



### Variables – for estimating outreach and lift height

- a** Average container spacing, typically 2.5 m
- b** Average container width, typically 2.44 m (8' 0")
- CH** Container height of top container, typically 2.59 m (8' 6")
- CL** Clearance between top of top container and lifted container
- D** Draft, see Approximations Note
- DWL** Design water level elevation
- h** Height from fender centerline to top of top container
- H** Height from keel to top of containers without list
- Lift** Lift height above top of rail (TOR) =  $H + CL + CH + (N_H/2) \times a \times \sin \Theta - DD - RH$
- List<sub>H</sub>** Horizontal movement of top container due to ship list, approximately  $h \times \tan \Theta$
- List<sub>V</sub>** Vertical movement of outermost top container due to ship list, approximately  $(N_H/2) \times a \times \sin \Theta$
- N<sub>H</sub>** Number of containers horizontally across deck
- N<sub>V</sub>** Number of containers stacked vertically in hull and on deck
- OR** Outreach
- OV** Overrun: additional distance to avoid trolley slowdown
- RH** Distance from TOR to DWL
- SB** Setback, the typical range is from 2 m to 6 m
- Θ** Ship list design angle, degrees
- TOR** Top of waterside gantry rail

### Approximate Outreach

N <sub>H</sub>	a x N <sub>H</sub> , m	h, m	Outreach, m		
			SB, m	θ, deg	OV, m
13	32.5	30.0	2.0	1.0	1.0
14	35.0	32.9	4.0	1.0	1.0
15	37.5	32.9	1.0	1.0	1.0
16	40.0	32.9	1.0	1.0	1.0
17	42.5	35.8	2.0	1.0	1.0
18	45.0	35.8	4.0	1.0	1.0
19	47.5	38.7	1.0	1.0	1.0
20	50.0	38.7	1.0	1.0	1.0
21	52.5	38.7	2.0	1.0	1.0
22	55.0	38.7	4.0	1.0	1.0
23	57.5	38.7	1.0	1.0	1.0
24	60.0	41.6	1.0	1.0	1.0
25	62.5	41.6	2.0	1.0	1.0
26	65.0	41.6	4.0	1.0	1.0

### Approximate Lift Height

N <sub>V</sub>	H, m	D, m	LH, Lift Height, m		
			RH, m	θ, deg	CL, m
14	41.4	10.7	2.0	1.0	0.5
15	44.1	11.0	3.0	1.0	0.5
16	46.9	11.4	1.0	1.0	0.5
17	49.6	11.8	1.0	1.0	0.5
18	52.4	12.1	2.0	1.0	0.5
19	55.1	12.5	3.0	1.0	0.5
20	57.9	12.9	1.0	1.0	0.5
21	60.6	13.2	2.0	1.0	0.5
22	63.4	13.6	3.0	1.0	0.5

### Approximations Note

Approximate values are provided for general understanding. Variables used are estimates based on a variety of projects. Actual values will vary for a particular location, ship, crane, and operation.

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