Water–Cement Ratio and Cement Content of a Mix

Water–cement ratio, cement content per cubic metre and free water from the batch quantities of cement, water and aggregates, with the yield of the batch.

Method: Batch mass balance; yield = batch mass / fresh density (ACI 211.1 terminology)

Input parameters

Unit system: SI

Parameter	Value	Unit
Cement in the batch	50.000	kg
Free water in the batch	22.500	kg
Fine aggregate (saturated surface dry)	110.00	kg
Coarse aggregate (SSD)	190.00	kg
Fresh concrete density	2,400.0	kg/m³

Calculated results

Parameter	Value	Unit
Water–cement ratio	0.45000	
Mass of the batch	372.50	kg
Yield (volume of concrete)	0.15521	m³
Cement content per m³	322.15	kg/m³
Water content per m³	144.97	kg/m³

Notes for this case

- Free water excludes water absorbed by the aggregates; correct the batch for aggregate moisture separately.

Formula and method

$$\frac{w}{c}=\frac{W}{C},\quad Y=\frac{C+W+F+G}{\rho_c},\quad c_c=\frac{C}{Y}$$

Variables

C	Cement in the batch	kg
W	Free water in the batch	kg
F	Fine aggregate (saturated surface dry)	kg
G	Coarse aggregate (SSD)	kg
ρ_c	Fresh concrete density	kg/m³
w/c	Water–cement ratio	-
m	Mass of the batch	kg
Y	Yield (volume of concrete)	m³
c_c	Cement content per m³	kg/m³
w_c	Water content per m³	kg/m³

Method and standards

Mass balance.

Assumptions and limits

- Saturated surface dry aggregates.

References

- Batch mass balance; yield = batch mass / fresh density (ACI 211.1 terminology)

Report details

Report reference	FCC-GJ7N-8A55 (the same inputs always give the same reference)
Generated	17 November 2026, 19:46 UTC
Calculator	Water–Cement Ratio and Cement Content of a Mix
Method last reviewed	12 November 2026
Software release	FireCAD Calc, release of 17 November 2026
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/concrete/water-cement-ratio

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.