Pile Group Consolidation Settlement (Equivalent Raft)

Consolidation settlement of a friction pile group in clay by Terzaghi's equivalent raft at two-thirds pile length, with 2:1 load spread.

Method: Equivalent raft (Terzaghi and Peck) with 2:1 spread

Input parameters

Unit system: SI

Parameter	Value	Unit
Total working load on the group	4,000.0	kN
Group width (outer pile faces)	4.0000	m
Group length (outer pile faces)	6.0000	m
Pile length in the clay	15.000	m
Compressible layer thickness below the raft	10.000	m
Average effective unit weight	9.0000	kN/m³
Compression index	0.30000	
Initial void ratio	0.90000	

Calculated results

Parameter	Value	Unit
Depth of the equivalent raft	10.000	m
Stress increase at mid-layer	40.404	kPa
Effective overburden at mid-layer	135.00	kPa
Consolidation settlement	179.54	mm

Notes for this case

• Terzaghi and Peck: a friction pile group in clay acts like a raft at two-thirds of the pile length. The load spreads at 2 vertical : 1 horizontal, Δσ = Q_g/((B_g + z)(L_g + z)) at depth z below the raft, here taken at the middle of the layer. Normally consolidated clay: s = C_cH/(1 + e₀)·log[(σ₀′ + Δσ)/σ₀′], with σ₀′ = γ′ × depth from ground. Divide thick layers into sub-layers for better accuracy; over-consolidated clays use the recompression index up to the preconsolidation pressure.

Formula and method

$$z_r = \frac{2}{3}L, \quad \Delta\sigma = \frac{Q_g}{(B_g + z)(L_g + z)}, \quad s_c = \frac{C_c H}{1 + e_0}\log\frac{\sigma_0{}' + \Delta\sigma}{\sigma_0{}'}$$

Variables

Q_g	Total working load on the group	N
B_g	Group width (outer pile faces)	m
L_g	Group length (outer pile faces)	m
L	Pile length in the clay	m
H	Compressible layer thickness below the raft	m
\gamma'	Average effective unit weight	N/m³
C_c	Compression index	-
e_0	Initial void ratio	-
z_r	Depth of the equivalent raft	m
$\Delta\sigma$	Stress increase at mid-layer	Pa

$\sigma_0{}'$	Effective overburden at mid-layer	Pa
s_c	Consolidation settlement	m

Method and standards

Group settlement.

Assumptions and limits

- Normally consolidated clay; single layer at mid-depth stress; uniform γ′.

References

Equivalent raft (Terzaghi and Peck) with 2:1 spread

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/civil/foundations/pile-group-settlement-raft

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Reopens the calculator with the inputs of this report.