Time of Concentration by the Kirpich Formula

Time of concentration of a small catchment from the flow path length and average slope by the Kirpich (1940) formula, for use with the rational method.

Method: Kirpich; Z. P. (1940); ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Longest flow path	800.00	m
Fall along the flow path	12.000	m
Surface adjustment factor 1 for natural ground; local manuals reduce it for paved or concrete channels (for example 0.2–0.4).	1.0000	

Calculated results

Parameter	Value	Unit
Average slope ΔH/L	1.5000	%
Time of concentration	16.865	min

Notes for this case

- Kirpich's data came from small rural catchments (under about 80 ha) in Tennessee; it is widely used beyond them with care.

Formula and method

$$t_c = 0.0078\, k\, L_{ft}^{0.77}\, S^{-0.385}\ \text{min}, \quad S = \frac{\Delta H}{L}$$

Variables

L	Longest flow path	m
ΔH	Fall along the flow path	m
k	Surface adjustment factor	-
S	Average slope ΔH/L	-
t_c	Time of concentration	s

Method and standards

Empirical.

Assumptions and limits

- Small catchments.

References

- Kirpich
- Z. P. (1940)
- Time of concentration of small agricultural watersheds
- Civil Engineering 10(6): t_c = 0.0078 L^0.77 S^−0.385 (minutes, L in feet)

Report details

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Release checks	3 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/hydraulics/kirpich-time-of-concentration

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.