Concrete Maturity and Equivalent Age (Nurse–Saul)

Temperature–time factor (maturity) of concrete from up to four curing periods by the Nurse–Saul function, and the equivalent age at a reference temperature (20 °C by default) for strength estimation.

Method: Nurse–Saul maturity function (ASTM C1074 principle; Neville, Properties of Concrete, ch. 6)

Input parameters

Unit system: SI

Parameter	Value	Unit
Datum temperature	-10.000	°C
Period 1 mean temperature	15.000	°C
Period 1 duration	24.000	h
Period 2 mean temperature	20.000	°C
Period 2 duration	48.000	h
Period 3 mean temperature	25.000	°C
Period 3 duration	96.000	h
Period 4 mean temperature	10.000	°C
Period 4 duration	0	h
Reference temperature	20.000	°C

Calculated results

Parameter	Value	Unit
Maturity	5,400.0	°C·h
Equivalent age at the reference temperature	180.00	h
Actual age	168.00	h

Notes for this case

• Nurse–Saul maturity M = Σ(T − T_0)Δt with datum −10 °C (or the mix's own). Strength comes from the mix's own strength–maturity calibration curve (ASTM C1074).

Formula and method

$$M = \sum \max(T - T_0,\, 0)\,\Delta t, \quad t_e = \frac{M}{T_r - T_0}$$

Variables

T_0	Datum temperature	K
T_1	Period 1 mean temperature	K
Δt_1	Period 1 duration	s
T_2	Period 2 mean temperature	K
Δt_2	Period 2 duration	s
T_3	Period 3 mean temperature	K
Δt_3	Period 3 duration	s
T_4	Period 4 mean temperature	K
Δt_4	Period 4 duration	s
T_r	Reference temperature	K
M	Maturity (°C·h)	-
t_e	Equivalent age at the reference temperature	s

t	Actual age	s

Method and standards

Nurse–Saul function.

Assumptions and limits

- Mean temperatures over each period; a period colder than the datum adds nothing (it is not counted as negative maturity).
- Maturity is always in °C·h, whatever the unit system.

References

• Nurse–Saul maturity function (ASTM C1074 principle; Neville, Properties of Concrete, ch. 6)

Report details

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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/concrete/concrete-maturity

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.