

# Return time wind speed

Table 1 below shows the return time for locally measured wind speeds, while table 2 shows the wind speed for different return times at different heights above ground. The average wind speed relates to a 10 minute average value while gusts relate to a 3 second average value.

As a basis for the calculations of return time, there is a statistical analysis of the wind which relates to 20 year storm situations in Sweden, which was carried out in connection with the preparation of Boverket's (Boverket, the National Board of Building, Planning and Housing) manual for the calculation of snow and wind loads.

Table 1. Calculated return time for maximum measured gusts and mean wind speed during a specific storm event.				
Weather situation	Gusts		Mean wind	
	m/s	Return time	m/s	Return time
Site A	25.8	20 years	14.6	5 years
Site B	28.3	285 years	14.0	6 years
Site C	28.5	180 years	16.7	33 years

Table 2. Calculated gust speed (m/s) for different heights (over ground) and different return times.					
Height (m)	Return time				
	1 year	10 year	25 year	50 year	100 year
10	30.0	35.6	37.5	38.9	40.3
60	39.0	46.7	49.4	51.3	53.2
72	39.7	47.5	50.3	52.3	54.1
85	40.4	48.3	51.1	53.1	55.0

# Return time storms

Based on daily measurements carried out over many years from one of our weather stations, storm return times can be calculated. For example, the greatest wind speed (gust) can be produced for each year in accordance with the figure (1) below. The solid black trend line shows whether the greatest gust of wind for the year has increased or decreased during the measurement period.

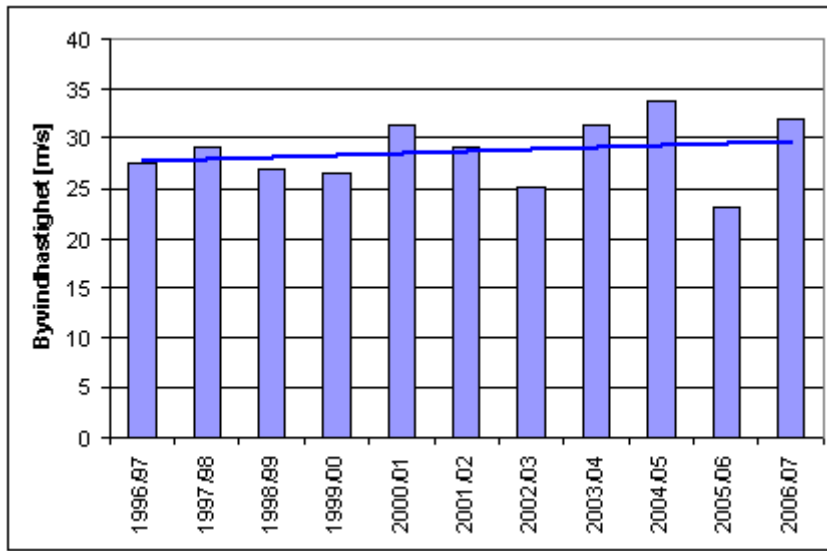


Figure 1. yearly maximum gusts [m/s] 1996/97 - 2006/07 at a Swedish weather station.

Based on the data that has been gathered, we calculate the return time with an *Extreme Value Analysis*, see figure 2 below. The three coloured curves in figure 2 are different adaptations to the observed values (yellow dots).

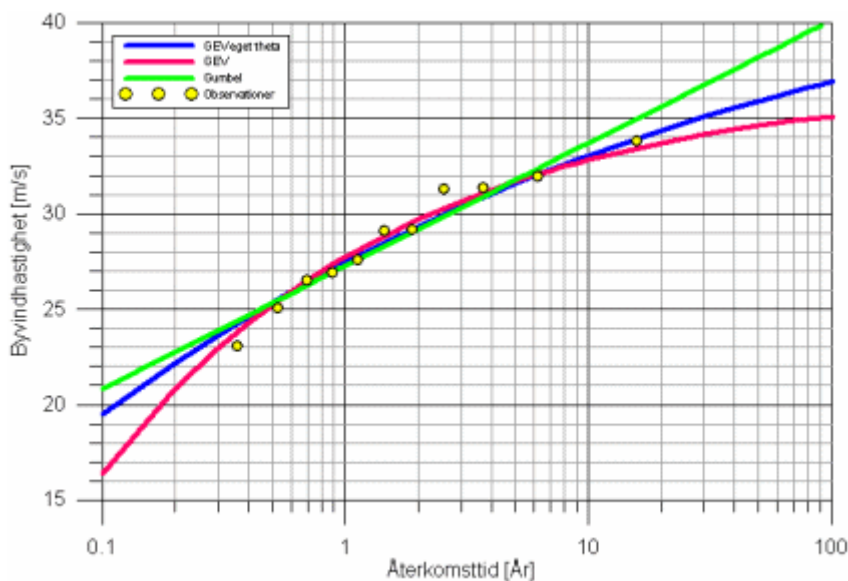


Figure 2. Return time of gust speed.

Figure 1 shows the greatest gust wind speed during 2006/2007, which is 32 m/s. Figure 2 shows the return time for a 32 m/s gust, which is six years. Conversely, we can see that the gust in excess of the average occurs once every 10 years, the speed is 33-34 m/s.

## About return time, probability and risk

A 100-year value has a return time of 100 years. This is achieved or exceeded on average once every hundred years which means that the probability is 1 in 100 for each specific year. Seeing as you expose yourself to the risk over a period of several years, the accumulated risk is much greater.

For a structure, whose lifetime is estimated at 100 years, the accumulated risk will be 63% that the 100-year value is exceeded at any time during the 100 years, see table below. The risk is therefore greater that the 100-year value is exceeded rather than falls short, if this safety level is chosen.

Return time	Probability during 5 years	Probability during 10 years	Probability during 20 years	Probability during 50 years	Probability during 100 years
5 years	67%	89%	99%	100%	100%
10 years	41%	65%	88%	99%	100%
20 years	23%	40%	64%	92%	99%
50 years	10%	18%	33%	64%	87%
100 years	5%	10%	18%	39%	63%
500 years	1%	2%	4%	10%	18%
1000 years	0%	1%	2%	5%	10%

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