# Pile Group Efficiency (Converse–Labarre)

Efficiency of a rectangular pile group by the Converse–Labarre formula from rows, piles per row, diameter and spacing, and the group capacity.

**Method:** Converse–Labarre equation (Das, Principles of Foundation Engineering, 7th ed. (Cengage, 2011), ch. 11)

## Input parameters

Unit system: SI

| Parameter | Value | Unit |
|---|---|---|
| Number of rows | 3.0000 | |
| Piles per row | 3.0000 | |
| Pile diameter | 600.00 | mm |
| Centre-to-centre spacing | 1.8000 | m |
| Single pile capacity | 1,200.0 | kN |

## Calculated results

| Parameter | Value | Unit |
|---|---|---|
| $\tan^{-1}(d/s)$ (in degrees in the formula) | 18.435 | ° |
| Group efficiency | 72.689 | % |
| Group capacity | 7,850.4 | kN |

**Notes for this case**

- Converse–Labarre applies to friction piles in clay; in sand driven piles often show efficiency ≥ 1. Spacing of 2.5–3.5 diameters is usual. Also check the group as a block.

## Formula and method

$$\eta = 1 - \theta\frac{(n-1)m + (m-1)n}{90mn}, \quad \theta = \tan^{-1}\frac{d}{s}\ \text{(degrees)}$$

### Variables

| | | |
|---|---|---|
| $m$ | Number of rows | - |
| $n$ | Piles per row | - |
| $d$ | Pile diameter | m |
| $s$ | Centre-to-centre spacing | m |
| $Q_u$ | Single pile capacity | N |
| $\theta$ | $\tan^{-1}(d/s)$ (in degrees in the formula; shown in degrees) | rad |
| $\eta$ | Group efficiency | - |
| $Q_g$ | Group capacity | N |

### Method and standards

Converse–Labarre.

### Assumptions and limits

- Rectangular grid; friction piles.
- Block failure of the group is not computed: check it separately and take the smaller capacity.

### References

- Converse–Labarre equation (Das, Principles of Foundation Engineering, 7th ed. (Cengage, 2011), ch. 11)

## Report details

| | |
|---|---|
| Report reference | FCC-RY90-GARX (the same inputs always give the same reference) |
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| Calculator | Pile Group Efficiency (Converse–Labarre) |
| Method last reviewed | 13 November 2026 |
| Software release | FireCAD Calc, release of 17 November 2026 |
| Release checks | 2 reference cases of this calculator, computed independently, are checked on every release |

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-efficiency

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.