Horton Infiltration Capacity and Cumulative Infiltration

Infiltration capacity of soil at a time and the cumulative infiltration by Horton's exponential decay from initial to final rate, with the runoff from steady rain.

Method: Horton's infiltration equation

Input parameters

Unit system: SI

Parameter	Value	Unit
Initial infiltration capacity	75.000	mm/h
Final (steady) infiltration capacity	10.000	mm/h
Decay constant	4.0000	1/h
Time since the start of rain	1.0000	h
Rainfall intensity (0 to skip runoff)	30.000	mm/h

Calculated results

Parameter	Value	Unit
Infiltration capacity at t	11.191	mm/h
Cumulative infiltration to t	25.952	mm
Rainfall excess to t (rain always at or above capacity after ponding)	9.4044	mm
Time for capacity to fall to the rain intensity	0.29466	h

Notes for this case

- Horton capacity curve; F(t) assumes water is always available at the surface. The runoff estimate is simple: rain in excess of the capacity curve after the time it falls to the rain intensity (0 if the rain never exceeds the capacity).

Formula and method

$$f(t) = f_c + (f_0 - f_c)e^{-kt}, \quad F(t) = f_c t + \frac{f_0 - f_c}{k}\left(1 - e^{-kt}\right)$$

Variables

f_0	Initial infiltration capacity	m/s
f_c	Final (steady) infiltration capacity	m/s
k	Decay constant	1/s
t	Time since the start of rain	s
i	Rainfall intensity (0 to skip runoff)	m/s
$f(t)$	Infiltration capacity at t	m/s
$F(t)$	Cumulative infiltration to t	m
R	Rainfall excess to t (rain always at or above capacity after ponding)	m
t_c	Time for capacity to fall to the rain intensity	s

Method and standards

Empirical exponential infiltration decay.

Assumptions and limits

- Water ponded at the surface; homogeneous soil.

References

Horton's infiltration equation

Report details

Report reference	FCC-S022-W1DV (the same inputs always give the same reference)
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Calculator	Horton Infiltration Capacity and Cumulative Infiltration
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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/horton-infiltration

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.