



**Mobile Cranes Rated Capacity Chart
Operating Mobile Cranes Under 75% of Tipping Loads**

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Mobile crane rated capacity chart is the most important and suitable information to follow when selecting the right crane for the lifting task. To produce the rated capacity chart, the crane manufacturer loads the crane and determines for every situation listed in the load chart how much weight it takes to make the crane tip, these loads are called the tipping loads. To maintain a margin of safety, tipping loads are then reduced by a percentage set by national standards to develop the rated capacity loads listed in the load chart of the machine for every lifting situation. Other than a designed lift (refer to AS2550.1), mobile cranes shall follow their rated capacity chart at all times for a safe lift.

In previous Australia Standard AS1418.5 (2002), mobile crane lifting capacities specified in the crane rated capacity charts are required to be not exceeding 75% of tipping loads for cranes operating on outriggers, stationary on wheels or on crawler tracks. Rating charts for mobile pick and carry work are based on 66.6% of tipping loads. The percentage margin between the safe working load in the rated capacity chart and the ultimate load is a safety margin to allow for the various forces which will act on the crane in operation. These include allowances for wind loading and for dynamic forces set up by normal operational movement of the crane and load.

In the current Australia Standard AS1418.5 (2013), the stability of the crane shall be in accordance with ISO 4305 (see picture below for Table 1 from ISO 4305). If we apply the formulas in ISO 4305 to a crawler crane as an example, the safety factor can be calculated, see calculations below.

ISO/FDIS 4305:2013(E)

Table 1 — Machine configuration stability calculation for applied load

Machine configuration/condition	Loading	Value to be taken into consideration ^a
On outriggers/crawlers ^b	Applied load	1,25P + 0,1 · F
On wheels (tyres) ^b	Applied load	1,33P + 0,1 · F
On crawlers with travel speed up to 0,1 m/s	Applied load	1,25P + 0,1 · F
On crawlers with travel speed greater than 0,1 and less than or equal to 0,4 m/s	Applied load	1,33P + 0,1 · F
On wheels (tyres) with travel speed up to 0,4 m/s	Applied load	1,33P + 0,1 · F
On crawlers/wheels (tyres) with travel speed greater than 0,4 m/s	Applied load	1,50P + 0,1 · F

^aIn these formulae:
P is the rated capacity (hoist medium load) as specified by the crane manufacturer for the various configurations of the crane. It shall be for the hoist medium load of the crane as defined by ISO 4306-1:2007, 6.1.5;
F is the load from the mass of the boom and fly jib referred to the boom head or fly jib head. (The determination of *F* is given in ISO 4310.)

Example:

Formula for crane on crawlers with travel speed greater than 0.1 and less than or equal to 0.4m/s (highlighted in red on the left) is:

$$\text{Load} = 1.33P + 0.1 \cdot F$$

For a 110t capacity lattice boom crawler crane, boom section weight = 2.8t, assume boom centre of gravity is at the middle of the boom, $\frac{R_c}{R} = 0.5$.

$$\text{Load} = 1.33 \cdot 110 + 0.1 \cdot 0.5 \cdot 2.8 = 146.44\text{t}$$

$$\text{Safety margin} = 110/146.44 = 75.1\%$$

ISO 4310:2009(E)

For cranes equipped with jib only:

$$r = r_c = m_j = 0$$

m_j is the mass of the jib;

and

R is the radius of the jib;

$$F_i = \frac{R_c}{R} \cdot m_j$$

R_c is the radius of the centre of gravity of the jib;

In the current Work Health and Safety Regulations (2016), plant and plant design is required to be registered to “published technical standard”, under this Regulation, mobile cranes could register to Standards that apply to countries other than Australia, which means, their rated capacity chart could be produced by the manufacturer with a safety margin different from the mobile cranes that complies to Australian Standards. For example, if a crane is designed to American Standard ASME B30.5, then the crane rated capacity chart is based on 85% tipping load (see picture below). The safety margin for this crane is less than the cranes that are designed to or complies with Australian Standard.

Table 1 Crane Load Ratings

(04)

Type of Crane Mounting	Maximum Load Ratings, %
Locomotive, without outrigger (stabilizer) support [Note (1)]	
Booms 60 ft (18 m) or less	85
Booms over 60 ft (18 m)	85 [Note (2)]
Locomotive, using outriggers (stabilizers) fully extended and set	80
Crawler, without outrigger support	75
Crawler, using outriggers fully extended and set	85
Wheel mounted, without outrigger support	75
Wheel mounted, using outriggers fully extended and set, with tires off supporting surface	85
Wheel mounted, using outrigger beams partially extended and set, with tires off supporting surface	Notes (3) and (4)
Commercial truck vehicle mounted, with stabilizers extended and set	85
Commercial truck mounted, using stabilizers partially extended and set	Notes (3) and (4)

NOTES:

- (1) As a precaution while testing for free ratings, outriggers should be loosely applied; rail clamps should not be used.
- (2) The difference between the backward stability moment and the forward moment resulting from the load should not be less than 30,000 lb-ft (40,675 N · m) with the backward stability moment being the greater.
- (3) The following formula shall be used for less than full extension of all outrigger beams to find the rated capacity:

$$P \leq (T - 0.1F) / 1.25$$

where

- F = load applied at boom tip that gives the same moment effect as boom mass
- P = rated capacity in the lifting direction specified
- T = tipping load

- (4) If crane operation with outriggers in positions other than fully extended is permitted by the crane manufacturer, specified procedures, ratings, and limitations for any configurations that are permitted shall be provided.

CICA Position

STABILITY is the ability of a crane to resist tipping. Many crane accidents are often the result of mistakes made, careless work practices or not following correct procedures when the crane is being set up. Lots of factors can put cranes in unstable conditions when performing a lifting task, wind speed, uncertainty of weight of load and lifting gear, operator competency, etc., are just a few examples. Failure to follow just one safety precaution can cause accidents.

Appropriate safety margin applied by the manufacturers on the rated capacity chart is an allowance for the various forces act on the crane in operation, operating mobile cranes under 75% of tipping loads is a requirement in Australia Standard and has been recognised by the crane industry as a safe practice.

CICA recommends that all mobile cranes in Australia should operate under a rated capacity chart not exceeding **75%** of the tipping loads for operating on outriggers, stationary on wheels or on crawler tracks. If a mobile crane is designed to a published technical standard that requires lower safety margin, a revised rated capacity chart should be adopted for that crane with adjusted value of **75%** or less of the tipping loads listed in the load chart for the machine.

Yours Sincerely,
 Brandon Hitch
 CICA CEO / CraneSafe General Manager