

The red face test.

I was doing some consulting for British Petroleum out of Anchorage Alaska when I came across an interesting concept: The red face test. A wise old Manager from that Company said if you can communicate a concept from one intelligent individual to another without suffering any embarrassment, it passes the red face test.

The 100 year storm is a critical issue for the cable ferry because it dictates the design parameters and lends credibility to the project if properly examined. Freedom of information request FOI- 2013-014 for the wind data from Baynes Sound brought the following response:

BC Ferries has wind and wave data for Baynes Sound for the two periods 2008 – 2009 and 2012, as well as ocean current data and ferry-collected data from 2012. You may purchase these data by sending a cheque or money order for \$7,500.00 for the data for each period, payable to BC Ferries, to my attention at the address above. We will await your cheque before proceeding further.

22,500 dollars is a lot of money for a group that is just trying to monitor what BC Ferries is doing. It is abundantly obvious, the FOI office was instructed to not release this data. The matter is currently under review by the Arbiter of Freedom of Information. No matter, I got the data. The report is titled Extreme Ocean Conditions at the Buckley Bay-Denman Island Ferry Crossing by Cascadia Coast Research Ltd of Victoria in co-operation with Roddan Engineering Ltd of Vancouver.

This report mentions the December 11th 2006 storm as an event. It certainly was an event.

Weather Feature Description for Dec 11, 2006: Strong westerly jet across central Pacific with trough just off West coast. Rapidly developing Pacific "bomb" low pressure centre SW of Vancouver Island in morning, crossing northern Vancouver Island about 4pm in afternoon and crossing central BC interior overnight (storm #1 this week).

This quote is from BC Hydro's Meteorologist.

The following is an account from a member of the Denman Ferry crew:

It was the school run. When we left Buckley Bay the Kahloke was encountering following winds. Very strong, deep valleys between the crests of rolling breakers. By the time we were half way across the tops of the waves were being chopped off by the wind, visibility was almost zero with spray. It took the captain about 7 minutes to dock the boat once we were inside the slip. Both engines were roaring. School kids who had come out on the deck for the fun and exhilaration 15 minutes earlier, were now crying and hanging on to each other and vehicles. When docked, I was about to head up the ramp to put in the pin, but

could not physically walk up the ramp. I hung on to the railing on the apron and could not make forward progress for 30 seconds at least. As I finally made it to the crank to put in the pin, I heard a crash. A metal lamp standard on the trestle had come down in the wind crashing onto the causeway, smashing the lamp assembly and then crashing overboard and into the water. If I had been at the gate I would have been hit and likely killed. Parents waiting for their children in the parking lot and waiting area were screaming. We unloaded all the students and cars, only to find there were several cedar trees down on the ferry hill. We cancelled the next 2 sailings.

Next is the Metars report from Environment Canada. Notice the 300 foot waterspout (Funnel cloud) special report at 4:15 and 50 knots gusting 83 knots.

December 11th, 2006

Comox Airport, METAR CYQQ

between 1:00 and 2:00 pm the max. wind was reported from 130 at 40G54kt
special at 4:15 pm with wind from 130 at 33G48kt, reported a 300ft tornado/waterspout 5 naut.
mile west of Qualicum, moving west towards Hornby/ Comox.
+FC TOPS 300FT REPORTED 5NM W OF QUALICUM MOVG W TWD HORNBY/COMOX

Chrome Island Lighthouse

at 3:40 pm from SE at 35G45kt
special report at 4:15 pm, wind shift and max. wind from S at 50G83kt

Cape Lazo

max.wind at 3:40 pm fromSE at 45kt and gusts

The Cascadia/Roddan report rejects human observations, which occur at Chrome Island and the ferry terminal. They factor Chrome Island as 0.47 of the reported value. They factor Comox Airport (the only reliable source according to them) at 0.59. They actually put in black and white that the maximum wind at the ferry terminal is 26 knots for December 11th 2006.

Here is their raw data from Apendix 13 of the report. You can see over a half million reports spanning 59 years and maximum wind of 16.44 meters per second which is 31.95 knots.

Wind Speed	Month												Total Events	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
0-1	0	0	0	0	0	0	0	0	0	0	0	0	0	35
1-2	12593	11770	10718	8627	7874	6750	6716	6904	11439	14410	12113	17527	121661	
2-3	13788	12201	12980	13135	14169	13734	14498	15575	14919	13296	11904	13113	163230	
3-4	6044	5704	7774	3458	12182	12177	13345	12161	6847	6406	5976	5837	105372	
4-5	1055	3105	4271	4707	5538	5202	5577	4332	3470	3475	3245	3071	48338	
5-6	3121	2890	3887	4602	3106	2870	2584	2812	2113	3008	3723	3270	35841	
6-7	2532	2702	2719	2078	1350	1215	972	751	1048	2164	2388	2702	22064	
7-8	1564	1509	1312	752	396	256	183	188	372	1179	1462	1658	28675	
8-9	372	676	769	380	122	68	50	54	154	643	974	1080	5973	
9-10	608	443	525	201	42	20	13	15	77	309	665	737	4708	
10-11	240	205	158	89	9	7	4	3	21	127	332	416	1650	
11-12	78	49	77	25	5	1	0	0	8	42	138	161	582	
12-13	28	18	18	4	3	0	0	0	0	13	30	53	172	
13-14	10	9	7	1	0	0	0	0	1	0	8	28	50	
14-15	0	2	5	0	0	0	0	0	0	0	5	7	19	
15-16	0	0	0	0	0	0	0	0	0	0	1	0	1	
16-17	0	0	0	0	0	0	0	0	0	0	1	0	1	
Total Events	44652	41081	41640	43700	44233	42467	43896	43036	42480	42866	45480	44859	520410	

Figure 1.11: Wind speed-month bivariate distribution for adjusted Comox Airport wind measurements

1.8. EXTREME WIND SPEED ESTIMATES

Extreme wind speeds were estimated statistically using the adjusted data-set from the Comox Airport. The annual maximum approach of extreme value theory was used. This involves identifying the largest wind event in each year and the return period associated with each event. A statistical distribution (in this case the Gumbel) is then fit to the data. The fitted distribution is then used to estimate extreme events at return periods greater than the length of the data.

To understand the influence of wind direction on extreme events the wind data was separated into 45 degree direction 'bins', then the above methodology was applied to each bin. The results for 50 and 100 year return periods are given in the Table 1.7 below. Note that the 1 year wind speed was selected, not based on the Gumbel distribution, but as the lowest of the annual maximum values.

T (years)	Direction Range							
	0-45	45-90	90-135	135-180	180-225	225-270	270-315	315-360
100	7.41	12.67	16.65	14.25	11.62	10.41	11.60	10.52
50	6.05	11.54	16.01	13.35	10.89	9.78	11.01	10.08
1	3.33	4.31	11.53	5.14	4.81	4.31	5.44	6.61





Table 1.7: Expected 1, 50 and 100 year extreme wind speed from each compass rose




The largest expected extreme wind speeds come from 90-135 degrees. It is notable that the largest wind speed in the 100 year adjusted data set is 16.44ms from 120 degrees.

This most certainly does not pass the red face test. Chrome Island reports 83 knots and Ferries Consultant says 26 knots. Just ASK any resident of Hornby or Denman if 26 knots makes sense for December 11th 2006. Trees uproot about 55 knots. 77 trees broke BC Hydro's wires on the South end of Denman Island. Hydro was out for 8 days. People of average strength can walk into 70 knots of wind. The report from Denman Ferry crew was NOT able to walk into the wind. The wind was 83 knots or perhaps more. 10 acres of Mount Geoffery on Hornby were deforested in 20 minutes. A canoe flew over a car waiting at Denman West.

26 knots! – No wonder BC Ferries didn't want to us to get that report. Let's get over that issue. They are using this data to DESIGN the cable ferry. Red face test failed.

The following is the Beaufort wind scale developed by Rear Admiral Francis Beaufort in 1805. It has been around way longer than Roddan Engineering. From my experience at Hornby over the last 16 years Beaufort force 10 happens about 3 to 5 times per winter. December 11th 2006 between 16:15 and 16:35 was absolutely unquestionably Beaufort force 12+. Ferries current design for the cable ferry can not handle this, even in dock.

3	Gentle breeze	12– 19 km/h 8– 12 mph 7–10 knot 3.5– 5.4 m/s	0.5– 1 m 2– 3.5 f t	Large wavelets. Crests begin to break; scattered whitecaps	Leaves and small twigs constantly moving, light flags extended.	
4	Moderate breeze	20– 28 km/h 13– 17 mph 11–16 knot 5.5– 7.9 m/s	1–2 m 3.5– 6 ft	Small waves with breaking crests. Fairly frequent whitecaps.	Dust and loose paper raised. Small branches begin to move.	
5	Fresh breeze	29– 38 km/h 18– 24 mph 17–21 knot 8.0– 10.7 m/s	2–3 m 6– 9 ft	Moderate waves of some length. Many whitecaps. Small amounts of spray.	Branches of a moderate size move. Small trees in leaf begin to sway.	
6	Strong	39–	3–4	Long waves	Large branches in	

	breeze	49 km/h 25–30 mph 22–27 knot	m	begin to form. White foam crests are very frequent. Some airborne spray is present.	motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic bins tip over.	
7	High wind, moderate gale, near gale	50–61 km/h 31–38 mph 28–33 knot	4–5.5 m	Sea heaps up. Some foam from breaking waves is blown into streaks along wind direction. Moderate amounts of airborne spray.	Whole trees in motion. Effort needed to walk against the wind.	 <p>SEAURIFT FORCE 7 WIND SPEED 38-50 KNOTS SEA WAVE HEIGHT 4.3-5.5 M (14-18 FT). SEA HEAPS UP WITH FOAM FROM BREAKING WAVES BEING BLOWN IN STREAKS ALONG THE WIND DIRECTION.</p>
		13.9–17.1 m/s	13–19 ft			
8	Gale, fresh gale	62–74 km/h 39–46 mph 34–40 knot	5.5–7.5 m	Moderately high waves with breaking crests forming spindrift. Well-marked streaks of foam are blown along wind direction. Considerable airborne spray.	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.	 <p>SEAURIFT FORCE 8 WIND SPEED 34-40 KNOTS SEA WAVE HEIGHT 5.5-7.5 M (18-25 FT). MODERATELY HIGH WAVES OF GREATER LENGTH, SOME OF WHICH BEGIN TO BREAK INTO THE SPINDRIFT FROM WHICH WELL MARKED STREAKS ALONG WIND DIRECTION.</p>
		17.2–20.7 m/s	18–25 ft			
9	Strong gale	75–88 km/h 47–54 mph 41–47 knot	7–10 m	High waves whose crests sometimes roll over. Dense foam	Some branches break off trees, and some small trees blow over. Construction/temporary signs and	 <p>SEAURIFT FORCE 9 WIND SPEED 41-50 KNOTS SEA WAVE HEIGHT 7.5-10 M (25-33 FT). HIGH WAVES, DENSE STREAKS OF FOAM ALONG DIRECTION OF THE WIND, MANY CRESTS BEGIN TO ROLL OVER, AND ROLL OVERS BEGIN TO AFFECT VISIBILITY.</p>



1 Storm, whole gale

1 Violent storm

20.8–24.4 m/s

89–102 km/h
9–12.5 m/s
55–63 mph
48–55 knot

24.5–28.4 m/s
29–41 ft

103–117 km/h
11.5–16 m/s
64–73 mph
56–63 knot

28.5–32.6 m/s
37–52 ft

is blown along wind direction. barricades blow over.

Large amounts of airborne spray may begin to reduce visibility.

Very high waves with overhanging crests. Large patches of foam from wave crests give the sea a white appearance.

Trees are broken off or uprooted, considerable structural damage likely.

of waves with heavy impact. Large amounts of airborne spray reduce visibility.

Exceptionally high waves.

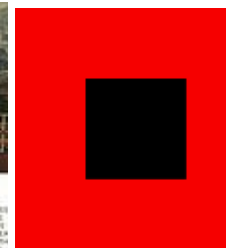
Very large patches of foam, driven before the wind, cover much of the sea surface.

Very large amounts of airborne

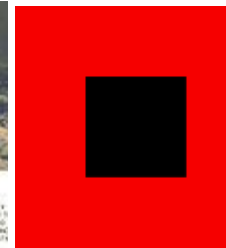
Widespread vegetation and structural damage likely.



SEASPORT FORCE 10
WIND SPEED 10-15 KNOTS
SEA WAVE HEIGHT 9 TO 12 METERS. WIND ALSO BRINGS WITH LONG OFFSHOREWINDS. RESULTS FROM GREAT PATCHES OF SEA SURFACE WHITE SURFACE ALONG WIND DIRECTION ON THE WIND. SEA SURFACE HAS A WHITE APPEARANCE OF 'FUMBLE' OF THE SEA IS HEAVY AND SHOCK LIKE. VISIBILITY LIMITED.



SEASPORT FORCE 11
WIND SPEED 15-20 KNOTS
SEA WAVE HEIGHT 12 METERS. WIND ALSO BRINGS WITH LONG OFFSHOREWINDS. RESULTS FROM GREAT PATCHES OF SEA SURFACE WHITE SURFACE ALONG WIND DIRECTION ON THE WIND. SEA SURFACE HAS A WHITE APPEARANCE OF 'FUMBLE' OF THE SEA IS HEAVY AND SHOCK LIKE. VISIBILITY LIMITED.



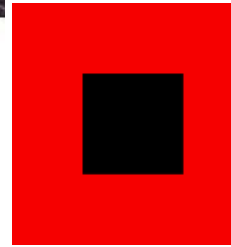
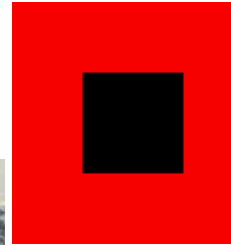


1 Hurricane force
2

		spray severely reduce visibility.
\geq 118 km/h	≥ 14 m	Huge waves. Sea is completely white with foam and spray. Air is filled with driving spray, greatly reducing visibility.
\geq 74 mph		Severe widespread damage to vegetation and structures. Debris and unsecured objects are hurled about.
≥ 64 knot		
\geq 32.7 m/s	\geq 46 ft	



BLAUPUNKT FORCE 118
WIND SPEED GAUGE
SEA IS COMPLETELY WHITE WITH FOAM AND SPRAY. AIR IS FILLED WITH DRIVING SPRAY, GREATLY REDUCING VISIBILITY. THE AIR IS FULL OF UNSECURED OBJECTS.



Capt. Pete Kimmerly

June 2rd 2013

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