pressure and velocity, the further you get away from that aperture?

MR. SCRUGGS: Object to the form. Incomplete hypothetical and asked and answered. Could you --

THE WITNESS: Again -- again, I have answered. But, again, if you have to block the -- if you block it, what level you block it. If you move away and you block it, you don't get much pressure. If you block it early, you will get high pressure.

Q. (Mr. Canada) So unless there's a blocking of that wind --

A. Correct.

Q. -- there is -- let me finish my question, sir -- there is no diminution and there's no effect on that wind the further it gets away from that aperture.

MR. SCRUGGS: Same objections.

THE WITNESS: I have answered that. Go ahead.

Q. (Mr. Canada) No -- no, sir. I'm asking you is it the case that as you move away from that aperture, unless there's a -- something blocking and stopping that wind, it will continue until forever --

A. Correct.

Q. -- at the same velocity as it came out of that aperture.

A. No. You lose velocity with time, unless you have some -- something pushing it behind it. You see, a hurricane, you have something pushing behind it. You have the hurricane behind it. But here the balloon example is the restraint of the balloon. That's just an example to demonstrate that if you have a bottleneck or if you have an opening in a blockage wall, then the wind speed as it goes through the opening, it gains speed. As it gains speed, means high velocity. High velocity square will give you the pressure.

Q. Now, wind or air as it moves through a bottleneck or aperture, does it stay contained within the same dimensions as that aperture, or does it spread out?

A. It spread out.

Q. Okay. And is there some type of mathematical relationship that would describe how the wind or the air spreads through that aperture?

A. It might be. I'm -- I don't know right now. It might be. I'm not aware of it.

Q. Okay. Do you know to what extent wind going through or air going through an aperture opening would diffuse or spread out within the first 10 meters after leaving that aperture?

A. Well, it all depends how much pressure you have behind it to drive it out. What's -- what's the pressure behind it that's driving -- driving this wind through the aperture?

Q. Okay. So what factors would I need to know to give you so that you could figure out just how much diffusion or spreading out of this air or wind going through an aperture at 10 meters?

A. Well, you give me the velocity wind where it's coming from, we could probably work something on that.

Q. Okay. And so what --

A. Like, if you squeeze on the balloon, you will get air at higher velocity out. The more you squeeze on it, the more higher velocity gets out. If you have the hurricane wind pushing behind it, you will get -- diffusion will -- changes.

Q. Okay.

A. But what --

Q. So --

A. Go ahead.

Q. Does -- does the diffusion or spreading out of the wind increase or decrease with an increase of pressure on the other side of the aperture?

A. If you move away from the aperture, of course it's going to decrease.

Q. Okay. What I'm asking you, you gave the -- the illustration of the balloon being pressed, and that increases the pressure of whatever is inside the balloon, right?

A. Correct.

Q. Okay. So that would equate to higher winds coming from the outside of the house, through the opening in the house, into the house, right?

A. Correct.

MR. SCRUGGS: Object to the form.

Q. (Mr. Canada) All right. What I'm asking, sir, is --

THE REPORTER: I'm sorry. I didn't get your answer.

THE WITNESS: I did not answer yet because I haven't -- he hasn't finished. I'm listening.

Q. (Mr. Canada) Well, I thought you said correct, but I -- I may be mistaken about that. Let me just set the -- the place back again, the question up. My understanding from what you've told me, sir, is that the pushing on the balloon is just like increased winds or increased pressure from winds on the outside of the house coming through an opening in the house, into the house, correct?

A. Correct.

Q. Okay. Now, what I'm asking you, sir, is when you push on that balloon, when you squeeze on that balloon, figuratively, that's -- that's an increase in the wind coming into the house. So as the pressure outside the house increases, the wind velocity increases, what effect does that have on -- on the diffusion of the wind coming through the opening in the house? Does it increase, also, or does it decrease?

MR. SCRUGGS: Object to the form. That's multiple questions and an incomplete hypothetical. Do you understand it? You can answer it.

THE WITNESS: Well, it -- I have no idea what you are really driving at because -- I don't know what you're driving at.

Q. (Mr. Canada) Okay. What I'm asking you, sir, is very simple, at least in my mind. And I'm not an engineer, so maybe it's simple in mine and nobody else can understand it. What I'm trying to find out, sir, is when you increase pressure, when you have -- let me back up and maybe try it this way. Let's say you've got that balloon, all right, and you're not squeezing on it but you open up the aperture so that the wind is coming out. Okay? You've already told me that there's going to be

some diffusion of that -- that air coming out of the balloon, right? We have not quantified it; is that correct?

A. Correct.

Q. All right. But it is going to diffuse somewhat.

A. Of course, it will diffuse.

Q. Okay. Now, as you press down on the balloon, you increase the pressure in the balloon, does that increase the diffusion or decrease the diffusion on the other side of the aperture? That's my question.

A. I would think it's diffu- -- decrease the diffusion because it's again at a higher velocity, so it going to travel further out before it really get dissipated.

Q. Before it starts to diffuse and dissipate.

A. Yes.

Q. Q.Right. Okay. Now, what I'm asking you, sir, is: Is there an equation by which one could calculate how that wind diffuses?

MR. SCRUGGS: Object to the form. Asked and answered.

THE WITNESS: I'm not aware of any equations right now, but I don't see the significance of what you are talking about on

the case unless you ask me something could be related to McIntosh, we could talk about it.

Q. (Mr. Canada) Okay. Now, you -- you had said something earlier when you were asked a question about the building envelope and whether there would be a difference if one or more windows had been busted out due to storm debris as opposed to what you talked about originally, about all the -- or most of the ground floor windows popping out due to low pressure. Do you remember that question?

A. Well, it was not low pressure. It was suction. Yeah.

Q. Okay, suction. But isn't suction low pressure, in fact?

A. No.

Q. Well, what is suction, then?

A. Suction is negative pressure on the outside.

Q. Okay. So negative pressure is low pressure, isn't it, as compared to --

A. No. It could be high pressure.

Q. It's high pressure?

A. Yeah, suction could be high pressure.

Q. Okay.

A. High suction.

Q. All right. Now, did you do any calculations

specifically to determine what the pressures were on the windows of the McIntosh house?

A. Oh, no question about that. ASCE-7 will give you all the formulas and the calculations to do that.

Q. All right. I'm asking you did you do those calculations?

A. Yes, I did some calculations.

Q. Where -- where --

A. I did the --

MR. SCRUGGS: Finish your answer.

THE WITNESS: A sample of the calculation is in the appendix of my report.

Q. (Mr. Canada) Where -- where are, I guess, all of your calculations?

A. Oh, I don't -- I don't really have any calculation. I gave a sample of the calculation. ASCE-7 will give you the formula. All you have to do is just plug in the number to get the answer.

Q. Okay. And -- and that calculation is where?

A. Sample.

Q. On Page 25?

A. Yeah, that's a sample.

Q. Okay. Well, where are the -- where are the calculations on the windows? I see roof uplift.

A. I don't -- no, I don't have calculation for the

windows in here.

Q. So you didn't do any -- any calculations on the windows.

A. I did, but I did not present them here. Just, really, very simple calculations. Just a formula. Plug in the numbers and you get the suction pressure.

Q. Okay, so --

A. And it's shown in the -- I gave it to you -- gave you the formulas in the beginning of the report. Here it is on Page 4. You can see the suction forces of the formula. Just plug in the numbers. You get --

Q. I'm sorry. Where -- where is the formula? On Page what?

A. Figure 2.

Q. I'm sorry?

A. Figure 2.

Q. That's the formula?

A. Yeah.

Q. All right. So where -- where is the data where you did the number crunching and came with your -- came up with your results from --

A. Just fill in the numbers. I'll give it to you. Q G C P, put the numbers in there, you get the answer.

Q. Sir, would you -- is there anywhere in your report, any indication of the data that you used in these

formulas?
A. Yes.
MR. SCRUGGS: Object to the form. Asked and answered.
THE WITNESS: It says in my report, the wind velocity.
Q. (Mr. Canada) All right. So what is Q sub H?
A. Well, that's the pressure. Variable, constant that you put in the formula.
Q. Okay. And what is G?
A. What's -- what? That's -- again, all these constants taken from ASCE-7. They gave you tables for them.
Q. Okay. And then C sub P is what?
A. Another constant, too. All of that is ASCE-7.
Q. All right. I mean, I--- again, I see the formula, but I don't see any calculations, sir. Are there any --
MR. SCRUGGS: Object to the form.
THE WITNESS: I don't have calculations in the report.
Q. (Mr. Canada) Okay. So --
A. That's a simple straightforward calculations. Nothing special about them.
Q. Well, what I'm asking you, sir, is before you

did your report, did you do calculations on each of these windows that are in the McIntosh house?

MR. SCRUGGS: Object to the form. Asked and answered.

THE WITNESS: Yes, I did calculations. They are simple calculations, straightforward calculations, easy, and you can get the pressure.

Q. (Mr. Canada) Where are --

A. I don't have them.

Q. -- the data? You don't have them at all.

A. No.

Q. In your files or anywhere.

A. No.

MR. SCRUGGS: Object to the form.

THE WITNESS: Not anymore.

Q. (Mr. Canada) Okay. Now, in -- in these calculations, are the various variables the same on all sides of the house?

A. Correct.

Q. Okay. Now, when you open up any portion of the building envelope, does the equations or the constants change?

A. Yes, they do.

Q. All right. Did you do those calculations?

A. Of course.
Q. Where are they?
A. I don't have them here. I don't have them here. Because they're a lot worse. If you open -- if you have partially enclosed, you multiply all the answers times three or four.
Q. When do you use 3 versus 4?
A. ASCE-7 will tell you.
Q. Okay. I don't want to have to read ASCE-7 --
A. Yeah, that's what I say --
Q. -- so you tell me.

MR. SCRUGGS: Object to the form. He cited ASCE-7 as the basis for his calculations. That was provided to you. Everybody has it. I don't know how else he can answer the question, but I mean, if you -- he wants you to listen to everything he says, and if you have anything else to --

THE WITNESS: I don't have really anything to add.

MR. CANADA: Well, hold on, Doctor, just -- just for one second. I've been admonished many times, not by you but by other people, about my speaking objections. So in the future, I'd appreciate your objection, and then

let's go forward.

MR. SCRUGGS: It wasn't a speaking objection. You are asking a misleading or mischaracterizing question, and he had already answered your question. You continued to ask it in different ways and then mischaracterized what he said. So the record is clear what he said. If you want to ignore the record and keep on asking questions along this line, you are welcome to. But he's asked and answered it.

MR. CANADA: Counsel, at the risk of getting into a debate with you, my question was -- my final question that rose -- brought the objection was I wanted him to explain to me without me having to refer to ASCE-7 when you use 3 and when you use 4. Now, if you think that's an inappropriate question, I understand, but that was my question. I don't know how I'm mischaracterizing anything.

MR. SCRUGGS: Well, that question alone is okay. Characterizing that he didn't provide you with anything or you can't find anything in the report is the objection -- is the basis of the objection.

MR. CANADA: That was not my statement at all.

MR. SCRUGGS: Well, that's -- that was my understanding of your statement, and the record will bear it out one way or the other. But if the question -- I believe the question -- I'm not going to characterize his question, but did you understand what he just said?

MR. CANADA: I'll tell you almost exactly what I said.

MR. SCRUGGS: Good.

Q. (Mr. Canada) I don't want to have to refer to ASCE-7. I want you to explain to me when you use 3 and when you use 4.

A. There's so many variables that -- as there are in my report, that determine the pressure from wind. The exposure -- is it exposure A, B, or C -- there's no more A -- B or C? What exposure do you have? The location. The slope, if you have flat, if you have a slope, depending on how steep a slope it is. If you have multi-bay, single bay. It's all kind of variables in the ASCE-7, depending on each case under its own merits, if you use a 3, a 2.7, a 2.4, 4.

Q. Is there any change in the equations or the forces if you add support or resistance before you get to

the surface that you are doing the calculation for?

A. No, not in the formula itself.

Q. Okay. Now, let's say that someone put plywood up over the windows. Would that change your calculation in any way?

MR. SCRUGGS: Object to the form. Assumes facts not in evidence. Incomplete hypothetical.

THE WITNESS: That's part of the calculation because you have to remove the plywood first.

Q. (Mr. Canada) Okay. So do you -- did you do any calculations on what would be required to remove the plywood first?

A. On suction it don't take much to take the nail out.

Q. Well, you're assuming that it was fastened by nails, aren't you?

A. Yes, I assume it was fastened by nails.

Q. Okay. Do we know in this case from the McIntoshes how they affixed the plywood?

A. No, I don't know how they affixed the plywood.

Q. Okay. And do you know whether or not plywood was affixed to any or all the windows on the first floor?

A. They were.

Q. Okay. Now, the side that the wind was coming from -- I think you said it was coming from the east, correct?

A. East, southeast, yes.

Q. East, southeast. Now, would that be a suction on the plywood, or would that be a direct force on the plywood?

A. In the front of the house will be direct force. In the back of the house it would be suction. On the side of the house, left or right, on the sides would be suction.

Q. Now, what are you calling the front of the house?

A. Facing the wind.

Q. But which -- facing the water or --

A. Facing the wind, east side.

Q. But what -- in relation to where the house was, is that -- is that the side that had the big steps going out --

A. Right.

Q. -- or was that the other side?

MR. SCRUGGS: If you've got -- if you want to show him a picture of what side of the house you're referring to so that he'll know. Because I don't think it's clear to me or

anyone else what you --

THE WITNESS: Figure 3 show the front of the house.

MR. SCRUGGS: Okay, thank you.

Q. (Mr. Canada) Okay. I guess Figure 4 would then show the back of the house.

A. Yes.

Q. Now, there in Figure 4, it appears that some of the plywood is still in place, right?

MR. SCRUGGS: Object to the form.

THE WITNESS: I don't know.

Q. (Mr. Canada) Well, look over on the right --

A. That's a -- that's plywood? Or that's --

Q. What does it look like to you?

MR. SCRUGGS: Object to the form.

THE WITNESS: Which plywood are you talking about? The window plywood? Which plywood are you talking about?

Q. (Mr. Canada) Well, what's that? You see -- you see the two trees and then to the right of it there's some plywood, looks like, that's there? What was that from?

A. That's the cladding.

Q. Oh, that's part of the actual structure of the house?

A. Yeah.
Q. How much water from storm surge or flooding actually was inside the house at any point in time?
MR. SCRUGGS: Object to the form.
THE WITNESS: Two feet. 2.6 feet at the most.
Q. (Mr. Canada) And that covered the entire house, correct? The -- the bottom floor.
A. Water rise.
Q. The entire floor plan. I'm sorry. Floor plan.
A. Yeah, the water -- water rise.
Q. And you attribute no damage to either the house or the contents due to that storm surge or flood water.
MR. SCRUGGS: Object to the form. Mischaracterizes his testimony.
THE WITNESS: The word damage should not be used. If you tell me water washout, I will accept that, washout. Damage, you have to see a picture of the house before the water to tell me if there is damage. I don't see a picture before the water got into the house.
Q. (Mr. Canada) You mean immediately before or just anytime before?
A. In between. We know the high velocity wind was ahead of the water. We know what the high velocity wind

did. I have went through that. My report talks about that in details. There's nothing left to talk about.

Q. Okay. Well, then if it's your testimony that all the damage in the house, or at least to the structure of the house, was caused by wind, then would it not also be a result of that opinion that there was no damage due to storm surge or flooding --

MR. SCRUGGS: Object --

Q. (Mr. Canada) -- to the structure of the house?

MR. SCRUGGS: I apologize.

THE WITNESS: There was --

MR. SCRUGGS: Object -- object to the form. Mischaracterizes his testimony.

THE WITNESS: I've answered this question. I will repeat. There was washout of the wind damage by the water. It is no water damage that I could see.

Q. (Mr. Canada) Thank you. Is there a difference in pressure from water, whether it's sitting still or flowing?

A. What do you mean by flowing?

Q. Well, okay. Well --

A. Has velocity with it?

Q. Yes, sir. If it's -- if it's moving water, is there -- is there a difference in the pressure due to

water or fluids like water whether --

MR. SCRUGGS: Object to the form. I'm sorry, Counsel. I apologize.

MR. CANADA: That's all right. I'll pause afterwards.

Q. (Mr. Canada) -- whether the water is sitting stagnant with no motion or actually has velocity and moving? I'm finished.

MR. SCRUGGS: Object to the form. Sorry.

THE WITNESS: There is certain minimum velocity that ASCE talks about. After you -- if you do not exceed that velocity, then if the water is still or is slow moving will have practically the same speed -- the same impact. But to answer your question correctly from a scientific point of view, definitely if you have velocity with the water, you get higher pressure.

Q. (Mr. Canada) Okay. And is there any kind of formula or correlation between the speed of water and the force exerted by that water?

A. Well, again, we have to -- tell me what kind of water you're talking about. If you're talking about tsunami effect, if you have a solid wall of water moving is one thing, and if you have just water just slowing

going up is another thing.

Q. Okay. Well, I wasn't really differentiating between the two. Is the fluid dynamics difference between a tsunami effect and just rising water?

A. Sure.

Q. Okay. So you don't use the same formula.

A. Definitely. It's not even no relationship to the two.

Q. Okay. Well, we know that there wasn't a tsunami here, right?

A. Correct.

Q. Okay. I think we all can agree on that. But we know that there was rising water?

A. Correct.

Q. All right. Do you have any indication as to how fast or at what velocity the water rose outside of the McIntosh's house?

A. Yes, I did say it in my report. It is in my report.

Q. Okay. And that speed exerted no pressure on any portions of the structural components of this building, the house, correct?

A. Not that I can tell.

Q. Okay. Now, did you do calculations on that, too?

A. No, I don't need to because there's nothing I can tell.

Q. Okay. Would you look at Page 10 of your report?

MR. SCRUGGS: I'm sorry, Counsel, what page?

Q. (Mr. Canada) Page 10. I'm about to ask about Figure 6. Now, as I appreciate it, Figure 6 shows before and after, although not taken from the same vantage point, of the same general area behind the house, correct?

A. Correct.

Q. All right.

A. That's --

Q. Now, besides the obvious damage to the structure over, I guess you could call it, the patio, do you see anything else that -- that's been damaged or removed outside the house? I'm not talking about the building envelope itself.

A. Yeah, I can see some brick being moved with the suction from the corner column. I can see that.

Q. All right. Well, you see -- you see the steps that are leading up to that back patio there?

A. Yeah.

Q. What happened to them?

MR. SCRUGGS: Object to the form.

THE WITNESS: I cannot tell from this picture here.

Q. (Mr. Canada) Do you think the wind took that away?

MR. SCRUGGS: Object to the form.

THE WITNESS: I'm not aware that it was taken away or not.

Q. (Mr. Canada) Well, looking at that right picture or the picture on the right side of Figure 6, do you see the steps there?

A. Yeah.

Q. You do?

A. Yeah, I see the steps.

Q. Oh. Well, okay, then I guess the steps are still there, huh.

MR. SCRUGGS: Object to the form.

THE WITNESS: I'm not sure right now.

Q. (Mr. Canada) Well, if the steps aren't there, do you know what would have caused them not to be there anymore?

MR. SCRUGGS: Object to the form.

THE WITNESS: No, I cannot tell.

Q. (Mr. Canada) All right. I'm going to show you -- and, I'm sorry, I didn't anticipate actually using

this, but it's McIntosh 409. And I'll let you-all see it before. (Pause.) And I want you to look at the bottom photograph --

A. Yes.

Q. In that set.

A. Yes.

Q. Does that appear to be the same area to you?

A. Yeah, it looks like it.

Q. Okay. Does it appear to you now that the steps are still there?

A. It looks like they were washed out. That's what I'm talking about. The water washed out, washed them out.

Q. Okay. So -- so there was some damage --

A. Not damage. Washout.

Q. Oh, okay.

A. There's a difference.

Q. So the steps not being there anymore --

A. No --

Q. That's not damage.

A. -- this is not structural --

Q. Excuse me.

A. These steps are not part --

MR. SCRUGGS: Yeah, y'all are stepping on each other.

THE REPORTER: Yeah.
MR. SCRUGGS: Go ahead.
THE REPORTER: One at a time, please.
MR. SCRUGGS: Complete your answer.
THE WITNESS: To me, the steps are not part of the structure. And I am trying to think nothing but structural interaction with the wind. The steps are not really part of the structure. They are not even secondary, and they were washed out. Whatever washed them out is immaterial, as far as I'm concerned.
Q. (Mr. Canada) Okay. So there was damage to the property but not to the structure.
A. You are talking like an insurance man now. Let's talk engineering.
Q. Okay. Let's talk engineering. When one talks about structural integrity. Are you talking about the entire structure?
A. Yes. The steps are not part of the structure.
Q. Okay.
A. They are decorative elements.
Q. Well, what -- what are the structural components of this house?
A. What makes the house as a house, which means the cladding, the framing, the roof. What makes a house

a house. Just like we are not talking about damage to the trees in here, you see. I'm not involved in that. The steps, again, decorative elements. What washed them out, I -- I'm not really -- I didn't even get into that. I'm not involved in that. I will not be involved in that. It's not a structural element.

Q. Okay. Well, sir, when -- when you design a house as an engineer, do you put in the -- the aesthetic effects, like windows and cladding and that sort of thing, or is that an architectural aspect?

A. That's architectural aspect.

Q. That's not an engineering aspect, is it.

A. No.

Q. And when you do a foundation and determine the transfer of moments and the like as an engineer, you don't take into account architectural components other than whatever dead load they may have.

MR. SCRUGGS: Object to the form.

Q. (Mr. Canada) Correct?

A. If they have impact on the structural design, I will.

Q. (Mr. Canada) Okay. And the impact would be --

A. Whatever.

Q. What?

A. Whatever it is.

Q. The dead load?
A. If it is dead load, live load, whatever it is.
Q. Well, if it's a component in the -- in the house, it wouldn't be a live load, now, would it?
MR. SCRUGGS: Object to the form.
THE WITNESS: No, not necessarily.
Q. (Mr. Canada) Okay. Now, you've limited your discussion of damage -- because you have used that word, have you not?
A. Yes. When it comes to wind loading, I talk about damage. When it comes to water, I will not use the word damage. I use washout.
Q. Washout. Because water doesn't cause damage, in your mind?
MR. SCRUGGS: Objection.
THE WITNESS: Not in the McIntosh house.
Q. (Mr. Canada) Okay. Can it cause damage in any instance?
MR. SCRUGGS: Object to the form.
THE WITNESS: Of course, it could cause damage. It depends on what you're talking about.
Q. (Mr. Canada) So the fact that the water may have removed the steps on the back, you don't consider that damage.

MR. SCRUGGS: Object to the form.

Q. (Mr. Canada) You consider that washout.

A. Yes, it is a washout because that's -- from a structural point of view, the steps are second -- remote. It's not even part of the structure.

Q. Okay. Well, what about the appliances?

A. But from an insurance point of view, I can see your point. Maybe you want to pay for the steps, don't pay for the steps. That's up to you.

Q. Sir, I can assure you I'm only talking to you with respect to engineering concepts, all right? And let's just keep that understanding between us here.

MR. SCRUGGS: I'm sorry. That door doesn't work, but you can come around.

MR. CANADA: Okay, we're taking a break because of the tapes.

MS. SANDERS: I'm sorry.

MR. SCRUGGS: No, that's okay.

(Following a break, the deposition proceeded as follows:)

MR. NABORS: Back on the record.

Q. (Mr. Canada) I was getting ready to ask you about appliances. Are you aware of whether or not any of the appliances inside the McIntosh home were damaged? And, if so, by what?

MR. SCRUGGS: Object to the form.

THE WITNESS: No, I'm not aware of anything about appliances. I didn't get into that.

Q. (Mr. Canada) Okay. If there was two to two and a half or however many feet you said of water inside, would that require the replacement of the appliances?

MR. SCRUGGS: Object to the form.

THE WITNESS: I don't know.

Q. (Mr. Canada) Okay. What about the floors? Were the floors in the McIntosh house damaged? And, if so, by what?

MR. SCRUGGS: Object to the form.

THE WITNESS: I could tell that it was really washed out because there was water inside the house. I could tell they were washed out.

Q. (Mr. Canada) Okay. So by -- by the floors being washed out, does that mean that they're damaged by storm surge or not?

MR. SCRUGGS: Object to the form.

THE WITNESS: As I said, I will not use the word damaged. Washed out stands by itself. Washed out.

Q. (Mr. Canada) Okay. Do you know whether or not

their being washed out would require their replacement or not in your professional opinion?

A. You see, I cannot tell what the wind did before the water surge. If you could show me a picture of what the wind did, then I could answer your question.

Q. Do you have an opinion as to whether or not the floors --

A. Yes, I have an opinion. Everything -- all the damage in the McIntosh house is related to the wind flow.

Q. Okay. That was one of those examples where I wasn't quite finished with my question. Do you have an opinion, sir, whether or not the floors in the McIntosh house were damaged due to wind?

MR. SCRUGGS: Object to the form.

THE WITNESS: Would you say that again?

Q. (Mr. Canada) Okay. Do you have an opinion, sir, whether or not the floors inside the McIntosh house were damaged due to wind?

MR. SCRUGGS: Same objection.

THE WITNESS: The wind did damage the floor. No question. It damaged everything inside the house.

Q. (Mr. Canada) Okay. How --

MR. SCRUGGS: And I'm sorry, Mr. Canada. Are we talking about upstairs or downstairs?

MR. CANADA: I'm talking about downstairs.

MR. SCRUGGS: Okay. I'm sorry.

MR. CANADA: I haven't even gotten to upstairs yet.

MR. SCRUGGS: Okay. Well, I just want to make sure we're on the same page.

MR. CANADA: That was a good note. I appreciate that.

Q. (Mr. Canada) How and to what extent were the floors in the McIntosh house damaged by wind?

A. We've gone over that. We've been talking about that for the last three years. The tunnelling effect, the high velocity wind that going from one window through the house and take everything in its way that is really exposed to that flow of wind.

Q. Okay, so -- now, you also talked about those equations and angle and all of this other stuff about what the forces would be and the impact on it. Is it your testimony, sir, that the wind came into the house, had a tunnelling effect, and destroyed the floors?

MR. SCRUGGS: Object to the form. Asked and answered.

THE WITNESS: We have answered that.

Q. (Mr. Canada) Yes or no?

A. Yes, it damaged.

Q. Okay, thank you.

MR. SCRUGGS: Object to the form.

Q. (Mr. Canada) In this paper that -- that was given to us today, this was researched directly onto a metal roof, correct?

A. If you read the paper carefully, it says at the beginning although it's done on a metal roof, it applies to all other roofs.

Q. Okay. Is there a direct correlation to all other types of roofs or -- or is there some --

A. Yes. They're related to all.

Q. -- or is there some difference depending upon how the roof is constructed and how it is secured?

A. Definitely how it's constructed, how it's secured is a part of the analysis.

Q. In fact, earlier, you talked about the dead load of the -- excuse me -- of the roof and the uplift forces on that. That's -- that's not all that you have to consider to determine whether or not there's been significant uplift on the roof to -- to have displaced it, is it?

A. No. You have to consider the anchorage details.

Q. And do you know how this house was anchored or the roof was anchored?

A. When I looked at it, it was all by nails.
Q. All right. Were there any hurricane straps?
A. Nope. I didn't see any.
Q. That would have -- have increased the stability of the roof, would it not?
A. Definitely. But the stability of this roof was really provided by having the second floor in the attic.
Q. How is that?
A. It has walls, stiffers, side walls. The second floor is part of the attic. It's an interior part of the attic, so the whole roof was really anchored down by the second floor.
Q. The -- Figure 6, again -- now, this time I'm going to look at the left picture. And you see the brick veneer that's on the outside of the house?
A. Yeah.
Q. All right. Is it possible, sir, that --
(An unidentified person enters the room.)
(Following a discussion off the record, the unidentified person exited the room and the deposition proceeded as follows:)
Q. (Mr. Canada) You look at the picture to the right. This is on Page 10 of your report again. And you see that some of the brick veneer there is missing,

correct?

A. Correct.

Q. Is it possible that the same force that removed the steps removed that brick veneer?

A. It's possible.

Q. How would you differentiate between whether or not that brick veneer was removed by water versus wind?

A. If it's washed out by water, you can really see it. It will be dispersed all over the place. If it's fall away from the wall, this means by suction.

Q. Okay, so, you would rely upon whether or not you found bricks in other places other than just right by the wall, correct?

A. Correct.

Q. Did you discern in either one of your visits whether that dispersment of bricks occurred so that you could differentiate between wind versus water?

A. Yes.

Q. And what was your --

A. It was -- it was very clear in the same Picture 6, that corner there, all the brick was just one piece, fallen back away from the house, which really indicate was suction by the wind. And you could see some of the brick all the way to the column or the corner of the house was sucked out and falling back away from the

house.

Q. All right. Now, how far away -- or excuse me. The -- the corner, where the -- where the brick is still there in the Figure 6 right picture, how high up is that in relation to the two and a half or so feet of water that you believe --

A. It's --

Q. Let me finish -- let me finish my question -- the two and a half feet of water that you believe was inside the house?

MR. SCRUGGS: Object to the form.

THE WITNESS: It is higher.

Q. (Mr. Canada) It is higher.

A. Uh-huh (affirmative response).

Q. By how much?

A. That looks about five -- four foot -- four feet, maybe higher, than the floor. Just judging from the picture here.

Q. Okay, well how -- how high is that opening that's in the back back there? How high is that?

A. I don't know. Not right now. I cannot tell.

Q. Well, look down in -- in Figure No. 8 to the opening that's there.

A. Correct.

Q. How high is that?

A. That's pretty close to the ground.
Q. I'm sorry, sir?
A. That's close to the ground. That's about, what, a few inches, I think.
Q. Well, Figure 8, the right picture, and Figure 6, the right picture, that's the same corner, isn't it? Just from a different angle?
MR. SCRUGGS: Object to the form.
THE WITNESS: I think it is now since you mention it.
Q. (Mr. Canada) Okay. So that opening that's in the back back there, that's the same opening that you see in the right picture of Figure 6 shown in the right picture of Figure 8. Right?
MR. SCRUGGS: Object to the form.
THE WITNESS: I'm guessing. I guess so.
Q. (Mr. Canada) Okay. So, I'm asking you, sir, how tall is that opening? How high is it?
A. It's a few inches off the ground.
Q. Are you telling me that the distance between the foundation of the slab and the house and the top of that opening is just a couple of inches?
MR. SCRUGGS: Are we talking --
THE WITNESS: No. From the floor of the house, the slab of the house to the opening.

MR. SCRUGGS: Yeah, I'm confused --

Q. (Mr. Canada) What I'm talking about is how high is the opening?

MR. SCRUGGS: I think where I'm -- and I don't know if the doctor is having confusion. Where I'm having confusion is are we talking about -- when we are talking about the ground, are we talking about the ground level, or are we talking about the slab? That's what I'm -- I don't know if --

Q. (Mr. Canada) Right. I think -- I think the doctor and my's problem is that he believed I was asking how -- how far was it from the slab to the bottom of the opening. Actually, what I'm looking for, sir -- and I apologize. It was a bad question. What I'm looking for is from the floor or the slab there to the top of the opening, how tall is that? Or how -- what's the distance there?

A. From the slab to the roof?

Q. No, sir. Maybe if I can --

A. From the ground?

Q. Maybe if I can approach. I mean, I hate -- hate to do it that way but -- because I know I'm going to strangle myself if I don't take this off. Can I sneak past your chair here? And I apologize for the --

A. That's all right.

Q. I don't -- I'm not very photogenic. The slab -- the slab's right there underneath -- there is a small lip of some sort right there, right?

A. Uh-huh (affirmative response).

Q. What I'm looking for is the distance from the slab to the top of that opening, which would be the distance to the top of this opening, right? Because we're talking about the same place. What's the distance there?

A. Eight feet.

Q. Eight feet, okay. And -- so that's about -- what, you still think that's about five feet from the slab to --

A. About four or five feet. Yeah, that's what I said.

Q. Q.Okay. All right. Now, brick veneer when it is placed on the outside of the house, is it always one continuous section of brick, or are there ties? Or how are they fastened and installed?

A. Well, they put one at a time. They will tie every other one.

Q. And isn't it possible, sir, that -- sorry. Isn't it possible, sir, that -- that the bricks that are still there are because they're anchored, and what was

removed below it was taken out by water.

MR. SCRUGGS: Object to the form.

THE WITNESS: Obviously what you are saying is completely out of the fact. If we go back to Figure 14, Page 14, this is a column of the corner. Go to Figure 14. You see the house was hit by the wind. The house deformed by the wind. The wind come from the east. The house deformed to the west. This column was on the west side. I am 100-percent sure, although I cannot prove it here except for by the cracking and the failure of the brick, that there was a crack in that column and it was the same location as the crack in the column on Figure 14. So this is a wind crack. Why? Because the house was deformed by the wind at 45 degrees because of the force up high. The house rotated. The same thing happened to that corner column. This is a wind failure of brick there, and it's sucked up by the wind.

Q. (Mr. Canada) And -- and that kind of damage that is shown in 14 could not possibly have been caused by either a storm surge or flood coming in and then ultimately going back out. That's your opinion.

A. Impos- -- impossible. Impossible to get a

45-degree angle like that cracking at high level except you have forces up high in the roof pushing the house from east to west.

Q. Now, which requires more force? Cracking of those bricks and the torsion of the house or moving a shingle?

MR. SCRUGGS: Object to the form.

THE WITNESS: The -- this -- this cracking here is a torque, is a bending, is a force with a big lever on it. So there's no relationship between the two.

Q. (Mr. Canada) I'm just asking you which requires more force, sir. The removal of the shingle or the torque that you say would be required to crack the brick as is shown in Figure 14 on Page 16?

MR. SCRUGGS: Object to the form. Asked and answered and incomplete hypothetical.

THE WITNESS: As I said, there's no relationship between the two.

Q. (Mr. Canada) You can't possibly tell me which requires more force.

A. No. No relationship between the two. I wish I could.

Q. Did you do calculations on the force that was required to torque the house so that it ends up with what

is observed in Figure 14?

A. I don't need to do any calculations. The figure speaks for itself loud and clear.

Q. (Pause.) I'm looking through my notes to see if I've missed anything. (Pause.) Sir, are you aware of what various insurance policies provide as it relates to whether wind or water damage is covered?

A. I'm not aware about the details, but I know the general scope.

Q. Okay. And the general -- the general is what?

MR. SCRUGGS: Object to the form, but you can answer.

THE WITNESS: There's -- about insurance companies, they differentiate between water damage and wind damage.

Q. (Mr. Canada) So one policy would cover one thing and the other policy would cover the other.

MR. SCRUGGS: Object to the form.

THE WITNESS: This is the extent of my knowledge.

Q. (Mr. Canada) So if, as is your opinion, there was no damage to this house due to wind -- excuse me -- there was no damage to the house due to flood or storm surge, that an application for damages or repairs due to flood or storm surge would be unsupported by the facts in

your opinion.

MR. SCRUGGS: Object to the form. Calls for a legal conclusion.

MR. CANADA: I'm not asking for a legal conclusion. I can assure you.

MR. SCRUGGS: Well, you are, and -- and I'm -- that's the basis of my objection, and it assumes facts not in evidence. If you understand what he's asking you, you can --

THE WITNESS: Yeah, you are going beyond my expertise, so I'm going to stop there.

Q. (Mr. Canada) But just so I'm clear, your opinion today is that there was no damage to this structure, to this house, that was due to flood or storm surge.

MR. SCRUGGS: Object to the form.

Q. (Mr. Canada) Correct?

MR. SCRUGGS: Object to the form. Mischaracterizes his testimony. And asked and answered.

THE WITNESS: Just repeating myself, there was a washout from the water after the wind damage.

Q. (Mr. Canada) Sir, I didn't ask you about washout because you don't use the word damage as it

relates to washout. I'm asking you was there any damage to this structure, as you use that term, due to storm surge or flood?

MR. SCRUGGS: Object to the form. Asked and answered.

THE WITNESS: I did not see any evidence of that.

Q. (Mr. Canada) As we sit here today, is there any -- any particular items or portions of the house that were washed out that weren't first caused by wind, in your opinion?

A. I am almost sure that wind has something to do with it because you cannot isolate the wind from the water.

Q. So the wind caused all the damage, and all the water did was move it around.

MR. SCRUGGS: Object to the form. Asked and answered.

THE WITNESS: I did not say that.

Q. (Mr. Canada) Okay. Well, I'm asking you, what items, if any, in the house or as a part of the house were moved around or washed out, as you said, due to flood and storm surge?

MR. SCRUGGS: Object to the form.

THE WITNESS: Could be the -- could be the

steps we just talked about. That could be washed out by the --

Q. (Mr. Canada) Okay. But that wasn't in your report, now, was it.

A. No, because the steps was not part of my structure. I don't consider it as part of the structural element.

Q. So other than the steps, was there anything else that was washed out?

MR. SCRUGGS: Object to the form. Asked and answered.

THE WITNESS: I have answered that. I'll -- I -- there's a washout from the surge. I stand by that. Everything else is in my report, yes.

Q. (Mr. Canada) I'm asking for specifics, though, sir. I'm asking for what in the house, if anything, was washed out by storm surge or flood that wasn't previously damaged, in your opinion, by wind --

MR. SCRUGGS: Object --

Q. (Mr. Canada) -- if anything.

MR. SCRUGGS: Object to the form. Asked and answered.

MR. CANADA: He has not.

MR. SCRUGGS: Well, that's -- you can take

that up with whoever you want to, but he's asked -- he's answered that question.

MR. CANADA: Okay. I understand.

MR. SCRUGGS: Have you answered the question?

THE WITNESS: You can look at the pictures and see where the washout is. I don't really know what you want. Tell you specifically there's a piece of wood in here, a piece of wood there? I cannot do that.

Q. (Mr. Canada) Okay. So there's nothing in --

A. Nothing --

MR. SCRUGGS: Go ahead.

Q. (Mr. Canada) There's nothing in or part of the house that you believe was washed out by flood or storm surge that wasn't previously damaged by wind.

MR. SCRUGGS: Object to the form. This has -- this has definitely been asked and answered. Now we're going on two or three minutes of this plus what was asked previously. Do you have anything to add from your previous answer?

THE WITNESS: No, I don't.

MR. SCRUGGS: If not, well, then, move on.

MR. CANADA: I'm asking for specifics, and

the only thing I've gotten so far is the one thing I've pointed out which is the steps. If your -- if your expert doesn't want to give me specifics, that's fine.

MR. SCRUGGS: He's answered your question the best way he knows how. If you don't like the way he answered it, I don't know what to tell you.

MR. CANADA: Okay. Well, are you instructing him not to answer? Because I'm going to ask it until I get an answer.

MR. SCRUGGS: I will instruct him not to answer because the answer is in there about 30 times, and -- and I think you're now bordering on harassment because he's given you the best answer he knows. I don't know what to tell you about whether you like it or not. I don't -- I can't help you there. I can just only tell you that he's answered -- he isn't supposed to sit here and answer the same question the same way 50 times. We'll be here until next week, and you still won't have -- I don't know what answer you're looking for.

MR. CANADA: I'm not looking for any answer, and I don't like or dislike any answer

that he's given. I'm just looking for what his opinions are, and I'm looking for specifics as to what may have been washed out by flood or storm surge that was not damaged by -- previously by wind.

MR. SCRUGGS: And he's answered that question, and you are just going to have to accept for purposes of today what he's given you about 30 times.

MR. CANADA: All right. I'm asking that same question again. If you're instructing him not to answer, then that's fine. I'll move on.

MR. SCRUGGS: I'm instructing him not to answer on the basis -- I'm sorry. I am instructing him not to answer on the basis that he has answered that question repeatedly, and I just don't know what else to do.

MR. CANADA: Okay. I disagree with you, but we'll take that up at another time.

MR. SCRUGGS: Yes, sir.

MR. CANADA: Why don't we take a little break just to see if I've got anything else.

MR. NABORS: Off the record.

(Following a break, the deposition proceeded as follows:)

MR. NABORS: Back on the record.

MR. CANADA: Sir, I have no further questions.

MR. SCRUGGS: Ms. Lipsey?

MS. LIPSEY: No questions.

MR. SCRUGGS: The plaintiffs have no questions.

MR. CANADA: Read and sign?

MR. SCRUGGS: Yeah. I think it's done.

MR. CANADA: We're finished.

MR. NABORS: Off the record.

(The videotaped deposition was concluded at 1:11 p.m.)

C E R T I F I C A T E

STATE OF MISSISSIPPI)

COUNTY OF LAFAYETTE)

RE: VIDEOTAPED DEPOSITION OF R. RALPH SINNO, PH.D.

I, Libby A. Furr, CSR 1724, a Notary Public within and for the aforesaid county and state, duly commissioned and acting, hereby certify that the foregoing proceedings were taken before me at the time and place set forth above; that the statements were written by me in machine shorthand; that the statements were thereafter transcribed by me, or under my direct supervision, by means of computer-aided transcription, constituting a true and correct transcription of the proceedings; and that the witness was by me duly sworn to testify to the truth and nothing but the truth in this cause.

I further certify that I am not a relative or employee of any of the parties, or of counsel, nor am I financially or otherwise interested in the outcome of this action.

Witness my hand and seal on this 18th day of October, 2007.

_____

LIBBY A. FURR
CSR 1724

My Commission Expires:

September 19, 2008

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

THOMAS C. AND PAMELA MCINTOSH PLAINTIFFS

VS. 1:06-cv-1080-LTS-RHW

STATE FARM FIRE AND CASUALTY COMPANY;
and FORENSIC ANALYSIS & ENGINEERING CORP.;
and E.A. RENFROE & CO., INC. DEFENDANTS

CERTIFICATE

I, R. Ralph Sinno, Ph.D., P.E., have read the foregoing pages, 1-154, of the transcript of my deposition given on October 11, 2007, and it is true, correct and complete to the best of my knowledge, recollection and belief except for the list of corrections, if any, attached on a separate sheet herewith. Witness my hand, this the _____ day of _____ 2007.

_____
R. RALPH SINNO, PH.D., P.E.

CERTIFICATE

Subscribed and sworn to before me, this the _____ day of _____, 2007.

_____

Notary Public in and for the County of _____, State of Mississippi.

My Commission Expires: _____

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Thomas C. & Pamela McIntosh v. State Farm, et al

Federal - No. 1:06-cv-1080-LTS-RHW

CAPTION

October 11, 2007 R. RALPH SINNO, PH.D., P.E.

DATE OF DEPOSITION DEPONENT'S NAME

PAGE	LINE	CORRECTION	REASON

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March 27, 2007

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Attention: **Mr. Richard F. Scruggs**

Reference: **Katrina Litigation**
Mr. and Mrs. Thomas and Pamela McIntosh
2558 South Shore Drive
Biloxi, MS 39532

Expert Witness Report

STRUCTURAL RESPONSE OF THE PROPERTY OF MR. AND MRS. THOMAS McINTOSH DURING HURRICANE KATRINA (8/29/02)

1.0 Introduction

The following summary report is prepared in reference to your request to assess the interaction of the high velocity wind forces from hurricane Katrina with the structure of the residential property owned by Mr. and Mrs. Thomas and Pamela McIntosh, 2558 South Shore Drive, Biloxi, Mississippi. An assessment of the structural damages is also included with recommendations for structural inspection for damages, retrofitting and repair as necessary. This report is for your own use, and you may use it in its entirety as a single piece of evidence as you see fit. I will be glad to answer any questions in the future, or expand on any idea presented, as per your request, and on my own initiative as necessary to satisfy any and all inquiries presented to me.

This report is based upon the evidences made available to me, and on basic well known established wind engineering scientific facts that are related to hurricane Katrina. Only refereed published research material on the subject of hurricane wind loadings and related damages to residential structures is used. No theoretical mathematical modeling or computer simulations based on assumed scenarios are employed in this presentation. All wind engineering data and the structural response presented in this report are based on either documented observations, measurements, or refereed findings from physical situations in the field or full scale laboratory testing on structures.

2.0 Background of Expert Witness

In August, 1969, I lived in Pass Christian, Mississippi when the eye of hurricane Camille hit the Mississippi Gulf Coast. I was working that summer for the General Electric Company at the NASA Test Facilities at Bay Saint Louis, Mississippi, while I was a faculty at Mississippi State University, Department of Civil Engineering. I lost my entire home at the beach property in Pass Christian with "only slab left" including a close friend who died as a result of the hurricane, Mr. Slim Wagner.

On the morning after the hurricane Camille hit the Mississippi Gulf Coast, I was contacted by the Manager of the General Electric Company and I was asked to inspect the damage to the Gulf Coast area including the NASA Test Facilities. I was granted special permission to access the then restricted area and I witnessed first hand and evaluated the destruction and resulting damages from the hurricane.

Ever since that day, I have dedicated part of my professional education and activities to study the interaction between hurricanes' high velocity winds and structures.

For the past sixteen years, I have concentrated my full time research efforts working on simulating in the laboratory hurricane wind forces on structures. This effort was finally successful for the first time ever in 2005, and the on-going research at the present time is dedicated to advance the knowledge and the state-of-the-art on this topic, see Exhibit 1, attached. Several publications on this topic are already available, and the work on this subject is quoted in recent presentations and publications by several wind engineering experts on the national and international scene, see Exhibit 2, references 1,2,3,4.

3.0 Forces from High Velocity Wind and Structures

Hurricanes are wind driven events coupled with variations in barometric pressure differentials. As a result of hurricanes, high velocity turbulent air flow is generated. This unsteady flow of air causes severe pressure differentials on structures leading to high loading forces and potentially catastrophic structural failures.

Wind forces are translated to pressures per unit exposed surface areas that have dynamic variable effects on structures. Wind produces direct pressures on structures when these structures block the natural flow of the high velocity air flow. Furthermore, these forces from the wind flow increase significantly if this blockage tends to increase the air flow velocities. Also, this high velocity air flow produces a vacuum between the flow of wind streams and the structure causing severe suction forces, see Figure 1, as presented in ASCE-7 for minimum design loads. [5,6]

Uplift forces on the roof and suction on the sides and leeward walls of the house are by far the most destructive forces because they generally exceed all other forces and cause detachment to components from the structural framing. In our case in question, the McIntosh

residence (house), these pressures acted on both the external and internal surfaces of the envelope of the house, as it will be discussed later, see Figure 1.

A house or a building (structure) must be strong enough to insure overall adequacy of the structure as a whole, and the adequacy of individual components that forms the envelope. ASCE-7 covers the loading on structures accordingly and under these two items: 1. Main Wind Force Resisting System (MWFRS), and 2. Components and Cladding forces (C&C).

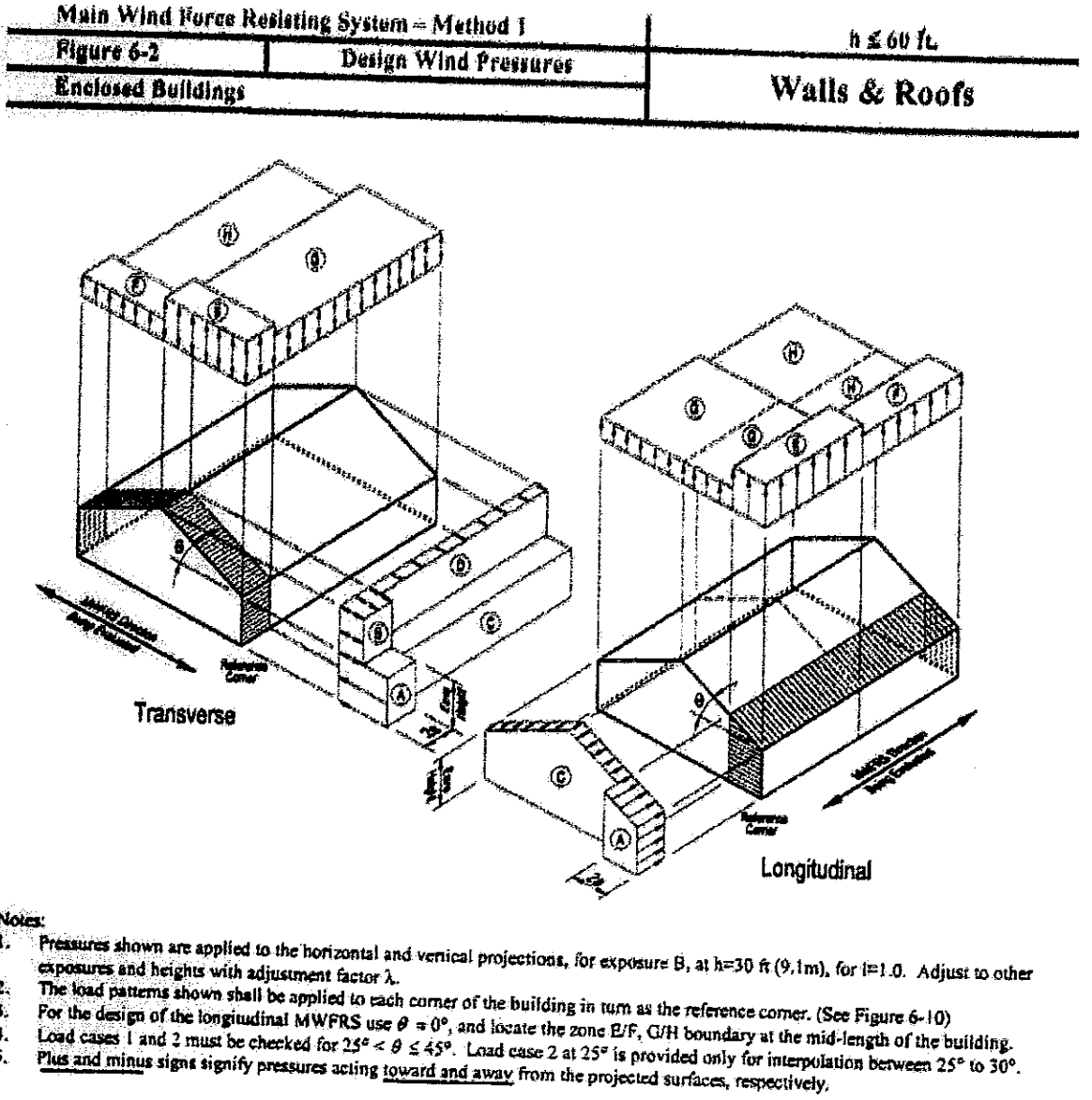


Figure 1. Direct inward, outward suction, and uplift pressures in the direction of high velocity wind on the McIntosh Residence

3.1 Main Wind Force Resisting System (MWFRS):

The main wind force resisting system is the structural system that provides the overall integrity and framing stability of the envelope as a whole when the effects of wind forces are applied to the entire structure. The MWFRS forms the load path that the winds follow to the ground. The MWFRS is expected to withstand all external and internal pressures, applied in one or more combinations that produce the most severe forces in the system's components, see Figure 2. Adequacy of the MWFRS is necessary for the survivability of the structure.

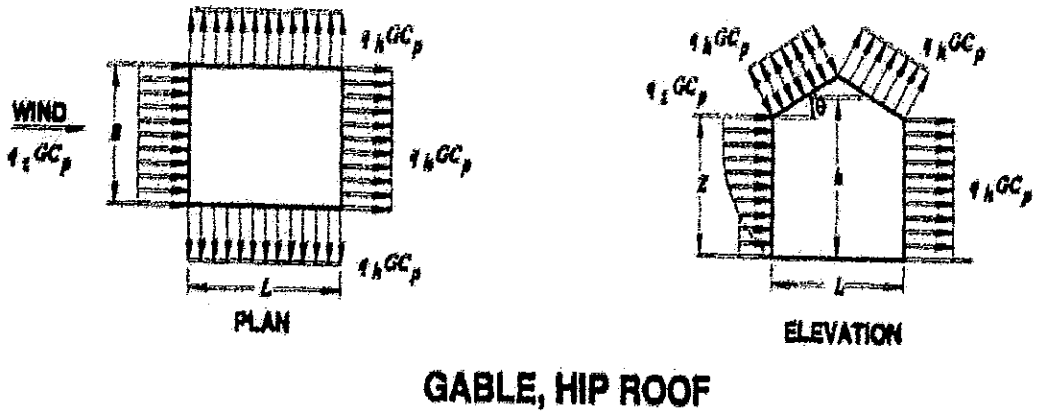


Figure 2. Main wind force resisting system (MWFRS) external and internal pressures as per ASCE-7

Typical MWFRS configurations for horizontal and uplift load transfer can be found in moment resistant structural framing. These frames are commonly used in a multistory or a single structure. Load path is provided by the beam-column rigid connections. The two story, McIntosh house did not have moment-resisting structural framing but it had main simple and free to rotate framing all around. It was well built using classical wooden framing, roof trusses, and plywood roofing with asphaltic shingles. The integrity of the framing and the good workmanship of the structural framing for this house in particular were evident from the field inspection of the house after the hurricane.

In the absence of moment-resisting integrated connections in the frames, then the structure must depend on braced frames such as trusses and shear walls, external and internal partitions as diaphragms, or the roof itself to provide structural stability. In limited special cases, the corner panels in a single story framing of a house, if well designed and anchored, could provide the lateral bracing to secure structural stability. The McIntosh residence did not have x-bracings or shear walls. This approach is seldom used in wood framing to a house, but commonly used in metal framing and in multi-story buildings. However, the McIntosh residence did have external solid columns and internal partitions. The external walls for the McIntosh house are extremely weak structurally by the fact that they are almost transparent with excessive lines of windows. Such glass windows are known to be subject to initial failure by instantaneous

high direct pressures and breakage by flying debris. The main columns in the McIntosh house framing are fairly solid and this is good for the structural stability of the house. The internal partitions are definitely not designed as shear wall diaphragms in this house. The only good structural cross-framing left in the McIntosh residence is the roof. This is the easiest part in such a residential house to get uplifted because of the extremely high suction forces created by the vacuum from the high velocity lines of wind flow. As per the ASCE-7 for the design of structures using minimum design loads from high velocity winds, the design is governed by the corners of the roof because they are the most vulnerable zones to uplift wind forces in addition to localized damages due to flying debris and falling trees, as it will be discussed later, see Figure 1.

The structural stability of the framing of the McIntosh house was not lost during hurricane Katrina, but the roof did get uplifted and clearly damaged at several locations and all around the house envelope. This severe shingle damage, uplift, and loss of integrity was clearly evident in the roof of this house and all around the neighborhood, see Figures 3, 4 and 5. Part of the roof plywood sheets were uplifted and blown away to cause severe rain and wind damage to the interior of the house. This roof damage is due to high wind velocity and occurred most definitely early in the timing of the hurricane history and way before any water surge occurred on the ground level.

Figure 3. View of the damages to the roof taken from the front elevation of the McIntosh Residence

Figure 4. View of damages to the roof taken from the back elevation of the McIntosh Residence

Figure 5. View of uplift damages and penetration of debris to the McIntosh roof

3.2 Components and Cladding (C&C) Forces on the Envelope Enclosure:

The components and cladding, as defined by the ASCE-7, are the individual components that collectively enclose the house. They make up the envelope. The C&C components including the roof cover transfer the wind loads from the exposed surfaces of the envelope to the MWFRS.

C&C failure degrade the integrity and serviceability of the house, cause unacceptable damage to the framing interior and to the contents. For example, loss of windows in a house would not necessarily result in the collapse of the structure, but could prevent the house framing from functioning as a stable structure. Failure in the C&C causes severe increase in the wind pressure differentials from the high velocity winds. This is common in wooden residential construction. The presence of excessive openings, windows and doors, in the envelope of the McIntosh house, that are highly susceptible to breakage by flying debris, made it easy to speculate premature failure in C&C. Failure of the C&C is often, but not always, followed by catastrophic structural failure of the MWFRS.[5,6,7,8]

For this reason the C&C, as per ASCE-7 Specifications for Minimum design loads, is subjected to higher pressures than the structure as a whole. But, this was not the case in the McIntosh Residence because the envelope was very fragile to wind loading and considerably weaker than the main framing, as it will be discussed and shown later on in the Report.

4.0 Wind Field from Hurricane Katrina at Biloxi, Mississippi

Katrina was a major hurricane when it made landfall in Biloxi. Because it was also an unusually large hurricane, the Mississippi Gulf Coast was exposed to hurricane-force winds for many hours, including several hours before landfall. Katrina's hurricane-force winds extended 120 miles from the storm center, and tropical storm-force winds 230 miles outwards. Katrina also maintained a large eye, thereby providing a large area coverage of its most fierce winds. Satellite images, National Weather Service radar, airborne radar (from the Hurricane Research Division), dropsonde data, buoy data, and an Ingalls Shipyards' anemometer provide intriguing insight into the three-dimensional structure of the hurricane. But, due to field failures of some critical instrumentations, the entire picture of the wind forces especially the extremely high instantaneous gust of wind loading was not recorded.

An outer-core band of strong thunderstorms from a second eyewall impacted the Biloxi area. The strong winds also created a situation where potent wind gusts could occur in thunderstorms and boundary layer turbulent eddies to create tornado like effects on localized areas. Structural damages to many residential areas in the neighborhood to the McIntosh residence are noted to reflect this localized catastrophic failures known only to occur in severe wind vortices and downbursts. National Weather Service radar data indicates many tornadoes, and satellite shows mesovortices on the inner edge of the eyewall capable of extreme wind damage that were similar to the damage caused by the mesovortices in Hurricane Andrew.

Eyewitness accounts of next door neighbors to the McIntoshes confirm wide spread structural failures before the water surge inundated the land and describe intense winds on the early morning of August 29. The affidavit of Ron and Linda Muchk, neighbors to Mr. McIntosh, are quoted in this regard.

An affidavit from Mr. George Sholl, director, Jackson County Emergency Communications District, tells of his observation of the wind speeds from anemometers mounted on the Emergency Operations Center (EOC) building. Mr. Sholl states that the two anemometers were professional type equipment and accurate to the best of his knowledge. He states that he observed the indicated wind speed from this equipment starting Sunday night, August 28, 2005 at 75 mph up to the early daylight hours of Monday, August 29, 2005 at an indicated wind speed of 137 mph. He states that shortly thereafter sections of the EOC building roof blew off and he evacuated to the nearby courthouse. He further reports that some personnel in the EOC building stayed for a short time after he left and observed the indicated wind speed at 140 mph. He further states that the anemometers' tower blew down approximately 20 minutes after he left and no more wind speed readings were possible. Mr. Sholl then states that the winds continued to increase after the tower blew down and he estimates that the winds must have been over 150 mph. He further states that the highest flood waters came later. The widespread wind damage is likely due to the longevity of hurricane-force wind exposure, fierce wind gusts, tornadoes, and mesovortices.

This affidavit from Mr. George Sholl is confirmed and backed by Mr. Butch Loper, the director of the Civil Defense for Jackson County. Mr. Loper testified that a wind gust speed of 137 mph occurred between 8:00 a.m. and 8:30 a.m.

At the McIntosh residence the sustained wind speed is estimated by the ADCIRC Simulation at 100-110 mph with the 3-second gust wind to reach 120-130 mph.

5.0 Magnitude and Distribution of Wind Pressures:

Factors that determine the magnitude and distribution of high velocity wind forces, with special reference and emphasis on the impact of these factors on the McIntosh residence, are the following:

Location: This is the single-greatest factor in determining wind effects. The McIntosh residence is in the coastal region with water front not too far from the house. The house is almost 4 miles inland from the sea shore but the adjacent Big Lake and the open waterfront most definitely created a situation for wind flow to gain speed and momentum as compared to adjacent neighborhood houses. It is therefore expected to face greater wind damage from hurricane Katrina than houses further inland away from the water and on dry land locations.

Exposure: The McIntosh residence is in open land spaces, adjacent to a large body of water. The effects of high velocity winds are not shielded or partially shielded by adjacent structures

and thus no unusual increase in design velocities is to be expected, exposure Category C as per ASCE 7-02 "Specifications for Minimum Design Loads."

Topography: McIntosh residence is on a relatively flat terrain and no special topographical impact on design wind velocity is to be expected.

Orientation to wind: The greatest wind effects and the most vulnerable direction on this house are probably from the south to southeast, that is at the time the eye of hurricane Katrina hit the Gulf Coast. The McIntosh house has southeast-northwest orientation with windows over the entire length of the front and back elevations. These windows created open enclosure of the entire house after failure of the glass due to wind suction forces and direct pressures coupled by the impact of flying debris, see Figures 6, 7, and 8 for before and after the hurricane.

Structure: Wind effects increase with height above ground. The McIntosh residence should feel higher direct and suction wind effects on the roof and the front and back elevation walls. The corners of the roof plan will be subject to extreme uplift forces, with the overhang extension over the open front and back porch areas of the roof experiencing added intensity of the uplift forces.

Shape: Wind exerts inward pressure on the windward face of this house, outward suction on the leeward and side faces of the house and both inward pressure and outward suction on the roof surfaces. The shape of the house dictates the aerodynamics of wind flow and the creation of catastrophic suction forces. The shape of the McIntosh house with extended window openings on the front and back elevations of the house will create an open alley for the high velocity wind to travel through. A tunneling effect is created that ripped through the house from right to left causing internal damages and inviting flying debris into the house. This open space allowed later on to be inundated by floating debris from the water surge.

Natural period: Most wind contains turbulences (*gusts*), which causes periodic fluctuations in the effect that the wind has on the structure. The McIntosh residence, whose natural periods are expected to be near the natural periods of the energy contained in the wind gusts should feel the effects of the wind more than other houses whose natural periods are not near those of the energy contained in the gusts. Buffeting is the effect of gusts on a building, and for the shape of this house it is expected to be severe due to its flexibility.

Building importance: No special importance can be attached to the McIntosh residence as defined in the referenced ASCE-7 standards.

Design criteria: If houses are designed properly, then they are often designed for two risk criteria: 1. risk of failure of the structural framing, and 2. risk of disruption of function due to failure of components, serviceability. Strength design is based on the most severe wind effects that are relatively infrequent. Serviceability design is based on wind effects that occur more often, but which are less severe. The McIntosh residence was most likely designed for strength but not for serviceability.

A review of the post Katrina pictures taken by the home owner show very clearly the sever destruction to the front and back elevations, detachment and displacement of the blown out window, and cracking of the outward walls and separation from the main house elevation due to suction forces. The internal structure of the house was severely damaged by this open harsh wind environment, and the open roof for rainwater to enter the attic and destroy the false ceiling and the interior partitions of the house, see Figures 9 and 10. The damage to vegetation, trees, in the yard of the house as a measure of wind forces can be seen in Figure 11.

Figure 6. Before and after showing the line of windows on back elevation of the McIntosh house.

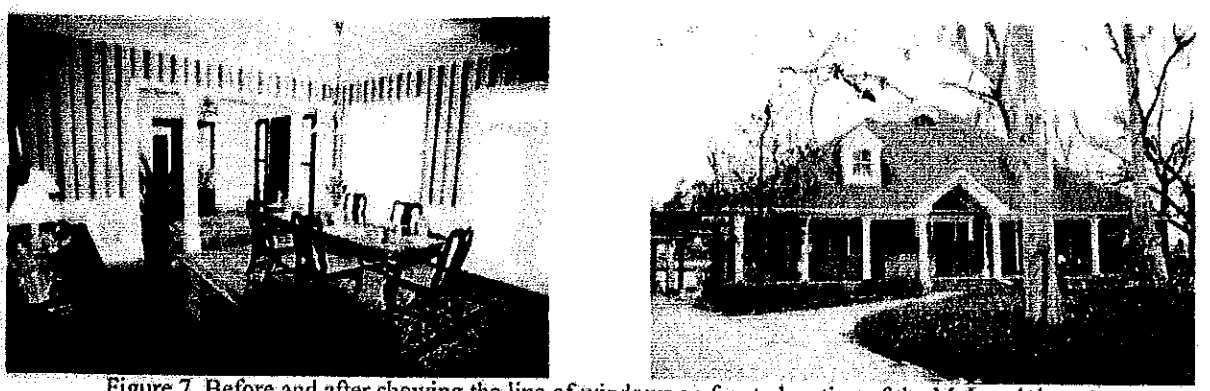


Figure 7. Before and after showing the line of windows on front elevation of the McIntosh house.

Figure 8. Before and after showing the line of windows in the master bedroom of the McIntosh house.

Figure 9. Damage to the interior false ceiling from rain water due to roof failure caused by wind.

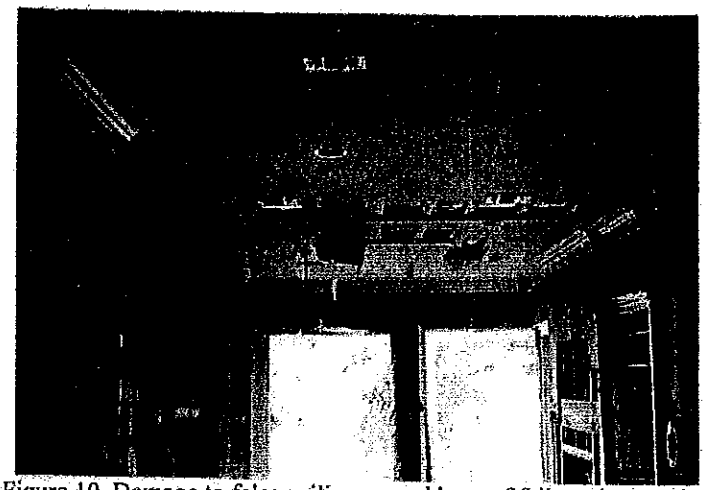


Figure 10. Damage to false ceiling caused by roof failure due to wind.

Figure 11. Trees in the yard stripped and broken due to high wind velocity.

6.0 Hurricane Wind Forces and Structural Response

6.1 General: The fundamental measurement of the effect of hurricane wind forces on structures is wind speed. Wind speed is normally measured using anemometers that record the sustained speed. A typical wind speed plot recorded during a thunderstorm is shown in Figure 12. The wind pressure at an average sustained wind speed at 65 mph for one hour is not a hurricane force, but for a 3 seconds gust, it is equivalent to a force of a hurricane wind speed of 110 mph.

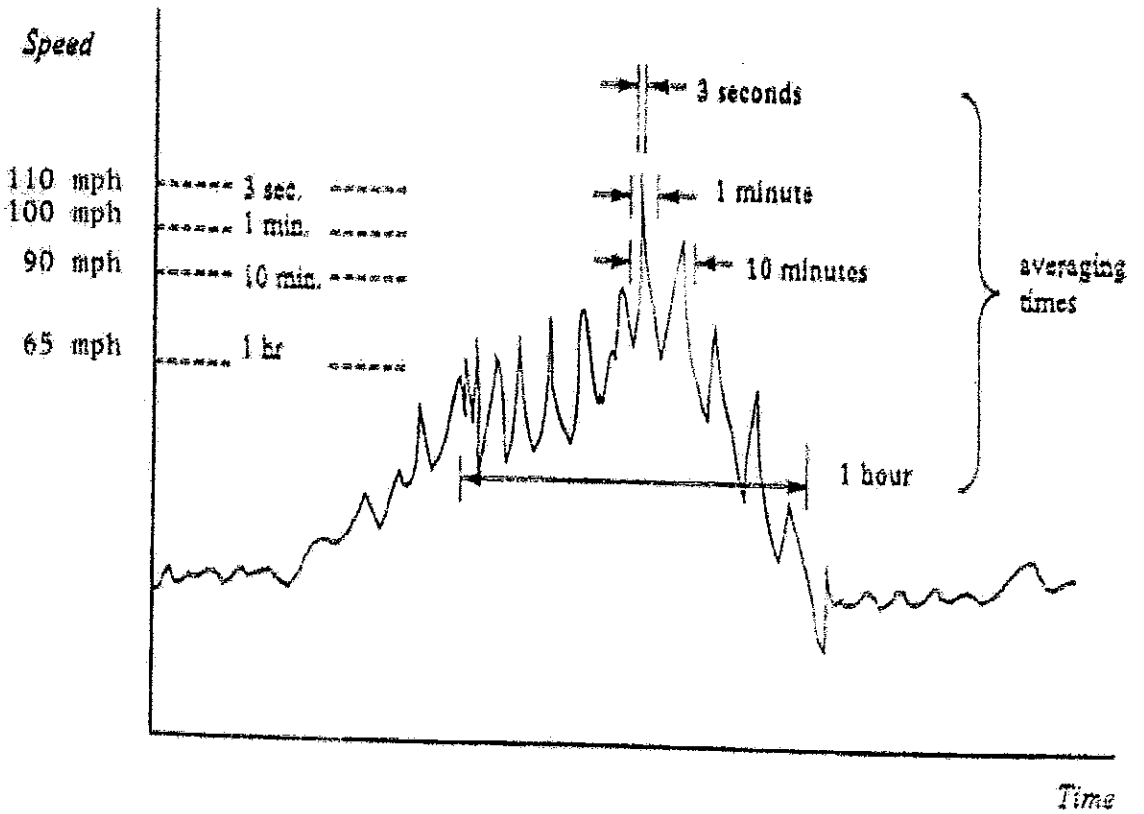


Figure 12. Typical wind speed variation vs. time from Ref. 6, see true measured hurricane wind loading in Figure 13 and in the Appendix.

6.2 Sustained Wind Speed: Only the critical and documented sustained one minute wind speed at the time the hurricane impacted the structural framing of the buildings on the site will be addressed here.

For the design purposes of the structural framing of buildings, the structural designer will be most interested in the 3-second gust wind speed as per the ASCE-7 specifications for the requirements of minimum design wind loads.

However, the assignment here is not the design process, but rather assessment of wind forces, damages, causes, and modes of structural failures. Thus, to address the impact of wind loading on the structures, it is vital and detrimental to use the maximum gust wind speed that these structures will be required to respond to and to sustain. Based on the most recent research conducted at Mississippi State University, at the Kelly Cook Structural Wind Simulation Laboratory, it was established beyond any shadow of a doubt that structures respond fully, 100% of the time, to one second instantaneous gust wind loading. Thus, to properly address the structural behavior of the McIntosh residence, the assessment must address the maximum one second wind gust rather than the 3 second wind pressure.

It is now well understood by all engineers working with wind loading on structures that the real wind pressures that act on building surfaces can vary dramatically from place to place, and from instant to instant. The spatial variation with a single surface on a building, say the roof, is remarkable. For example, the peak suction, uplift, spatially averaged over an area 8 ft X 14 ft can vary by a factor of 4, or more, compared with the worst, peak, local suction acting at a point within the same area at the same time, for critical wind direction. Time variation of significance occurs up to several cycles per second under real life hurricane wind conditions. These conditions are very significant and will be illustrated in more detail later under the discussion of "wind tunnel testing." Video recordings of the response of full scale true roofs to real life instantaneous loading duplicating the footprint of hurricane Andrew (1992) confirmed the significance of instantaneous loading. Those recordings were made recently by the writer at the Kelly Gene Cook Wind Simulation Laboratory at MSU[13].

The most significant change in the design specifications "Minimum Design Loads for Buildings and Other Structures," known as ASCE-7 was made in 1995. They introduced for the first time the 3-second gust wind speed instead of fastest-mile wind speeds. This change necessitated revisions of many factors. Figure 13 shows real life hurricane wind loading that varies in time and space at the rate of several cycles per second, and the variation is extremely unpredictable.

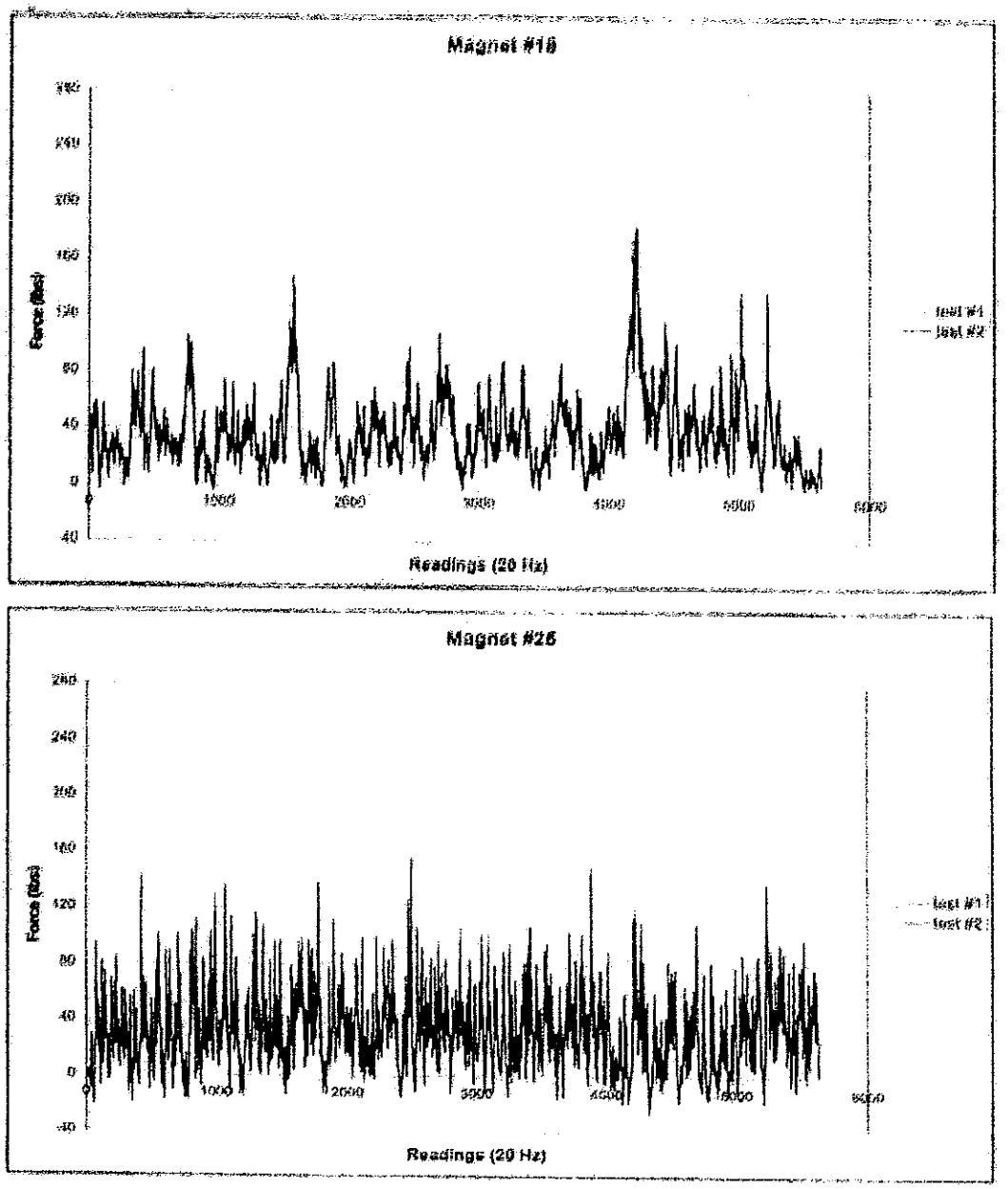


Figure 13. Instantaneous uplift wind pressure vs. time in seconds for Hurricane Andrew (Florida, 1992) (#18 and #25 are two one square foot areas on a roof 6 feet apart)

The data in Figure 13 was collected and plotted at the rate of 20 (Hz), readings per second, of real life. The instantaneous peak uplift pressure on a flat roof can vary as much as 200 pounds per square foot for a sustained wind speed of 115 mph. It is important to note that the unit dead load weight of a typical wooden roof similar to that built at the McIntosh house is about 13 pounds per square foot. Accordingly; the maximum instantaneous uplift wind loading at the flat corners is about 15 times the weight of the roof.

It is also universally accepted now that the rate of change in time and space of true hurricane wind loading on structures is nonuniform and unsteady; that is, variable and dynamic. Fatigue of anchorage details of the roof to the walls and to the base boards of the house including the framing panels of roof and wall siding panels are severely tested under high velocity winds. This known fact makes it extremely vital and necessary to inspect and retrofit all anchorage points and connections of the structural framing of the McIntosh residence as an integral part of any repair to protect it from future sudden failures under moderate thunderstorms or hurricanes.

For design purposes, and for simplifying the complexity of wind loading in time and space, the ASCE-7, and all other design standards, rely on average wind speed and loading. The average over 3 second wind speed has been selected by the ASCE-7, called 3-second gust, and loading on panel areas in any structure are divided into zones in order to use uniform pressures, see Figures 1 and 2.

6.3 Instantaneous Gust Wind Speed at the McIntosh Site: The gust in hurricane winds are caused by slow overturning of air as it travels at high velocity. The hurricane boundary layers rolls have been documented in every recent hurricane. Truck-based radars that usually follow hurricanes and tornadoes and record the wind speed in the hundreds of a second have provided detailed footprints of loading spectrum including the boundary layer rolls of the wind that cause the wind gusts. These gusts when they collide with structures cause the unsteady nonuniform wind pressures. The loading that needs to be considered in this assessment of damage is the one second gust based on the ability of the structures to respond to the changes in the unsteadiness of the loading. This loading is referred to here as the instantaneous gust wind loading.

The instantaneous wind gusts played an important role at the McIntosh site by the fact that the roof and all the windows and the structural framing got severe wind damage. The entire structure of the house shifted away and deflected from its original location causing separation from encased brick columns and horizontal shear cracking was evident in these columns, see Figure 14 for a typical failure. It is also a well known fact by all wind engineering researchers and related studies as acknowledged by the ASCE-7, that the 3-second gust wind factors are between 20 to 30 percent higher than the one minute sustained wind speed. ASCE-7 uses the three seconds gust. The instantaneous wind speed, one second gust, is another 20 to 30% higher than the three second gust wind speed. These instantaneous wind speeds are the cause of the initial wind failures in the envelope and uplift in roof shingles and cladding. The instantaneous wind speed at the McIntosh house that needs to be used in the assessment of initial structural response based on 110 mph sustained wind speed is then equal to 160 – 180 mph.

Figure 14. Horizontal shear cracking of column encasement and separation from the house envelope.

6.4 Rain water: All eyewitnesses and weather reports confirm that heavy squalls of rain accompanied the gusty high velocity winds of hurricane Katrina. If the rain water is assumed to be transported by the wind, then the direct impact of this water against the structures, walls and roofs, will be huge. Furthermore, if the impact of rain water is assumed to be uniform and steady, then the impact forces will be at least 800 times that of the wind assuming that the water is traveling at the same velocity as the wind. The impact forces will be over twice that of the wind if the velocity of the water is only 10 mph. This logic is purely theoretical because it assumes that the rain water is traveling at a uniform mass, steady, and uniformly distributed, a "tsunami" effect. This is obviously wrong and an invalid assumption.

But, if the rain water is considered to be carried by the wind as transported debris to impact structures, then this is a valid assumption and the impact forces are most definitely higher than those produced by the wind alone. The findings from wind tunnel testing and ASCE-7 specifications for minimum design loads are not adjusted accordingly for rain water. Thus, it is only fair to note that by intentionally ignoring the rain water in the instantaneous gust wind loads is a significant underestimate in the true instantaneous direct loading impacting the envelope of the structure of the McIntosh residence.

7.0 TIMING OF HURRICANE WIND AND WATER SURGE VERSUS STRUCTURAL DAMAGES

Tide gauges show tropical-storm force winds from hurricane Katrina arrived about three (3) hours before significant flooding from the water rising or the water surge. Computer models, National Weather Service radar, reconnaissance radar, dropsondes, surface observations at Ingalls Shipyard, buoy data including a nearby Dauphin Island CMAN station, tide gauge data, eyewitness accounts, newspaper reports, and videos show hurricane-force winds, tropical storm-force winds, and strong wind gusts occurred hours before the surge impacted the Beach Boulevard, Highway 90, at Biloxi, MS. The official Hurricane Research Division wind analysis and experienced reputable local meteorology experts concur with this assessment, see Pat Fitzpatrick Report.

Low lying coastal areas are always susceptible to water pressure as a result of rise in water level. This includes the forces resulting from the movement of water onto land while the area becomes inundated by the hurricane wind forces. In the initial stages of a hurricane, land very near the coastline will be subjected to the impact of relatively large surface waves. However, much of this energy is absorbed as the waves break in shallow water approaching land. As time progresses, rising water is pushed toward the shore by the force of the winds. Thus, the rise in the surface water level is again a wind driven event coupled by the reduced barometric pressure within the eye of the hurricane that causes the rise in the water. This is known as the storm surge and mistakenly interpreted by some evaluators as a hydrostatic wall of water. This, in my opinion, is absolutely false, and unrelated to the physical mechanics of all around rising water levels. The structural response to an active turbulent water level with a known directional wind force is minimal. Water from a storm surge rises slowly initially at the rate of 2-3 feet per hour, and then at a higher rate, 1.0 inch per minute, as the wind increases in velocity.

A team of experts quoted and stated in a very recent publication the following:

"Storm surge does <u>not</u> occur as a wall of onrushing water like the Indonesian Tsunami; however, large wind-generated waves moving on top of the surging waters may create the impression of a tsunami-like effect, and the force of those waves may be responsible for great damage."[10] The emphasis by underlining the word "not" is added here. The unfortunate mistake made by most assessments of hurricane damages after a water surge is the isolation of rising water with aggressive wave action, if the surge is in open waters, from the high velocity wind forces that are driving the water surge.

The water rise during hurricane Katrina lasted several hours and affected about 100 miles of coastline. The peak wind speed generally preceded the peak surge, as expected, and for hurricane Katrina, this lag time has been estimated by most meteorological researches and experts to vary between 2-3 hours for the McIntosh site, see Figure 15.

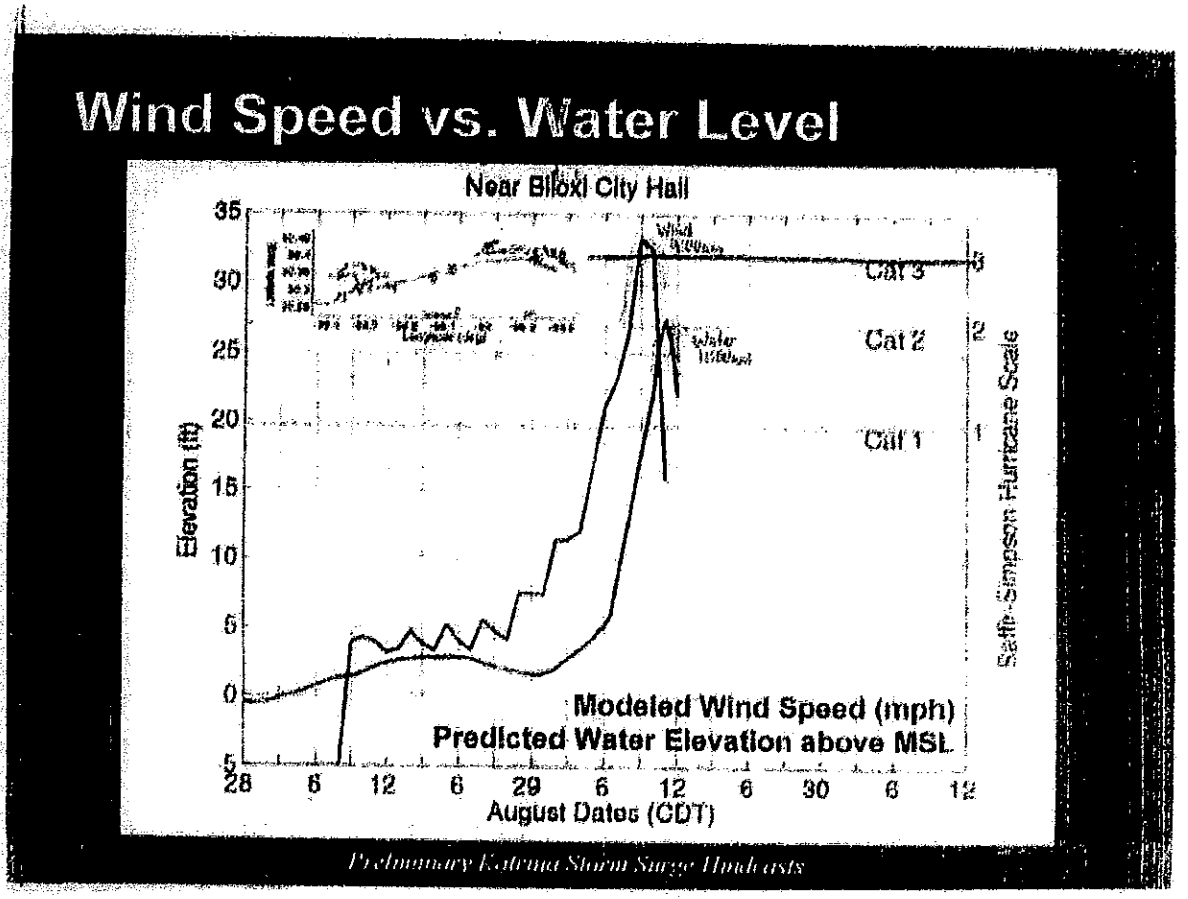


Figure 15. Wind speed and water surge elevation vs. time for Biloxi, MS (Reference 11)

In order to cause structural damage to existing buildings in a storm surge there must be significant differential pressure applied by the water. It is well accepted that water surge is a slow rising water at a maximum rate of less than one inch per minute and causes severe flooding around and inside residential homes. Water surge is a serious threat to the building's curtain walls, interior partitions, and contents of a residential house if the house is severely inundated by the water surge. However, damages from water surge are usually occurring after the peak high pressure differentials from winds have passed through the house. To evaluate the total water surge as a hydrostatic pressure behind a wall barrier is a fatal error by any engineer. For the McIntosh residence the water surge exceeded the ground level around the house. The back porch of the house itself was raised 4 feet above ground, and the water surge at its peak reached 2-3 feet above the ground slab level. The McIntosh residence is 4 miles away from the sea shore, and the Big Lake water front is a confined water with a restrained openings to the Iberville Bay. Thus, there are physical restrictions on water velocity and transportation with no wave action other than localized turbulence from the wind forces that were impacting the McIntosh residence at that same time.

But, in my opinion, since the water surge occurred three hours after the collision of the damaging sustained peak high velocity wind forces with the McIntosh residence, then this leaves no justification whatsoever for the water surge to be blamed to have caused any structural damage to the wall framing and the envelope of the house.

This opinion is also shared by the document "Is it Wind? Or is it Water?" prepared jointly by the Civil Engineering Department of the George Washington University, Washington, D.C.; the National Committee on Property Insurance (NCPI); the National Flood Insurance Program (NFIP); the Property Claims Services (PCS); the Property Loss Research Bureau (PLRB); State Farm Insurance Companies; and the Federal Insurance Administration (FIA) of the Federal Emergency Management Agency (FEMA). The purpose of this working document is that an adjuster can carry it with him or her when visiting the site of a disaster to help him evaluate site damages. This document is also aimed at providing technical information to assist property insurance claim adjusters in making determinations as to whether losses sustained to properties as a result of a hurricane or severe storm were caused by wind or water.

The following section in this report is a direct quote from the above noted insurance endorsed publication. It is presented here because it fits exactly the situation at the McIntosh residence and the resulting structural damages (this document is not copyrighted and permission is given to copy or quote from it):

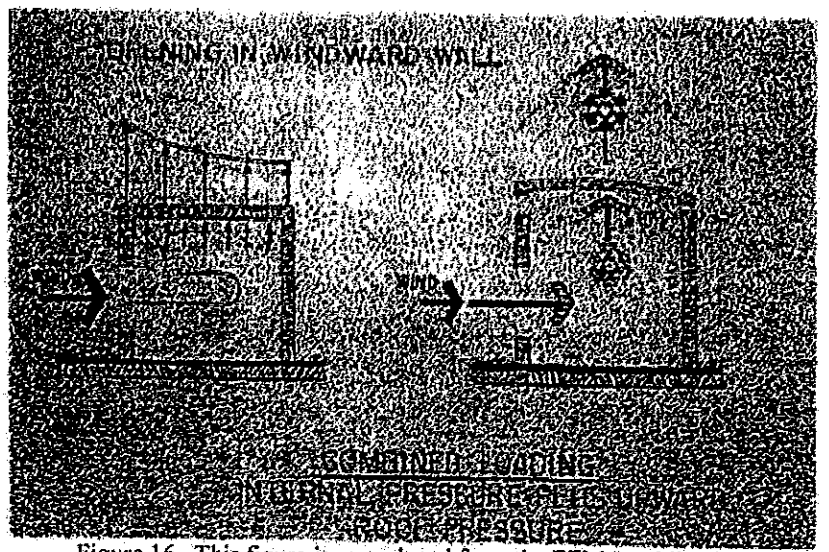


Figure 16. This figure is reproduced from the FEMA publication

- *Knowing the power of wind as compared to the power of water can help one determine what caused the damage.*
- *At 40 miles per hour, wind can exert an effect of about seven (7) pounds of pressure per square foot. At 60 miles per hour, the pressure increases to about 15 pounds per square foot.*
- *A wind of 100 miles per hour can exert an effective pressure of over 40 pounds per square foot on a building. Further, winds passing over and around a building can*

develop negative or "pulling" pressure in addition to the "pushing" pressure. See Figure 4.1(Figure 16 above).

- *The average wooden roof is built to sustain a weight of about 30 pounds per square foot. Thus, if a roof is fairly well constructed, winds of approximately 80 miles per hour would be necessary to cause considerable damage.*
- *If windows on the windward wall were open or broken, the pressure within the building would increase and push even harder from the inside out. See Figure 4.2 (Figure 17 below).*

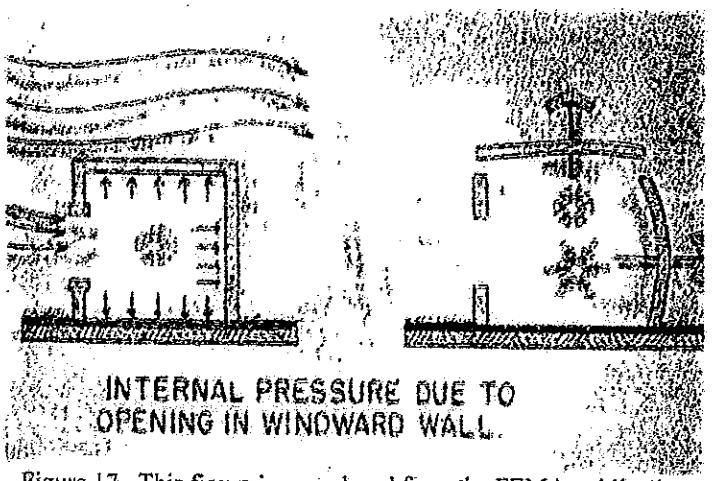


Figure 17. This figure is reproduced from the FEMA publication

Figure 18. This figure is reproduced from the FEMA publication

- *The pressure on the outside of the roof and leeward and side walls is negative, or pulling. This combination can be enough to lift off an entire roof, especially under hurricane wind*

force conditions. See Figure 4.3 (Figure 18 above). Inexpensive, galvanized straps can be used to tie the roof to the wall and thus reduce damage. Proper nailing of walls is required to prevent their removal by suction forces. Refer to the FEMA Coastal Construction Manual for additional construction details.

- *The power of wind can also be devastating to the landscape. As shown in Figure 4.4 (Figure 19 below), trees snapped off at a high level, bent, or uprooted are indicative of wind damage.*
- *Sometimes a documented canvas in the area and talking to clean-up crews and eyewitnesses will give some special insight about the conditions during and after the storm that would help an adjuster determine the cause of damage.*

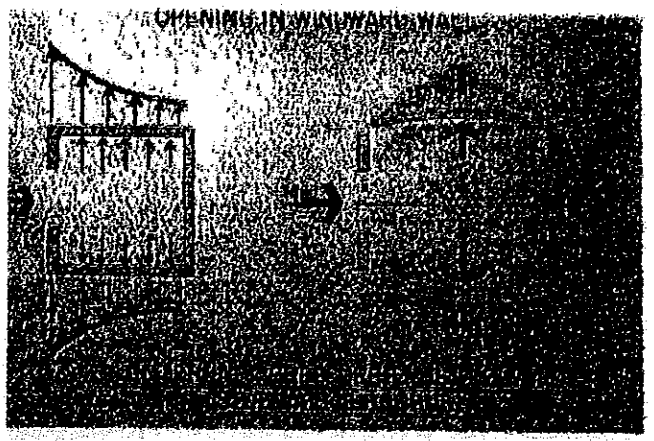


Figure 19. This figure is reproduced from the FEMA publication

Figure 20. This figure is reproduced from the FEMA publication

- *This house suffered extensive roof damage caused by wind. The wind damage left holes in the roof, allowing rain to enter. From this view there is no evidence of damage from water, but read on, (see Figure 20 above).*

Figure 21. This figure is reproduced from the FEMA publication

- *This is an interior look at the house in Figure 7.1,* (see Figure 21). *Notice the ceiling damage caused by water that came through the wind-created holes. This evidence, together with the evidence in Figure 7.1,* (see Figure 21), *clearly established wind damage for both the interior and exterior.*
- *Remember, water coming in through the roof probably caused damage to the plasterboard and ceiling. This would be covered under the wind policy.*

8.0 WIND TUNNEL TESTING

Several attempts in real life have been made to capture the response of low rise buildings to hurricane wind loading. All of these attempts to date have either failed completely or registered only marginal success. The only valid and currently available testing has been the use of boundary layer wind tunnel testing. In such tests, almost all of the major variables that influence the magnitude and distribution of wind pressures are duplicated; namely, location, exposure, topography, and wind orientation. However, only scaled miniature models of the buildings can be used, 1/50 scale. Therefore, the true characteristics of building framing and materials used for construction and the details of the connections are lost in the models.

Data from boundary layer tunnel testing is collected using over a hundred pressure cells spaced at 6 to 12 ins. apart and at a rate of at least 20 (Hz) cycles per second, see Figure 13. All building codes, including ASCE-7, are based in part on the findings from boundary layer wind tunnel testing among other research data. The unsteady nonuniform pressures of real life are

simplified in the codes into static uniform loads over designated and well defined zones in any panel, wall or roof. Therefore, the loadings from ASCE-7, or any other building code, are not the true loadings of hurricane wind pressures, but rather simplifications of a very complex problem. This is the only thing that we have available for design at the present time. But, as we experience more hurricanes in time and with the current applications of advanced technologies, these codes or standards will be changing in the future.

It is important to note here that the ASCE-7 specifications have consistently and significantly increased the hurricane wind pressures on structures for the Mississippi Gulf Coast over the past twelve years.

9.0 STRUCTURAL LABORATORY TESTING

Present structural testing in the laboratory for the response to high velocity wind pressure loading can be found for individual components (C&C) of housing construction. Since hurricane loadings are caused by pressure differentials, the present testing in the laboratory uses this same procedure. The most used specifications in this regard are the ASTM – E 1592 "Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference" and ASTM – E 330 "Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference."[7,8] These are relatively new tests, 10-12 years old, and they have been excessively used only during the past 5-6 years. The air pressure difference procedure can be either direct pressure or suction uplift pressure. Both of these laboratory tests use uniform static load application, contrary to the nonuniform unsteady loading from high velocity winds in real life.

Tests performed using air pressure difference has confirmed that almost all procedures and techniques used in the past for placing roofing and siding materials, fixing windows, doors, curtain walls, etc. have been found to be marginal, if not inadequate[9,10]. Impressive improvements have been made especially after hurricane Andrew and the rigid requirements for testing by the State of Florida. The construction procedure and techniques for building wood houses over the past five years, in this regard, have improved impressively.

The reason this subject matter is discussed here is to show that laboratory testing using pressure differential to simulate wind loading on windows, doors, skylights, and curtain walls has already captured the ASTM requirements for future designs. Failures of these C&C elements due to wind are very common and the McIntosh residence is no exception.

10.0 COST ESTIMATE OF STRUCTURAL REPAIRS

It is difficult to estimate the additional cost for the structural repairs that need to be done following a detailed structural inspection to the McIntosh house. However, it is expected that the existing anchorage mechanisms that were definitely compromised by the dynamic unsteady wind loading will require to be reinstated if not up-graded and retrofitted. The cost of engineering inspection, review, design and supervision of the work that needs to be done at cost-plus basis for this kind of structural work is left to professional appraisals in this field.

11.0 SUMMARY AND CONCLUSIONS

In my opinion, the following summary and conclusions based on the facts presented can be made:

1. The McIntosh residence was subjected to a sustained wind velocity of at least 110-115 mph during hurricane Katrina, and for an extended period of time. This sustained wind velocity with heavy down pouring rain lasted for at least three hours before the land was inundated by the water surge.

2. The 3-second wind gust, as defined by the ASCE-7 to be used for design purposes, reached at least 120-130 mph. This wind speed needs to be addressed when checking the current structural status of the house for repair and retrofitting as needed.

3. The McIntosh residence suffered extensive roof damage caused by the wind to compromise its integrity. The damage left large holes in the roof for an open exposure to the enclosure of the house that caused severe damage to the interior of the house. Glass windows that were present over the full left and right elevations of the house were also compromised. The house interior was severely damaged due to the rain water from the roof and due to the wind.

4. In summary, the structural integrity of the McIntosh house was compromised for both the exterior and interior by the high velocity winds of hurricane Katrina and extensive repair and retrofitting will be needed to retain its original status and structural strength.

Submitted by,

R Ralph Sinno, Ph.D., P.E., F. ASCE
Professor of Civil & Environmental Engineering

Appendix

TABLES OF TRANSFER OF WIND VELOCITY IN MILES PER HOUR TO UNIFORM PRESSURE IN POUNDS PER SQUARE FOOT (ASCE 7– 02)

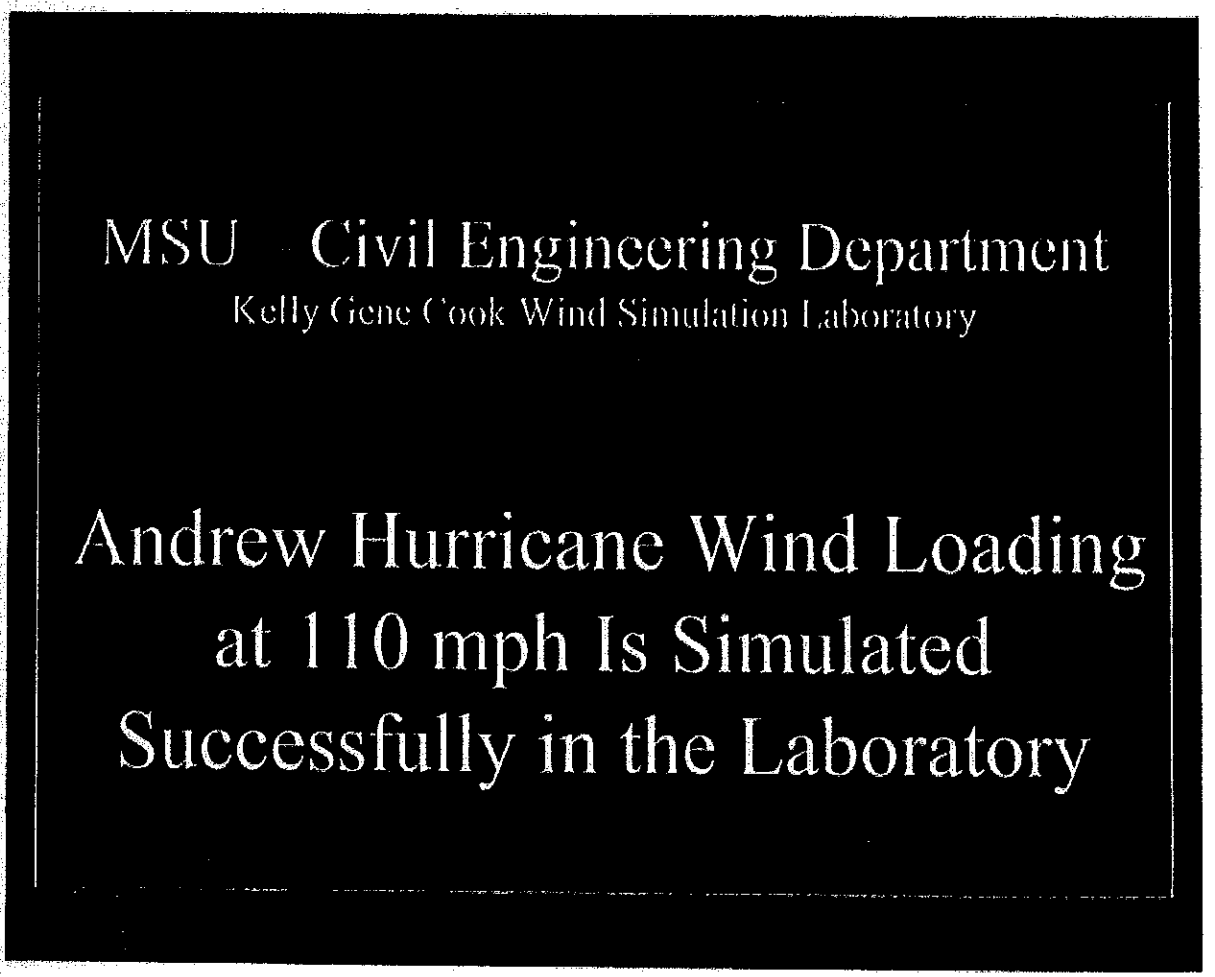
Velocity Pressure, $q_z = (0.00256 * K_z * K_{zt} * K_d * V^2 * I)$
Roof Uplift Pressure, $q = (0.00256 * K_z * K_{zt} * K_d * V^2 * I) * (GCp + GCpi)$

EXPOSURE C	**ASCE 7-02**	
Eave Height (ft) = z =	32	
z_g (ft)	900	Table 6-4
α	9.5	Table 6-2
$K_z = 2.01 * (z/z_g)^{2/\alpha}$		Table 6-2
K_z	0.9957	
K_{zt}	1.0	No Topographic Effect
K_d	0.85	Table 6-4, MWFRS
I	1.0	Table 6-1, Building Category II
GC_p(roof center)	-1.0	Figure 6.11B
GC_p(edge)	-1.8	Figure 6.11B
GC_p(corner)	-2.8	Figure 6.11B
GC_{pi}	-0.18	Figure 6.5

Fastest mile Wind Speed, V (mph)	Conversion to 3 sec Gust Speed (mph)	Velocity Pressure, q_z (psf)	Roof Uplift Pressure at mid-span (psf)	Roof Uplift Pressure at edge (psf)	Roof Uplift Pressure at corner (psf)
50	1.23	8.195	-9.670	-16.228	-24.420
55	1.225	9.835	-11.605	-19.474	-29.309
60	1.22	11.609	-13.699	-22.986	-34.596
65	1.21	13.402	-15.815	-26.537	-39.939
70	1.2	15.286	-18.039	-30.270	-45.557
75	1.195	17.404	-20.536	-34.459	-51.863
80	1.19	19.636	-23.171	-38.880	-58.516
85	1.185	21.982	-25.938	-43.523	-65.505
90	1.18	24.436	-28.835	-48.383	-72.820
95	1.175	26.996	-31.856	-53.453	-80.449
100	1.17	29.659	-34.997	-58.725	-88.383
105	1.165	32.420	-38.256	-64.192	-96.612
110	1.16	35.276	-41.626	-69.847	-105.124
115	1.155	38.225	-45.105	-75.685	-113.909
120	1.15	41.261	-48.688	-81.697	-122.958
125	1.145	44.383	-52.372	-87.878	-132.260
130	1.14	47.586	-56.151	-94.220	-141.806
135	1.14	51.317	-60.554	-101.607	-152.924
140	1.14	55.189	-65.122	-109.273	-164.462
145	1.135	58.683	-69.246	-116.192	-174.875
150	1.13	62.248	-73.452	-123.250	-185.498
155	1.125	65.880	-77.738	-130.442	-196.321
160	1.12	69.576	-82.100	-137.760	-207.336

Exhibit 1

The Department of Civil Engineering at Mississippi State University announced the success of simulating true hurricane uplift wind forces on a metal roof in the laboratory. The footprint of hurricane Andrew (Florida, 1992) from the University of Western Ontario Boundary Layer Wind Tunnel was used in the simulation. The accuracy of the simulation was verified by Dr. Eric Ho from the UWO, Canada. The test set-up and work on the simulation was envisioned and directed by Dr. Ralph Sinno, Professor of Civil Engineering at MSU.


MSU - Civil Engineering Department
Kelly Gene Cook Wind Simulation Laboratory
Andrew Hurricane Wind Loading
at 110 mph Is Simulated
Successfully in the Laboratory

Computer Controlled Electromagnetic Uplift Loading Is Applied on Roofs of Metal Buildings.

This is the First Time Ever, this Simulation in Time, Space, and Correlation Coefficients Is Attempted and Done Successfully in the Laboratory.

With Further Research Hazard Mitigation of Damage due to True Hurricane Wind Loading on Metal Roofs Is Now Feasible.

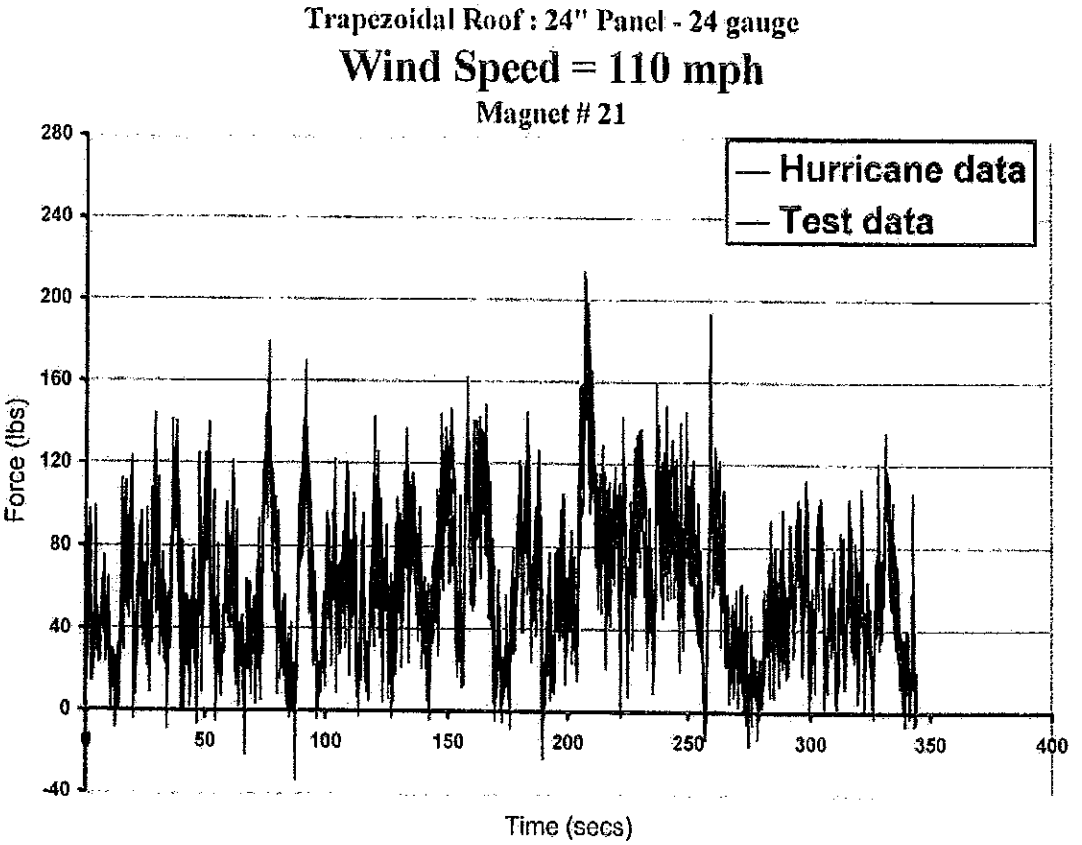

Trapezoidal Roof : 24" Panel - 24 gauge
Wind Speed = 110 mph
Magnet # 21
— Hurricane data
— Test data
Force (lbs)
280
240
200
160
120
80
40
0
-40
50
100
150
200
250
300
350
400
Time (secs)

Exhibit 2
References

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