

How to determine the “Crane Capacity Index”

In this document is explained how a “Crane Capacity Index” (CCI) can be determined. The CCI basically is calculated as follows: “Radius * Lifting Height * Capacity”. The result CCI is in $Te \cdot m^2$

To clarify calculations a Liebherr LTM 1100-5.2 is used as an example.

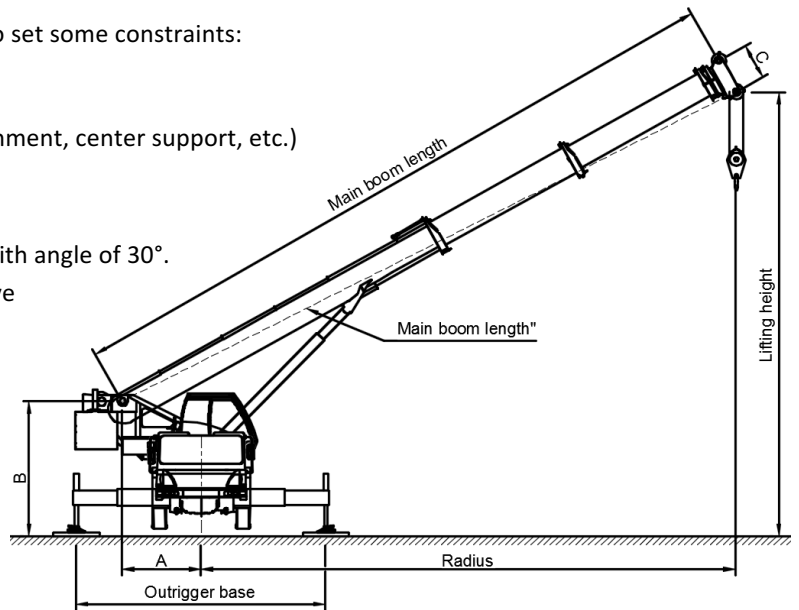
Units:

Distance	meter	m
Angle	degree	°
Weight	metric Ton	Te
CCI		$Te \cdot m^2$

Constraints

In order to get a fair “Crane Capacity Index” we need to set some constraints:

- Main boom only (no jib, no guyed main boom)
- Only with standard equipment (no heavy lift attachment, center support, etc.)
- 360° swing angle
- Minimum radius = $\frac{1}{2}$ *outrigger base
- Maximum radius = Maximum main boom length with angle of 30°.
- Lifting height is height of the center of lower sheave
- Base dimensions;
 - A. Crane center – pivot point main boom
 - B. Height of crane pivot point
On standard tires, 100mm between ground and tires
 - C. Sheaves distance



For the Liebherr LTM 1100-5.2 the base dimensions are: **A=2.0 m**; **B=3.83 m**; **C=1.1 m**

Calculations

Minimum radius

Minimum radius = $\frac{1}{2}$ *outrigger base

Liebherr LTM1100-5.2: $\frac{1}{2} * 7.0 = 3.5 \text{ m}$

Maximum radius

Maximum radius = Maximum main boom length with angle of 30°.

Maximum main boom length * $\cos(30^\circ)$ + **C** * $\sin(30^\circ)$ – **A**

Liebherr LTM1100-5.2: $52.0 * 0.866 + 1.1 * 0.5 - 2.0 = 43.58 \text{ m}$

Lifting height

$\sqrt{\text{main boom length}^2 + \text{C}^2 - (\text{radius} + \text{A})^2} + \text{B}$

Liebherr LTM1100-5.2 (example with 30.1m main boom at 15m radius:

$$\sqrt{30.1^2 + 1.1^2 - (15 + 2.0)^2} + 3.83 = 28.69 \text{ m}$$

The base formula for the Crane Capacity Index is:

$$\frac{\text{Average}(\text{Radius} * \max(\text{Lifting height} * \text{Capacity}))}{100}$$

Notes

- * The first radius is the minimum radius, then every 5m, till maximum radius.
For the LTM1100-5.2 the used radius are: 3.5; 5.0; 10.0; 15.0; 20.0; 25.0; 30.0; 35.0;40.0; 43.6
- * For each main boom length at each radius the “Lifting height*Capacity” is calculated.
At one radius the value of “Lifting height*Capacity” varies with different main boom lengths.
At each radius the maximum value of “Lifting height*Capacity” is chosen.

For every main boom length a table is made, for the LTM1100-5.2:

Radius	Main boom length 19.0 m			Main boom length 30.1 m			Main boom length 52.0 m		
	Lifting height	Capacity	Lift. Height * Cap.	Lifting height	Capacity	Lift. Height * Cap.	Lifting height	Capacity	Lift. Height * Cap.
3,5	22,05	64	1411,19	33,44			55,55	-	-
5	21,53	61	1313,19	33,13	42	1391,27	55,37	-	-
10	18,60	30,5	567,36	31,46	31,5	990,88	54,44	11,4	620,60
15	12,39	23,7	293,55	28,69	18,55	532,27	52,98	9,85	521,90
20	-	-	-	24,40	12,8	312,35	50,96	8,6	438,25
25	-	-	-	-	-	-	48,28	7,35	354,89
30	-	-	-	-	-	-	44,83	6	269,00
35	-	-	-	-	-	-	40,38	4,6	185,77
40	-	-	-	-	-	-	34,51	3,6	124,23
43,58	-	-	-	-	-	-	28,88	3,063	88,47

Tables for boom lengths 11.5; 15.2; 22.7; 26.4; 33.9; 37.6; 41.3; 45.0; 48.8 are not shown.

The tables for every main boom length result in 1 main table with the highest value of “Lifting height*Capacity” at each radius. An extra column is added in which “Lifting height*Capacity” is multiplied by “Radius”:

Radius [m]	Lifting height * Capacity	Lifting height * Capacity * Radius
3,5	1411,19	4939,15
5,0	1450,79	7253,93
10,0	990,88	9908,78
15,0	653,07	9796,00
20,0	493,00	9859,93
25,0	373,76	9343,97
30,0	269,00	8069,86
35,0	185,77	6501,86
40,0	124,23	4969,32
43,6	88,47	3855,52
Average of Lifting height * Capacity * Radius:		7449,83
Crane Capacity Index:		74,50

Finally an average is calculated of al “Lifting height*Capacity*Radius”. This number divided by 100 results in de Crane Capacity Index.