

QUESTION: A contractor is using a D-15 diesel pile hammer to drive a HP 10 X 42 pile that is 66.6' long. The total penetration of the piling was 5 inches in the last 20 blows. The height of fall of the hammer was 5.25 ft. The mass of the cap and or anvil was 2130 lbs. What is the bearing capacity of the piling?

STEP # 1: Select correct formula? Section 704- Piling, page 700-12 in the 2007 Standard Specifications for State Road and Bridge Construction.

$$P = \frac{1.6 W H}{S + 0.1 \left(\frac{X^{**}}{W} \right)}$$

*** For diesel hammers, the quantity of X/W shall not be less than 1.*

STEP # 2: Fill in known values and solve for unknown values:

P= safe bearing power in pounds

W= weight in pounds, of striking part of hammer

H= height of fall in feet

S= the average penetration in inches per blow for last 20 blows for diesel hammer

X= weight in pounds of the pile plus the weight of any cap and/or anvil used on the pile during driving

For weight in pounds, of striking part of hammer (W) find the D-15 hammer on following page:

GRLWEAP Preprogrammed Hammer Listing for DELMAG Hammers

Hammer Model	Hammer Type	English Units			SI Units		
		Energy/Power (kip-ft)/(kW)	Ram Weight (Pounds)	Stroke (ft)	Energy/Power (kJ)/(kW)	Ram Weight (kN)	Stroke (m)
3 D12	OED	22.61	2750	10.8	30.65	12.237	3.29
37 D 12-32	OED	31.33	2820	11.81	42.48	12.549	3.6
38 D 12-42	OED	33.3	2820	11.81	45.16	12.549	3.6
39 D 14-42	OED	34.5	3086	11.81	46.78	13.733	3.6
4 D15	OED	27.09	3300	10.8	36.74	14.685	3.29
5 D 16-32	OED	40.2	3520	11.76	54.51	15.664	3.58
40 D 19-32	OED	42.44	4000	11.76	57.55	17.8	3.58
41 D 19-42	OED	43.24	4000	11.86	58.63	17.8	3.61
35 D 19-52	OED	43.24	4000	11.86	58.63	17.8	3.61
46 D 21-42	OED	55.75	4630	14	75.59	20.604	4.27
6 D22	OED	40.61	4910	9.5	55.06	21.849	2.9
7 D 22-02	OED	48.5	4850	13.44	65.77	21.582	4.1
8 D 22-13	OED	48.5	4850	13.44	65.77	21.582	4.1
9 D 22-23	OED	51.22	4850	13.44	69.45	21.582	4.1
10 D 25-32	OED	66.34	5510	13.76	89.96	24.52	4.19
11 D30	OED	59.73	6600	9.5	80.99	29.37	2.9
12 D 30-02	OED	66.2	6600	13.44	89.76	29.37	4.1
13 D 30-13	OED	66.2	6600	13.44	89.76	29.37	4.1
14 D 30-23	OED	73.79	6600	13.44	100.06	29.37	4.1
15 D 30-32	OED	75.44	6615	13.73	102.29	29.37	4.18
16 D36	OED	83.82	7930	10.57	113.66	35.288	3.22
17 D 36-02	OED	83.82	7930	12.98	113.66	35.288	3.96
18 D 36-13	OED	83.82	7930	19.98	113.66	35.288	6.09
19 D 36-23	OED	88.5	7930	12.98	120	35.288	3.96
20 D 36-32	OED	90.56	7930	13.14	122.8	35.288	4.01
21 D44	OED	90.15	9500	9.52	122.25	42.275	2.9
22 D46	OED	107.08	10140	10.57	145.2	45.123	3.22
23 D 46-02	OED	107.08	10140	12.94	145.2	45.123	3.94
24 D 46-13	OED	96.53	10140	12.94	130.9	45.123	3.94
25 D 46-23	OED	107.08	10140	12.94	145.2	45.123	3.94
26 D 46-32	OED	122.19	10140	13.1	165.69	45.123	3.99
1 D5	OED	10.51	1100	9.62	14.24	4.895	2.93
47 D 5-42	OED	10.56	1100	9.6	14.32	4.895	2.93
27 D55	OED	125	11860	11.15	169.51	52.777	3.4
28 D 62-02	OED	152.45	13660	12.71	206.72	60.787	3.87
29 D 62-12	OED	152.45	13660	12.71	206.72	60.787	3.87
30 D 62-22	OED	164.6	13660	13.26	223.2	60.787	4.04
36 D 6-32	OED	13.52	1322	10.23	18.34	5.883	3.12
31 D 80-12	OED	186.24	17620	12.87	252.55	78.409	3.92
32 D 80-23	OED	212.5	17620	13.05	288.15	78.409	3.98
2 D 8-22	OED	20.1	1760	12.05	27.25	7.832	3.67
33 D100-13	OED	265.67	22066	13.5	360.25	98.194	4.11
43 D120-42	OED	301.79	26450	11.81	409.23	117.702	3.6
45 D125-42	OED	313.63	27560	13.6	425.29	122.642	4.15
44 D150-42	OED	377.33	33070	11.81	511.66	147.161	3.6
42 D200-42	OED	492.04	44090	16.83	667.21	196.2	5.13

Substitute the hammer weight for “W”

$$P = \frac{1.6 \quad W \quad H}{S + 0.1 \left(\frac{X}{W} \right)}$$

W=3300

P= safe bearing power in pounds

W= weight in pounds, of striking part of hammer

H= height of fall in feet

S= the average penetration in inches per blow for last 20 blows for diesel hammer

X= weight in pounds of the pile plus the weight of any cap and/or anvil used on the pile during driving

$$P = \frac{1.6 \quad 3300 \quad H}{S + 0.1 \left(\frac{X}{3300} \right)}$$

The height of fall of the hammer was 5.25 ft.

Substitute the height of the fall of the hammer for “H”

H= 5.25 ft.

$$P = \frac{1.6 \quad 3300 \quad 5.25}{S + 0.1 \left(\frac{X}{3300} \right)}$$

The total penetration of the piling was 5 inches in the last 20 blows.

The average penetration would then equal 5 inches / 20 blows or 0.25 inches.

S= 0.25 inches

$$P = \frac{1.6 \quad 3300 \quad 5.25}{0.25 + 0.1 \left(\frac{X}{3300} \right)}$$

QUESTION: A contractor is using a D-15 diesel pile hammer to drive a HP 10 X 42 pile that is 66.6' long. The mass of the cap and or anvil was 2130 lbs. What is the bearing capacity of the piling?

To solve for X: HP 10 X 42

The 10 is the dimensions and 42 is nominal weight per foot.

$$\begin{array}{r} 42 \times 66.6' \text{ (length of pile)} = 2797.2 \\ \text{Mass of cap/anvil} \quad \quad \quad + \underline{2130} \\ \hline 4927.2 \end{array}$$

$$X=4927.2$$

Substitute the total mass of pile and cap/anvil for X.

$$P = \frac{1.6 \quad 3300 \quad 5.25}{0.25 + 0.1 \left(\frac{4927.2}{3300} \right)}$$

$$\frac{1.6 * 3300 * 5.25}{0.25 + 0.1 \left(\frac{4927.2}{3300} \right)} = \frac{27720}{0.25 + 0.1 * 1.493^{**}} = \frac{27720}{0.25 + 1.493}$$

** For diesel hammers, the quantity of X/W shall not be less than 1.

$$P = \frac{27720}{0.3993} = 69421$$

Convert pounds to tons by dividing by 2000

$$\frac{69421}{2000} = 34.71 \text{ rounded to } = \mathbf{35 \text{ tons}}$$

$$P \text{ (safe bearing power)} = 35 \text{ Tons}$$