



More on Rig Damage and Structural Integrity

Posted by [Prof. Goose](#) on September 30, 2005 - 12:18pm

Topic: [Supply/Production](#)

Tags: [damage](#), [oil](#), [peak oil](#), [rig](#), [rig damage](#) [[list all tags](#)]

First below the fold, a couple of pictures of damaged rigs and some words from one of our insiders. Then, a really interesting note from our friends over at KAC/UCF. Pretty long, but also pretty interesting...goes a long way in explaining why their models are so good.

From one of our insiders, here's a couple of pictures of damaged rigs [here](#) (GSF Adriatic VII) and [here](#) (GSF High Island III). The insider reminded us that:

You might also point out that in order to beach one of these rigs, ALL THREE of their 150' legs must be broken off by the storm. So to fix these rigs, they would require 3 new legs, a new derrick, a new block and drawworks, repair of everything broken....it is most likely that they will be scrapped or at a minimum, stripped to the hull and rebuilt. Rebuild will take longer than building a new rig because of inspections and removal of damaged stuff, but with material costs high, it may be viable.

From our KAC/UCF friends:

Thought I could shed a little light on design criteria for the offshore facilities.

As you pointed out you have to balance the design life of the structure, the raw replacement cost of the structure, and the cost of not having the production from the structure. Lets look at five sites in the GOMEX (map attached [here](#)).

All wind speeds are in knots, two minute average at 10meters above the surface, and are based on an analysis of hurricane activity since 1851 (see Watson and Johnson, "Hurricane Loss Models, an opportunity to improve the state of the art", Bulletin of the American Meteorological Society, Nov. 2004). Assuming a 10 year design life, what conditions should we expect? Here are the 10 year, 95% prediction limit values (in other words, in any given 10 year period there is only a 5% chance this value will be exceeded) for these sites:

10 Year

Site 1

70

Site 2

79

Site 3

80

Site 4

	75
Site 5	
	70

Most engineers use a 100 year design criteria for major structures even if the design life is substantially less than that. Our comparable 100 year values are:

100 Year	
Site 1	117
Site 2	139
Site 3	140
Site 4	131
Site 5	118

The 100 year values used in the GOMEX are a bit lower than this because most ocean engineering firms base their analyses on data since 1900, and missed the period of intense activity in the late 1800's.

It is important to keep in mind that very few sites actually exceeded a 100 year design event for Katrina or Rita. However, even if a structure is a 100 year design on commissioning day, after a couple years bathing in warm salt air and the normal wear and tear of use it probably isn't anywhere near that level in reality, even with a PM program.

So how hard is it to build a better structure? Harder than you might think. This table shows the relative wind load and relative stress (which includes vibration modes) between the minimum wind speed for each Saffir Simpson Category:

Category	
Min Wind	
Wind Load	
Stress	
1	64
	1.00
	1.00
2	84
	1.72
	2.26
3	97
	2.30
	3.48
4	114
	3.17

5.65
5
135
4.45
9.39

In Saffir/Simpson terms, most designs are for a Cat 3. If you wanted to build something to withstand a Cat 5, you would have to build it roughly three times stronger - a pretty tough thing to do without totally blowing out the economics of the structures. These are wind loads - designing for wave loads for an anchored structure get to be nightmarish for extreme events. A big air gap for waves means a big surface area for wind loads. The uplift forces, differential stress from waves coming from different directions (which happens inside hurricanes), combined with wind loads, makes designs above Cat 3 problematic.

The ultimate question is, do you pay some large amount up front in your design, or do you roll the dice and hope your less well designed structure is lucky? Most engineers try to split the difference and protect against most events, and hope the big ones don't show up during their watch.



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