Extreme Wind Speed for a Return Period (Gumbel)

Extreme wind speed for a return period from the mean and standard deviation of annual maximum winds (Gumbel), with the risk over a design life.

Method: Gumbel extreme-value distribution by the method of moments

Input parameters

Unit system: SI

Parameter	Value	Unit
Mean of the annual maximum wind speeds	25.000	m/s
Standard deviation of the annual maxima	3.5000	m/s
Return period (years)	50.000	
Design life (years)	20.000	

Calculated results

Parameter	Value	Unit
Gumbel scale parameter	2.7289	m/s
Gumbel mode (location)	23.425	m/s
Reduced variate	3.9019	
Extreme wind speed for the return period	34.073	m/s
Probability of exceedance during the design life	33.239	%

Notes for this case

• Gumbel (type I) by the method of moments: 1/α = s√6/π, u = Ū − 0.5772/α, U_T = u + (1/α)y_T with y_T = −ln(−ln(1 − 1/T)). Needs at least 10–20 years of independent annual maxima; the 50-year wind is typically 1.4 times the mean annual maximum.

Formula and method

$$\frac{1}{\alpha} = \frac{s\sqrt{6}}{\pi}, \quad u = \bar{U} - \frac{0.5772}{\alpha}, \quad U_T = u - \frac{1}{\alpha}\ln\left[-\ln\left(1 - \frac{1}{T}\right)\right]$$

Variables

$\bar{U}_{max}$	Mean of the annual maximum wind speeds	m/s
s	Standard deviation of the annual maxima	m/s
T	Return period (years)	-
L	Design life (years)	-
$1/\alpha$	Gumbel scale parameter	m/s
u	Gumbel mode (location)	m/s
y_T	Reduced variate	-
U_T	Extreme wind speed for the return period	m/s
R	Probability of exceedance during the design life	-

Method and standards

Extreme-value statistics.

Assumptions and limits

- Stationary climate; Gumbel tail.

References

Gumbel extreme-value distribution by the method of moments

Report details

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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/environmental/wind-power/extreme-wind-gumbel

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.