



## ASCE Wind Load Insanity?

*"The answer, my friend, is blowin' in the wind..."*

VisualAnalysis 6.0 is sailing on the horizon (perhaps arriving in late 2006), and the engineers at IES are working hard to bring out the next-generation of structural software to blow you away. IES customers have been asking for help with "Wind Loads" for a number of years. Here at IES we have been trying to take VisualAnalysis from a raw finite element tool into a smarter structural engineering tool with more built-in support for building codes, including some support for wind loads.

Our goals have always been to make VisualAnalysis practical, understandable, and intelligently capable--providing just the features typical structural engineers need and not more. As we take a look into the heart of ASCE 7-05 (or 7-02) we see some very troubling code requirements.

### Wind Driven Specification?

Perhaps it is because we are in a high seismic region far away from the hurricane force winds that plague our coastlines that we are somewhat ignorant. But it seems to some of us here, that the wind load specifications have blown away all sense of reason. It seems like the code-writers have placed a very heavy and perhaps unnecessary burden on engineers with the wind load requirements. And for what reason? When was the last time we had significant primary structural failures due to wind loads, and not during construction? What was really wrong with the "old ways"?

### ASCE 7: Wind Loads

Here is our understanding of the MWFRS loading requirements for any 'non-trivial' building, anywhere in the USA under ASCE 7-02 or 7-05. The following discussion applies to the analytical procedure in chapter 6. The concern at IES is that in order to follow the requirements of the specification, you would need to consider 96 possible wind load 'cases' (Service Cases in VisualAnalysis terminology) and nearly 700 load combinations, ignoring the non-wind load cases and combinations. Here is how we arrive at that figure:

#### 1. Wind Pressures from 6.5.12.2.

The code presents a very simple equation for wind pressure calculation which shows the external and internal pressures acting on a system:

$$p = qG C_p - q_i(GC_{pi}) \quad [Eq. 6-17]$$

Unfortunately, this equation hides some complexity which is not discovered until you go to figures 6-5 & 6-6 to find  $C_p$  and  $GC_{pi}$  which turn out to have +/- values, which in effect give you four possible equations for pressure, based on whether the pressures are positive or negative. Therefore you end up with up to four different pressure values to use for any given direction of the wind. Because these pressure values are distributed unevenly around the building and act in different directions (e.g. for windward and leeward walls), you cannot simplify this down to a single pressure distribution which is a "worst" case. Conclusion: For each wind "direction" to consider, you have 4 possible pressure distributions to evaluate.

#### 2. Design Wind Load Cases from 6.5.12.3

The real kicker in the provisions lies in the number of different load cases that need to be considered. This section of the specification sends you off to figure 6-9, which is this:

### Contents

- ASCE Wind Load Insanity?
- New VA Resources
- Licensing Results
- AnalysisGroup Tutorials
- Latest Updates

## New VA Resources

*Tips, Tutorials, Time-savers*

VisualAnalysis is a very popular product and very easy to use! Yet, it is also deeper and wider than many customers know, with features built-in that you may not have discovered.

### Quality Help

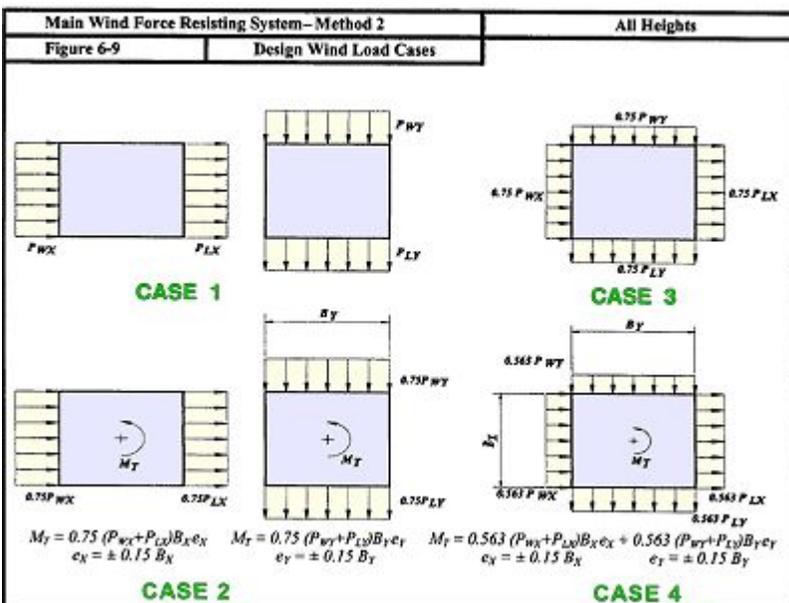
IES is committed to providing quality documentation and support for this tool directly in the software itself through the use of "*What's This?*" help tips, a searchable and detailed User's Guide ([either PDF](#) or Help-CHM format). And built-in tutorials found under Help | Quick Start Tutorials.

Even so, we get asked questions in technical support that lead us to believe things are not always as simple or clear as we thought or hoped.

So in addition to the [FAQ Answers](#) area of the web site, we have added a new [VisualAnalysis Resources](#) section to the web site.

### Flash Movies

This page contains more than half a dozen "Video" introductions to various features. You can watch these online in your web browser to get a 2 minute training course. Currently, these are silent movies with some "bubble" text to help explain the action.



The specification implies that you just have four cases to check, which can be summarized as follows:

- CASE 1: Orthogonal wind directions
- CASE 2: Skewed (45 deg.) wind directions
- CASE 3: Orthogonal directions with a torsional eccentricity
- CASE 4: Skewed directions with a torsional eccentricity

Once again, the pretty picture is somewhat deceptive to the true requirements that are presented here. When you consider that the wind must blow in two directions for every sketch shown above, combined with the fact that you have to consider both positive and negative eccentricities, you end up with:

- CASE 1 = 4 wind load cases
- CASE 2 = 4 wind load cases
- CASE 3 = 8 wind load cases
- CASE 4 = 8 wind load cases

So how many wind load cases do you need to consider? Well, if you add these up, and then multiply by the number of pressure conditions that need to be considered for each wind load direction you have  $4 * (4 + 4 + 8 + 8) = 4 * 24 = 96!$  Wow! Granted, if you had a symmetric building (with symmetric framing, symmetric wall areas, symmetric roof conditions, etc.) you might be able to divide this number in half, or perhaps even by 4. But really how many buildings are completely symmetric with respect to exterior shape and interior framing?

### 3. Load Combinations from 2.3.2

Now let's go back to the requirements for load combinations presented in chapter 2 of the specification. Once again the code provides a few simple load combinations to consider, and only three of them include wind loads:

- $1.2D + 1.6(L_r \text{ or } S \text{ or } R) + (L \text{ or } 0.8W)$
- $1.2D + 1.6W + L + 0.5(L_r \text{ or } S \text{ or } R)$
- $0.9D + 1.6W + 1.6H$

But now let's start expanding what this really means. All of the 'or' conditions in these equations must be multiplied out to give not three possible equations, but 7 load combinations, as shown below:

## Supplementary Tutorials

You will also find here, the "Lost" tutorials. We had written these tutorials (#10-23) during 2005, sometime after shipping VisualAnalysis 5.5 and then we promptly forgot them in a folder somewhere. These recovered gems provide tips on using features such as:

- 3D Modeling Tips
- Copying Loads
- Validating Results
- Using Generate Standard

Next time you are searching for an answer, remember the [Resources](#) page. If you have ideas for additional resources you would like to see, we still have about 1GB of space available to publish more stuff...

## Licensing Results

### How Surprising is That?

IES asked customers last month what they thought about various licensing issues and here are the results of that survey, and some conclusions that we have drawn from these results.

#### 1. Hardware Locks?

- 64% Hate 'em!
- 28% Think they are OK
- 9% Like using them.

#### 2. Telephone Support Costs?

- 22% Phone support should be 'free'!
- 7% Software+\$\$, keep support free.
- 31% Not Free, but I won't buy it!
- 40% Not Free, I would pay for it.

#### 3. \$50 Trial-Version Software?

- 62% Bad Idea
- 24% Maybe it would be OK
- 14% Good idea

## IES Conclusions

It is very clear from this rather unscientific study that you do not want IES to implement hardware locks.

- $1.2D + 1.6L_r + 0.8W$
- $1.2D + 1.6S + 0.8W$
- $1.2D + 1.6R + 0.8W$
- $1.2D + 1.6W + L + 0.5L_r$
- $1.2D + 1.6W + L + 0.5S$
- $1.2D + 1.6W + L + 0.5R$
- $0.9D + 1.6W + 1.6H$

So the potential number of wind load combinations resulting from 96 wind cases is 672. Double Wow! (Perhaps it is time to invest more dollars into chip makers Intel and AMD!)

"But wait!", you say, I live in the south and we don't have any snow, and I live in the desert so we don't have any rain, and I always build on solid rock so there is no earth pressure to consider. Well OK, then you only have to consider 128 load combinations. No big deal, perhaps.

### Is this Sane or Vain?

This is what you are doing, right? We are scratching our heads here in the research labs at IES wondering what customers really want us to do with regard to wind loads. Perhaps this is a good time to start a little discussion on the [IES User's Group](#)? (See [March's VirtualWork](#) for details). If you have thoughts on the matter, please send your comments to IES before we actually implement something rather insane.

## AnalysisGroup Tutorials

*Another shameless product promotion*

Did you know that [AnalysisGroup](#) was faster, smarter, and more polished than your average finite element tool? It's true! This little workhorse of a tool can make light work of many typical structural components that you will face day in and day out. AnalysisGroup solves analysis problems that would be rather difficult to model in a tool like VisualAnalysis. For example, shear wall systems, mat footings, and circular tank analysis.

We have now published some getting started tutorials for AnalysisGroup (not that you will need them). If you want to see how easy it is to analyze a mat footing for example, please take a look at the [AnalysisGroup Resources](#) page for the document that explains it in detail. Or better yet, download the free-trial version and just do it.

Our current plan is to continue with the software-only lock and simple activation of the license for all individual licenses. We are exploring other options for network and site licensing for larger firms.

At present we have no plans to start charging for [technical support](#), even though most customers would understand if we did. This would be an administrative nightmare for our small company. Instead, we have 'demoted' the phone support to a "leave a message" system and we will get back to you. This is not the best, but until we can hire a support engineer, it keeps IES working efficiently. You will get the best technical support via email.

The free-trial software will remain free. It was a dumb idea, what were we thinking?! We may 'protect' our free-trial software and customer updates a bit more behind a login-password web system in the future.

## Latest Updates

*Computer Time: 1 yr = 1/2 Eon*

**Why** do you Download Updates?

Because IES Uploads the Downloads!

Get your monthly bits free of charge at [www.iesweb.com/install.htm](http://www.iesweb.com/install.htm)

These bits are good for a fresh install on a replacement machine or for repairing your current ill disposed installation.