

Wind Speed

The essentials of safe crane operation

Wind speed is critical for safe crane operations

The following information is guidance only on safety precautions that should be considered for wind.

When working in wind consider the following: (in order of importance)

1. The Load

Every load has its own characteristics. Consider:

a. Wind Resistance

The shape and size of a load will have a major impact on the stability and the loading of a crane along with the wind speed and direction. This may cause the load to move uncontrolled or the crane to exceed known limits. When lifting consider the cross section of the load exposed to the wind relative to the loads weight. Use tag lines where possible while ensuring the manufacturers guidance on wind speed is followed.

b. Weight of the load

If the load is moved out of radius or side ways the crane may fail as the manufacturers limits for the crane are exceeded. This may result in structural or tipping failure from side loading of the boom to exceeding the safe working load of the crane.

2. Manufacturers Limit

Every Make and Model of crane has its own limits set by the manufacturer based on the crane and its configuration. There may be limits for setup and for operation specified by the manufacturer. These limits should never be exceeded.

Typical maximum in-service wind speeds

- Tower cranes 20 m/s (45 mph / 72 kph)
- Crawler cranes 14 m/s (31 mph / 50 kph)
- Mobile cranes 9.8 m/s (22 mph / 35 kph)

For specific limitations on the crane in use you should check with the manufacturer. Operational limitations may well be lower than these figures, eg when handling loads with a large wind area such as wide formwork panels.

3. Crane Operators Limit

The Crane Operator is the most experienced person on the crane. The crane operators experience and knowledge of the load and manufacturers specification is vital. The Crane Operator is also the best person to take into account the wind direction and boom configuration. In example: Wind forces acting on the rear of the boom can result in decreased forward stability, Wind forces acting on the underside of the boom can result in decreased backward stability while winds acting on the side of the boom can result in structural damage.

4. The Crane Companies Limit

The controller of the crane may impose limits under their responsibilities for the crane as stated in the Pressure Equipment, Cranes and Passenger Ropeway Regulations. The controller is often also the the most experienced in the region of operation. They know the competency of the crane operator and capability of the equipment.

(Our experience is that crane companies often set a figure of 9.8 m/s as a point that the wind must be considered for safety. This may be lower or higher based on points 1 - 3 above.)

5. The Site Limit

Every site is different. The owner of the site is often the most experienced person in local conditions and may set a limit on activities based on the site.

The wind speed should take into account the speed the wind is gusting to in the area of operation, its frequency and duration.

Wind Forces on the Load

The following calculation has been developed based on formulas outlined in a guideline issued by the Federation for European Manufacturers - product group cranes and lifting equipment. This formula is reasonably complicated - your company management or the Crane Association of New Zealand should be contacted for further information on its use.

$$V_{\text{allowed}} = (V_{\text{capacity chart}} : V_{\text{capacity chart}} * \sqrt{\frac{1,2 * m}{A_p * C_w}})$$



The Beaufort Wind Scale

This chart is intended as a general guide only

All conversion calculations are rounded to the nearest whole number. Accurate details relating to the working conditions of individual cranes must be obtained by reference to the crane specification manuals or other bulletins issued by the manufacturer of the crane concerned.

Beaufort number	Description	Wind speed				Wave height		Sea conditions	Land conditions
		km/h	mph	kts	m/s	m	ft		
0	Calm	< 1	< 1	< 1	< 0.3	0	0	Flat.	Calm. Smoke rises vertically.
1	Light air	1 – 5	1 – 3	1 – 2	0.3 - 1.5	0 – 0.2	0 – 1	Ripples without crests.	Wind motion visible in smoke.
2	Light breeze	6 – 11	4 – 7	3 – 6	1.5 - 3.3	0.2 – 0.5	1 – 2	Small wavelets. Crests of glassy appearance, not breaking	Wind felt on exposed skin. Leaves rustle.
3	Gentle breeze	12 – 19	8 – 12	7 – 10	3.3 - 5.5	0.5 – 1	2 – 3.5	Large wavelets. Crests begin to break; scattered whitecaps	Leaves and smaller twigs in constant motion.
4	Moderate breeze	20 – 28	13 – 17	11 – 15	5.5 - 8.0	1 – 2	3.5 – 6	Small waves with breaking crests. Fairly frequent white horses.	Dust and loose paper raised. Small branches begin to move.
5	Fresh breeze	29 – 38	18 – 24	16 – 20	8 - 11.0	2 – 3	6 – 9	Moderate waves of some length. Many white horses. Small amounts of spray.	Branches of a moderate size move. Small trees begin to sway.
6	Strong breeze	39 – 49	25 – 30	21 – 26	11 - 14	3 – 4	9 – 13	Long waves begin to form. White foam crests are very frequent. Some airborne spray is present.	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	High wind, Moderate gale, Near gale	50 – 61	31 – 38	27 – 33	14 - 17	4 – 5.5	13 – 19	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. Swaying of skyscrapers may be felt, especially by people on upper floors.
8	Gale, Fresh gale	62 – 74	39 – 46	34 – 40	17 - 20	5.5 – 7.5	18 – 25	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.
9	Strong gale	75 – 88	47 – 54	41 – 47	21 - 24	7 – 10	23 – 32	High waves whose crests sometimes roll over. Dense foam is blown along wind direction. Large amounts of airborne spray may begin to reduce visibility.	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
10	Storm[6], Whole gale	89 – 102	55 – 63	48 – 55	25 - 28	9 – 12.5	29 – 41	Very high waves with overhanging crests. Large patches of foam from wave crests give the sea a white appearance. Considerable tumbling of waves with heavy impact. Large amounts of airborne spray reduce visibility.	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	Violent storm	103 – 117	64 – 72	56 – 63	29 - 32	11.5 – 16	37 – 52	Exceptionally high waves. Very large patches of foam, driven before the wind, cover much of the sea surface. Very large amounts of airborne spray severely reduce visibility.	Widespread damage to vegetation. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	Hurricane[6]	≥ 118	≥ 73	≥ 64	≥ 33	≥ 14	≥ 46	Huge waves. Sea is completely white with foam and spray. Air is filled with driving spray, greatly reducing visibility.	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris may be hurled about.

Resources

Many modern cranes are now fitted with Anemometers. But there are some other simple resources available:

1. Hand Held Anemometers (See companies like JayCar)
2. Windfinder (www.windfinder.com)
3. Trademe - Keyword: Weather Devices