

From: David Nickerson [dnickerson@rubbusa.com]

Sent: Friday, November 06, 2009 10:37 AM

To: structuralsafety@nist.gov

Subject: Comments on NIST Draft Report on Dallas Cowboys Collapse

Dear Sir/Madam:

Please find enclosed an electronic copy of my comments on the NIST draft report on the Dallas Cowboys practice facility collapse. Please direct these to the attention of Stephen Cauffman.

I have also enclosed some pages of trial testimony related to the collapse of a Summit building in Philadelphia in 2003.

If there are any questions on the enclosed, please direct them to me at 207-324-2877 or via e-mail.

Thanks for your consideration of the enclosed.

Sincerely,

Dave Nickerson

November 5, 2009

Mr. Stephen Cauffman
National Institute of Standards and Technology
U.S. Department of Commerce
100 Bureau Drive, Stop 8611
Gaithersburg, MD 20899-8611

Via e-mail: structuralsafety@nist.gov

Reference: Draft Report on Cowboys Practice Facility Collapse

Dear Mr. Cauffman:

I am writing to you with regard to the draft report issued by NIST on the May 2, 2009 collapse of a fabric-covered, steel frame facility produced by Summit Structures, LLC, a division of Cover-All Building Systems of Saskatchewan, Canada. In full disclosure, Summit is a competitor to our company and we were an unsuccessful bidder on the Dallas Cowboys practice facility project.

Your draft report welcomed comments and the enclosed is provided in the spirit of trying to be both constructive and blunt regarding the matters at hand. These comments are based on my experience of over twenty five years in the fabric structure industry and represent my own opinion based upon this experience. We were all saddened by the irreparable personal injuries that occurred as a result of the Summit collapse. If there is any good to come out of this, perhaps it will be to effect positive changes in the fabric structure industry and its customers such that future collapses can be prevented.

On the whole, your report is very thorough as it relates to the wind load events which occurred on May 2, 2009 and to the relative structural capability of the Summit design to resist wind loads. However, it did not address other critical factors of structure design such as code live load requirements. In addition, it did not get into significant commentary regarding connection detailing, foundation design and other aspects of engineering a building system to safely withstand extremes of weather. Note that I have highlighted key comments/concerns in boldface.

Perhaps my most significant concern is that the NIST report limits its recommendations to fabric-covered steel frame structures. To the extent that these recommendations give the impression that only this specific type of structure is at risk, the report ignores serious deficiencies which can exist with any structure when poor design practices are followed.

In addition, for those of us in the industry that do take compliance with the building codes very seriously, I ask you not to paint with too broad a brush. **Properly engineered and constructed fabric-covered structures offer a number of environmental, life/safety, operational and other advantages over alternative types of construction.** Our employees take great pride in building reliable and safe products and they and their families depend on the well-being of this industry for their livelihoods. **This collapse did not occur because the structure involved was a fabric-covered structure. As the NIST report clearly shows, it collapsed because a single building supplier made fundamental and substantial errors during the engineering design process which resulted in a structure that was significantly under-designed.**

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Regarding NIST's principal recommendations, I offer the following comments on each:

- 1) Rubb designs do not rely on the fabric to laterally brace to main truss chord members in our buildings. We believe it is a fundamental error to rely on fabric cladding for lateral support of main span trusses. Trusses are braced with both purlins and diagonal cables.

Some companies in the fabric-covered structures industry, including companies utilizing aluminum versus steel frame systems, do rely on the fabric as an integral structural component and assume that their primary structural elements are continuously braced by the fabric. In my opinion, this non-conservative approach should not be used for structures which are required to comply with building code standards.

- **The NIST recommendation should extend to both steel and aluminum frame fabric covered structures and neither should be allowed to utilize the fabric to laterally brace the structural frame system**

- 2) The NIST report recommendation regarding designing for "partially enclosed" rather than "fully enclosed" seems to be based, at least in part, on NIST's observation on page 41 of the report that, "the structure is flexible and under design wind loading conditions deforms significantly (see table 5-3), resulting in substantial distortions to the door framings.....".

While I agree that section 6.2 of ASCE 7-05 should be followed with regard to determining the classification of a structure as fully or partially enclosed, **I disagree with the thesis that all fabric-covered structures deform significantly under wind loadings.** The calculations in the report were clear that structural members in the collapsed structure were significantly over-stressed with some internal truss chord members reaching a demand to capacity ratio of 500 to 600 percent. Clearly this implied the need for significantly more structural truss spans, larger frame elements, a substantially deeper structural truss or some combination thereof. There is no doubt in my mind that a properly engineered fabric-covered structure with a truss type frame will, for equal design load requirements, have substantially less frame deflection under load than will an aluminum beam structure or, for that matter, a pre-engineered metal building portal frame.

In my experience, properly designed fabric-covered structural frames withstand severe hurricane forces and it is either the cladding system that is damaged and/or rolling steel door curtains that fail and not the structure itself.

- 3) The NIST report notes that the failure of one or a few frame members may propagate leading to a partial or total collapse of the structure. While this statement is true it also applies to the vast majority of pre-engineered and conventionally built structures in existence today. One need look no further than the progressive collapse of the World Trade Center to understand that not all risks can be guarded against. That said, clear and concise code requirements regarding when and how redundancy measures should be incorporated into structural design methodology would reduce the risk of catastrophic failure due to localized failure of a small number of structural elements.

Other Observations

1) Major structure failures are more likely to involve pre-engineered metal or other type buildings than they are to involve fabric-covered structures.

As I reviewed the NIST report I also went back and reviewed the trial transcripts and trial court conclusions in the case of the collapse of a 100,000 square foot Summit warehouse at the Port of Philadelphia during a snowstorm on President's Day in 2003. The structural engineer expert for the Port of Philadelphia in that case was a Charles N. Timbie, P.E. who has also now been working on behalf of the Dallas Cowboys. In his testimony on day 4 of the Summit trial in Philadelphia on June 26, 2006, Mr. Timbie testified (see page 176) that,

"We've seen a lot of pre-engineered buildings collapse in snow storms"

and when asked if those buildings were similar to the Summit building he replied:

"Well, they are, except the skin is metal. This particular building has a PVC membrane skin on it. The skeleton is steel, but the skin on all the other buildings I looked at was metal."

Page 177 of the transcript reveals that Mr. Timbie investigated three other structural failures which occurred during the 2003 President's Day storm, none of which were fabric structures.

2) The root causes of failure in the Dallas Cowboys collapse were very similar to those in the Port of Philadelphia collapse and both involved the same building manufacturer.

In the collapse of the Summit building in Philadelphia Mr. Timbie testified that,

"I think that there were three deficiencies in the building. Firstly, interpretation of the code. In order to design a building like this, you have to pick out the design criteria from the code, and I think there were mistakes and misinterpretations in applying the code to this building in both factors that determine what the load would be and, also, the extent of the roof where snow would lay.

Secondly, the building has what's called eccentric moment connections.... the bolted connections are moment plates....and it turns out these plates (splices/flanges) are eccentric. They are not concentric and it would cause a certain moment and a tendency for that plate to buckle.

The third defect we found was there are missing members. There were missing web members. Web members shown on the calculation and partially shown on the Summit drawings, but in the actual building, there were 124 of these members missing."

And in that case, two of many findings of the Court were as follows:

"75. In addition to designing a building which was inadequate to perform under the conditions and requirements contracted for, Summit further failed to construct the building in accordance with its own design requirements."



“76. These two fundamental failures produced a building which simply collapsed under the weight of the first significant snowfall of the new year which were conditions that would have been easily tolerated by the building had it been properly designed and constructed.”

In the Philadelphia case the structural expert found that design and other errors essentially resulted in demand to capacity ratio of 300 percent for certain structural elements. In the case of the NIST report, the under design was apparently nearly twice as egregious with demand to capacity ratios of 500 to 600 percent for some members.

Again, these faults do not relate to the structure being a fabric-covered building, they relate to faulty design by a company that happens to make fabric-covered buildings. Had these structures been designed to existing codes, they would not have collapsed.

3) The NIST report does not address the issue of design assumptions regarding roof live load. This leads to a fundamental and serious omission in the NIST conclusions.

As a point of background, the clear interpretation of the 2006 International Building Code section 1607 is that the Code does not allow for a reduction of roof live load below a minimum of 12 psf. Yet it is standard practice for certain manufacturers in the fabric structure industry to ignore this code standard and to continue to claim compliance with the building code. This applies to manufacturers of both steel frame and aluminum frame fabric-covered structures.

A review of the web sites of at least two major manufacturers of aluminum frame fabric-covered structures will reveal language to the effect that the “Structure is engineered to shed snow”. Independent engineering review data from a 1993 analysis of these manufacturers indicated that overstresses in the range of 400 to 500 percent of allowable were present for structures purported to comply with a 25 psf code specified live loading. These analyses revealed deflections for the aluminum structures that far exceeded the NIST conclusions for the steel frame structure which collapsed in Dallas. **It would be an omission to neglect to include a review of such aluminum frame structures.**

There is insufficient data in the NIST report to conclude what live load factor was used in the design of the collapsed Summit structure. However, data was provided in the NIST report on the dead load of the Summit structure. These dead loads are approximately one-third the weight that a Rubb structure would be if designed for the same building size and location.

	<u>Summit</u>	<u>Rubb</u>	<u>Estimated Difference</u>
Weight of Main Spans:	2.35 psf	+/- 5.8 psf	2.5x
Weight of Axial Steel:	0.44 psf	+/- 2.4 psf	5.5x
Total Frame Weight:	2.79 psf	+/- 8.2 psf	2.9x

Clearly there is little incentive for a company to over-design to the point that its product weighs approximately three times that of its competitor’s for the same application and using basically the same materials. Conversely, there is a major competitive advantage gained by claiming to comply with the building code but actually designing to far below code standards.





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I would also submit that had the Dallas Cowboys practice facility been properly designed using the code minimum 12 psf live roof load plus dead and collateral loads, it would have likely survived the 60 mph winds present during the microburst event on May 2, 2009.

The above leads to a recommendation that sets a minimum standard for live load capacity:

- **Roof live loads should be determined in accordance with the provisions of Chapter 7 of ASCE 7, but the design roof load should never be less than that determined by Section 1607 of the International Building Code (12 psf minimum).**

4) Major Errors in Design including lack of application of code prescribed loads, inadequate lateral bracing, poor design detailing and eccentric connection details can all lead to significant design overstresses.


In light of an AP report today that a huge facility which Summit completed last year at Texas A&M wasn't built to code, and is undergoing repairs, it should be clear that there is a pattern of questionable engineering design practice that has not been resolved even after two significant structural failures. From the AP report it appears that Summit has now contracted for wind tunnel testing apparently in order to find a way to counter the opinion of structural experts hired by Texas A&M that incorrect wind loading assumptions were used. In my experience code prescribed wind pressure coefficients are well-researched and appropriate for use in most circumstances. In our experience we have also found that certain manufacturer's wind tunnel test claims cannot be replicated by independent test laboratories.

One means to protect the end user from potential problems is to conduct a fully independent structural review of design assumptions, member sizing, lateral bracing, connection details, etc. as a condition of contract with a building supplier. The experience of both the Dallas Cowboys and the Port of Philadelphia and now Texas A&M has been that professional engineering reviews and seals provided by engineers subservient to the building supplier have proved ineffective in obtaining a structure which meets code standards.

- **NIST should consider recommendations regarding truly independent engineering review and/or consider recommendations to increase civil penalties for professional engineers who are grossly negligent in their review function**

These are my initial thoughts on the NIST draft report. I remain hopeful that NIST will not take any action that reflects negatively on an entire industry based upon the performance of a single company in that industry. If I can be of any further assistance in your work, please do not hesitate to contact me.

Sincerely,
Rubb, Inc.


David C. Nickerson
President



1 balanced load test?

2 **A.** Well, the truss did not fail and we knew this
3 was not the -- this was not the critical loading, but
4 in the other bay, the trusses failed at the ridge
5 where there's a splice, and I thought that that would
6 be the most logical place for the truss to fail under
7 this loading. So in that regard, it didn't tell us
8 the capacity of the truss.

9 We also hung from the truss three tape
10 measures and had a transit to read the deflection on
11 the sag in the roof as we loaded it up. What the
12 test did tell us is that the deflections that we were
13 actually measured during the test coincided very
14 closely to the computer model that was developed by
15 O'Donnell & Naccarato, and so it's sort of a
16 verification of that model that's performing
17 properly.

18 **Q.** And you said earlier that you didn't perform an
19 unbalanced load test. Why is that?

20 **A.** Could you repeat that?

21 **Q.** You said earlier that you did not perform an
22 unbalanced load test.

23 **A.** We did not perform an unbalanced load test
24 because we could not find two suitable samples to
25 load.

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1 **Q.** And what would have the unbalanced load test
2 tested for?

3 **A.** Well, the unbalanced load test indicates,
4 according to the computer models, very, very much
5 higher stresses on that particular type of load than
6 you get in the load that we -- we actually performed
7 here. This is a uniform test. Uniform, meaning it's
8 an equal amount spread across the entire truss.

9 **Q.** And were the results of this uniform or
10 balanced load test helpful in your investigation of
11 the warehouse's collapse?

12 **A.** Not particularly, other than verifying the
13 computer model.

14 **Q.** Okay. Taking into account all of the
15 photographs and investigations and tests that you
16 discussed yesterday and this morning, based on those,
17 have you formed an opinion as to why the building
18 collapsed on February 17th, 2003?

19 **A.** Yes.

20 **Q.** And in your opinion, why did the building
21 collapse that day?

22 **A.** I think there were two deficiencies in the
23 building. I think there were three deficiencies in
24 the building. Firstly, interpretation of the code.
25 In order to design a building like this, you have to

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1 pick out the design criteria from the code, and I
2 think that there were mistakes and misinterpretations
3 in applying the code to this building in both factors
4 that determine what the load would be and, also, the
5 extent of roof where the snow would lay.

6 Secondly, the building has what's
7 called eccentric moment connections. The building is
8 fabricated at a steel shop. It's delivered in
9 bundles to the site in segments. Each segment has a
10 number on it indicating where it should go in the
11 truss. Those segments are laid down on the ground
12 and then bolted together, and the bolted connections
13 are moment plates, similar to the one that was just
14 put on the lawyer's table, and it turns out those
15 plates are eccentric. They are not concentric and it
16 would cause a certain moment and a tendency for that
17 plate to buckle.

18 The third defect we found was there are
19 missing members. There were missing web members.
20 Web members shown on the calculation and partially
21 shown on the Summit drawings, but in the actual
22 building, there were 124 of these members missing.

23 **Q.** Okay. Mr. Timbie, did you reach those opinions
24 to a reasonable degree of engineering certainty?

25 **A.** Yes, I did.

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1 **Q.** And did you put those conclusions into a
2 report?

3 **A.** Yes, I did.

4 **Q.** And those reports were made on April 22nd,
5 2005?

6 **A.** Yes.

7 **Q.** And March 30th, 2006?

8 **A.** Yes.

9 **Q.** And they have been marked, Your Honor, as
10 Exhibits P-147 and 148.

11 Now, Mr. Timbie, if we could look at
12 each of your conclusions a little more in-depth now.

13 Your first conclusion dealt with the
14 snow load calculations?

15 **A.** That's correct. It's the Summit calculations.

16 **Q.** What is one of the first things that an
17 engineer does when designing a building?

18 **A.** Well, the very first thing you do is find
19 the -- if you're designing it structurally is to find
20 the design criteria. You define the code that's
21 applicable and then from the code you take the
22 various factors in loading that the code prescribes
23 for your particular building, and then you design
24 from that point.

25 Now, obviously, if you start at the
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1 residual strength a building would have. If you
 2 design a building for a certain load, you would
 3 incorporate in that load a safety factor of maybe one
 4 and a half, and that would account for any kind of
 5 damage to the material in transit, a missing bolt,
 6 erection cable too tight, that sort of thing. And
 7 this particular building with their loading was
 8 beyond that safety factor. It was an unsafe building
 9 the way it was designed here using these factors in
 10 uniform, and it was even more in the unbalanced. The
 11 more critical, as I say, is the unbalanced and, you
 12 know, that was like over 200 percent under-designed.
 13 Q. Okay. You mentioned the unbalanced snow load.
 14 Could you explain what that is?
 15 A. Yes. The code responds to the fact that during
 16 a heavy snow storm there's frequently wind
 17 accompanying that, and so the code requires a certain
 18 amount of wind to be scouring snow from -- scouring
 19 snow from one side of the building and then
 20 depositing a drift on the leeward side.
 21 Q. Could you, please, show Exhibit P-542?
 22 Can you zoom in on those calculations
 23 on the top, please? The length of the whole --
 24 Do you recognize this drawing, Mr.
 25 Timbie?

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1 A. This is a drawing that I prepared and it's in
 2 my report.
 3 Q. And this drawing discusses the unbalanced snow
 4 load?
 5 A. That's correct.
 6 Q. And you were explaining earlier how to code --
 7 how the code requires you to take into account the
 8 unbalanced snow load?
 9 A. That's correct. The code, the applicable code,
 10 is actually -- I'm really not good at this -- that
 11 line. What this is a graph as to what load is going
 12 to be imposed on the building. The actual snow, of
 13 course, would be down in here, but this other graph
 14 at the top is the loading for ASCE 7-93 and the code
 15 requires the load to start at the ridge continue to
 16 increase until you get to the valley where there's a
 17 maximum load, in this case, it's 63 pounds a square
 18 foot and then it diminishes as you approach the
 19 second ridge.
 20 In this case, it's 9.5 pounds a square
 21 foot and then the code says there will be a drift
 22 continuing until you reach 30-degree mark. At 30
 23 degrees, it would start to diminish, and at 70
 24 degrees it's assumed that's the eave and it's going
 25 to drop off the building.

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1 Again, as we're looking at this, you'll
 2 note that the code -- the code recognized that
 3 there's no snow sliding off of the building when
 4 you're in the valley region.
 5 Q. Is that why that is the highest point on the
 6 graph on the top?
 7 A. Yes. That's the highest point. That's the
 8 maximum amount of snow that you would get on this
 9 type of roof in a windy snow storm.
 10 Q. Mr. Timbie, what amount did Summit Cover-All
 11 use as the maximum unbalanced snow load?
 12 A. Well, they arbitrarily took a value of 35
 13 pounds a square foot. There's no formula. I believe
 14 there was a discussion among the engineers at Summit
 15 Cover-All and they just said, well, let's use 35
 16 pounds a square foot. 35 pounds a square foot, of
 17 course, is in here someplace, but the more critical
 18 item here is the extent of snow. The code requires
 19 almost the full length of the building whereas Summit
 20 Cover-All confined their snow to an area in here. I
 21 think you have a graphic for that.
 22 Q. Could you, please, show P-542A, and could you,
 23 please, zoom in?
 24 Do you recognize this drawing, Mr.
 25 Timbie?

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1 A. Yes, this is my earlier drawing where I
 2 superimposed the Summit Cover-All unbalanced snow
 3 load.
 4 Q. Could you point out where that area was?
 5 A. Well, I'll certainly try.
 6 Well, it's that cross-hatch area there.
 7 It's this crossed hatch. I think you better than --
 8 how's that?
 9 Q. Good. And could you, please, explain why the
 10 use of -- what the effect of the use of 35 pounds per
 11 square foot was important?
 12 A. Well, 35 is less than the required by code,
 13 which it was 62, I believe, behind that circle, but,
 14 of course, more importantly, they're assuming a
 15 little snow drift right down here. That's,
 16 obviously, not what the code intended. This code
 17 intended to have the unbalanced snow where the valley
 18 has snow and there's a snow drift on the opposite
 19 side.
 20 So what this indicates is that the
 21 loading they've used was considerably less when the
 22 code requires and so their building was considerably
 23 less under structure and had less support for
 24 unbalanced snow loading.
 25 Q. Could you clear that drawing out a second?

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1 And what was the amount that was
 2 supposed to be used?
 3 A. 63 pounds per square foot, according to the '93
 4 code.
 5 Q. And they used?
 6 A. They used 35 on a much smaller extent.
 7 Q. And in your investigation, did you uncover any
 8 calculations to reach this number 35 done by Summit
 9 Cover-All?
 10 A. No, there's no formula or calculation.
 11 Q. And were the use of these improper -- were the
 12 use of these variabilities, the use of these values a
 13 substantial factor in the collapse of the warehouse?
 14 A. Absolutely. What this represented was an
 15 under-design, amazing proportions it was
 16 under-designed, over 200 percent.
 17 What that means, at every existing
 18 truss, in order to support the code-required load,
 19 you need two other ones, so it's considerably
 20 under-designed.
 21 Q. And this under-design contributed to the
 22 collapse of the warehouse?
 23 A. Yes.
 24 Q. Mr. Timbie, are these snow load calculations
 25 normally rechecked and verified for code compliance

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1 THE COURT: Is there such a word
 2 E-X-E-N-T-R-I-C?
 3 MR. TROY: Not that I'm aware of, Your
 4 Honor.
 5 BY MR. TROY:
 6 Q. In what respect was structural truss steel
 7 system effective to eccentric loading?
 8 A. I could better describe probably by showing the
 9 Court the sample we have down here.
 10 Q. Sure. And you're referring to what's been
 11 marked as Exhibit P-602?
 12 THE COURT: Before we take -- before we
 13 -- I have to take care of some other business.
 14 Take a ten-minute break, please.
 15 (Whereupon, a short recess was taken.)
 16 THE COURT: Resume.
 17 BY MR. TROY:
 18 Q. Before the break, we were discussing the
 19 eccentric loading of the structural steel truss
 20 system?
 21 A. Yes, we were.
 22 Q. And you were about to discuss Exhibit P-602,
 23 which was a portion of the roof truss?
 24 A. Yes.

THE COURT: I don't think we were
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1 by the engineer of record prior to ceiling drawings?
 2 A. Yes, they would always be checked by the
 3 engineer of record unless, of course, the engineer of
 4 record prepared them, but they would be checked and
 5 the ensuing calculations would be checked as well and
 6 then you'd see them sign the calculations.
 7 Q. Turning to your second conclusion as to why the
 8 building failed, you referred to it as a weak splice
 9 connection?
 10 A. Eccentric, actually.
 11 Q. Eccentric?
 12 A. That doesn't mean it's goofy, it's a structural
 13 term for two loads that don't actually meet each
 14 other.
 15 Q. Could you spell the word "eccentric" that you
 16 use there?
 17 A. Spell the word eccentric?
 18 Q. Yes.
 19 A. E-C-C-E-N-T-R-I-C.

MR. TROY: Thank you.

THE COURT: What was the purpose of
 that?

MR. FREY: Your Honor, there's some
 confusion as to the spelling, if there was an X
 involved instead of two Cs.

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1 discussing eccentric loading, we were
 2 discussing an eccentric splice, as I understand
 3 the testimony; is that right?
 4 THE WITNESS: Yes, actually an
 5 eccentric-loaded splice.
 6 THE COURT: That's because of the fact
 7 that the flange only covers 270 degrees of the
 8 diameter of the pipe?
 9 THE WITNESS: That's part of it.
 10 There's a stiffener in there that plays as
 11 well.
 12 THE COURT: All right. Go ahead.
 13 Is this flange section marked, by the
 14 way?
 15 MR. TROY: Yes, Your Honor. It's
 16 marked as 602.
 17 THE COURT: Okay. P-602. Is it
 18 labeled?
 19 MR. FREY: I'll label it now to make
 20 sure.

BY MR. TROY:

Q. Could you please show Exhibit P-181?
 Do you recognize this drawing, Mr.

Timbie?

A. Yes, this is a drawing that I traced off of

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1 Michener Art Museum in Doylestown. We just added a
 2 lot of units to The Folkways Retirement Community in
 3 Lower Gwynned. Actually had a – we designed the
 4 EXXON engineer exhibit at EPCOT in Orlando, Florida.
 5 We also renovate buildings. We renovated a lot of
 6 loft buildings in Philadelphia, like the Wireworks,
 7 Banks Street Court, Latisha Court, Riverworks and,
 8 actually, renovated the City Hall in Harrisburg into
 9 luxury apartments. All those buildings were
 10 renovated into luxury apartments.

11 We do a lot of forensic work as well
 12 concerning natural disasters, man-made disasters.
 13 For example, snow losses. We looked at the Winnebago
 14 Factory in Floyd City, Iowa, which collapsed. Put
 15 them out of business for about a year. I'm working
 16 currently on a fire loss at a Mercedes dealership
 17 burned in Reading, and we're there to try to see how
 18 to put the building back together.

19 We do wind damage. You may recall the
 20 Academy of Music was closed before the season was
 21 over several years ago because of a wind damage
 22 claim, and we looked at that for a Factory Mutual
 23 Insurance Company. We've looked at buildings that
 24 have been hit by almost anything you can think of,
 25 cars, trolley cars, moving vans, airplanes, ships,

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1 at Drexel for 20 years. I did that at Temple for
 2 eight years.
 3 Q. And do you belong to any professional
 4 societies?
 5 A. National Society of Professional Engineers.
 6 Q. And you explain that you were an instructor for
 7 the American Institute of Architects?
 8 A. Yes. I taught the exam preparation seminars
 9 for about eight years for the American Institute of
 10 Architects. Those are the exams where the architects
 11 are trying to be registered and their least favorite
 12 part of the exam turns out to be structures for some
 13 reason, and I conducted seminars to try to bring them
 14 up to speed in those fields.

15 Q. And how many times have you been retained as an
 16 expert in building failure cases?

17 A. I would say 50, 60, something like that.

18 Q. And have you investigated the cause of building
 19 failures in cases where metal buildings collapsed in
 20 snow storms?

21 A. Yes. Yes, I have. Probably the largest one
 22 was the Mannington Carpet Mills in Calhoun, Georgia
 23 which collapsed. They lost -- it was actually a set
 24 of buildings and they lost 400,000 square feet of
 25 buildings in a snow storm. We investigated,

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1 trains. Even it was a conductor backing a train into
 2 a factory and he forgot how many cars he had and he
 3 backed it through the back wall of a factory. So we
 4 do a lot, quite a range of work in new buildings,
 5 renovations and forensic.

6 Q. And on average, how is your work divided
 7 between structural design of new buildings,
 8 refurbishing older buildings and investigating
 9 building failures?

10 A. It's been about a third of each, lately, one
 11 third for each.

12 Q. Okay. And have you taught any courses in
 13 engineering?

14 A. Yes, I've taught at Drexel University. I
 15 taught there for twenty years as an adjunct assistant
 16 professor in the evenings, taught Structural Systems
 17 I, II, III, Materials and Structural Design I, II and
 18 III, Engineering Economy and Statistics, and my
 19 favorite has been teaching architectural studios.

20 I'll actually go to the architectural
 21 studios and sit with the students and consult with
 22 them as though I were a consulting engineer, and as
 23 they work on their building, design their building
 24 architecturally, we individually try to develop a
 25 structural system for building as well. I did that

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1 recently, the Toys R Us collapse in just outside
 2 Baltimore County. A large building called Del Homes
 3 catalogue group in New Castle, Delaware or in Dover,
 4 Delaware, a bedding manufacturer collapsed in New
 5 Castle. We've investigated a shopping center in
 6 Sicklerville, New Jersey which collapsed and an
 7 adjacent drug store which collapsed, and a Sun Sweet
 8 Fruit building warehouse that collapsed in Temple,
 9 Pennsylvania. One called Amatax. We've seen a lot
 10 of pre-engineered buildings collapse in snow storms.

11 Q. And they are similar to the design of the
 12 building at issue here?

13 A. Well, they are, except the skin is metal. This
 14 particular building has a PVC membrane skin on it.
 15 The skeleton is steel, but the skin on all the other
 16 buildings I looked at was metal.

17 Q. And they were also pre-engineered metal frames?
 18 A. Yes, they are pre-engineered as opposed to
 19 conventionally-framed building, a

20 conventionally-framed building is one where the
 21 architect would or the owner would hire an architect
 22 and he would hire his team of engineers and they
 23 would draw up drawings of the building, take those
 24 drawings and give them to a steel fabricator or steel
 25 contractor. They would fabricate the steel members

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1 and deliver them then and an erector would come and
2 put the building up.

3 With these pre-engineered buildings,
4 it's one package. The contract is one package where
5 the building is designed, fabricated, delivered and,
6 in this case, erected by one company.

7 Q. Okay. And have you investigated other building
8 failures in connection with the Presidents' Day 2003
9 snow storm?

10 A. Yes.

11 Q. And can you give some examples to the Court of
12 those investigations?

13 A. Well, the Toys R Us building collapsed during
14 that snow storm. The catalogue resources collapsed
15 during that snow storm in Dover, Delaware. The one
16 in New Castle County, the bedding manufacturer, fiber
17 products, collapsed in that snow storm.

18 Q. Okay. And when you do these investigations,
19 who hires you to do them?

20 A. Mostly insurance company. I've done work for
21 public adjusters. I've done work for owners of the
22 building, but most of the work I got is from
23 insurance companies. And it's, basically, to
24 investigate the building, to determine if it can be
25 repaired, if it can be repaired, how would you do

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1 Q. Good afternoon, Mr. Timbie.

2 A. Good afternoon.

3 Q. My name is Elizabeth Horneff. I think we've
4 met once or twice.

5 A. I believe in the building.

6 Q. A couple of questions. Looking at the CV
7 you've presented to the Court, you've been involved
8 in the design of over 1200 buildings, more or less?

9 A. More or less, yes.

10 Q. How many of those were frame-supported membrane
11 structures?

12 A. I've never designed a frame-supported membrane
13 structure. Most of my work is in pre-engineered or
14 in conventional-framed buildings. Most of the work
15 that I design, it turns out that most of the forensic
16 work is in pre-engineered buildings.

17 Q. Of the renovation work that you do, the
18 one-third of your work that involves building
19 renovation, how much of that has involved
20 frame-supported membrane structures?

21 A. I don't recall one.

22 Q. And, again, on the third of your work that you
23 do is forensic, how many framed-supported membrane
24 structures have you been asked to examine?

25 A. This is the first one with a membrane on it.

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1 that and, also, frequently to determine the cause of
2 damage to the building.

3 Q. And you've testified for insurance companies,
4 owners and builders in the past?

5 A. Yes, I have, mostly insurance companies.

6 Q. Could you please show Exhibit 149?

7 Mr. Timbie, is this a copy of your CV?

8 A. Yes, it is.

9 Q. Can you show the next page, please?

10 There's a complete copy that was
11 attached to your report?

12 A. Yes.

13 MR. TROY: Your Honor, I offer Mr.
14 Timbie as an expert in structural engineering
15 with respect to the cause of the partial
16 collapse on the Tioga Marine Terminal warehouse
17 on February 17th, 2003.

18 THE COURT: Does anyone wish to
19 inquire?

20 MR. PHILLIPS: No questions, Your
21 Honor.

22 MS. HORNEFF: Just a few, Your Honor.

23 ---
24 VOIR DIRE EXAMINATION - CROSS

25 BY MS. HORNEFF:

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1 The structure, itself, is similar to the other
2 buildings. It's a pre-engineered metal building.

3 In this case, steel trusses made out of
4 tubes, and instead of skinning that with a metal
5 skin, it's skinned with a membrane, but the analysis
6 of the frames are pretty much the same.

7 Q. Now, you're a structural engineer?

8 A. That's correct.

9 Q. Not a mechanical engineer?

10 A. That's correct.

11 Q. Do you have any expertise as a fire suppression
12 expert?

13 A. No.

14 Q. How about as a fire code expert?

15 A. No, I'm not. I'm a structural engineer.

16 Q. Sir, do you have any expertise as a
17 meteorologist?

18 A. I really have no training in that. Sometimes
19 in a small project, a small collapse, I will get
20 involved in collecting surface data from the weather
21 services in order to determine how much snow was on
22 that building. On a larger project like this, I
23 would always obtain the services of a meteorologist.

24 Q. And you're not a forensic meteorologist
25 yourself?

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