



Geotechnical Bearing Capacity of Impact Driven RR-Piles

Calculation of allowable geotechnical capacity is based on total safety factor method.

$$R_{ca} = \frac{R_{bu} + R_{RSU}}{F}$$

R_{bu} is ultimate point resistance

R_{SU} is ultimate shaft resistance

F total safety factor, in compression 2,2

Ultimate point and shaft resistance is calculated from equations:

$$R_u = q_{bu} A_b$$

$$R_{su} = \sum_{i=1}^n q_{siu} A_{si}$$

A_b is cross-sectional area of pile point,

A_{si} is shaft area in soil layer i

q_{bu} is ultimate point resistance/area from table 1

q_{siu} is ultimate shaft resistance/area from table 1

Geotechnical resistance has not reached before driving of the pile has to fulfil end driving criteria, which described in next page.

Table 1 Ultimate point and shaft resistance/area.

Friction angle	Dynamic probing l/0,2 m	Weight sounding [pk/0,2 m]	Point resistance q_{bu} [MPa]	Shaft resistance q_{siu} [MPa]
33	5	10	2	0,02
35	10	30	3	0,03
36	20	50	4	0,06
37	30	80	6	0,08
38	40	100	8	0,09
40	50		10	0,10
42	60		12	0,11
43	80		16	0,12
45	100		20	0,13
	*3 m		26	0,14
	*5 m		30	0,15



End Driving Criteria:

Geotechnical bearing capacity of pile has to be proven with end driving criteria:

$$R_{cu} = k_3 \frac{E_{mx}}{s + \frac{1}{2}c}$$

E_{mx} total efficiency of driving

R_{cu} ultimate capacity of pile

s settlement per blow

c elastic compaction of pile and soil

k_3 soil factor in till 0,75 – 0,8 and in bedrock 0,8 - 0,85

Total efficiency of driving can be calculated:

$$E_{mx} = k_1 k_2 W_h H$$

k_1 hammer factor

0,6 drop hammers

0,85 hydraulic hammers

1,0 accelerated hydraulic hammers

k_2 factor which take consideration cushion et cetera, normally 0,9

W_h weight of hammer

H drop height of hammer

Drop height has to be more than 0,3 m, otherwise formula is not valid.

PDA-measured total efficiency values of hammer (E_{mx}) can be used in calculations if measurements have been done from same size of pile.

Calculation of End Driving Criteria can be done from formula:

$$s = \frac{k_3 E_{mx}}{2.2 R_{ca}} - \frac{1}{2}c$$

R_{ca} allowable geotechnical capacity

Elastic compaction of pile and soil has to evaluate, in calculations of end driving criteria.

At the end driving phase of pile has to check that evaluated values are corresponding to measured values.

End driving criteria has to define or check with PDA-measurements, in very demanding piling.