3D Printing: Material, Filament Length and Print Time

Material mass, filament length and print time for an FDM 3D print from the part volume, infill, shell share, filament density and diameter and volumetric rate.

Method: Volume balance: deposited volume = V(s + (1 − s)φ)

Input parameters

Unit system: SI

Parameter	Value	Unit
Part volume	120.00	mL
Infill density	20.000	%
Share of volume in solid walls and skins	30.000	%
Filament density PLA about 1240 kg/m³, PETG 1270, ABS 1040.	1,240.0	kg/m³
Filament diameter	1.7500	mm
Average volumetric print rate Your printer's average including travel.	0.30000	mL/min

Calculated results

Parameter	Value	Unit
Material mass	65.472	g
Filament length	21.952	m
Print time	2.9333	h

Notes for this case

- Supports and brims add material; the slicer's estimate is better once you have it.

Formula and method

$$V_d = V[s + (1 - s)\phi], \quad m = \rho V_d, \quad L_f = \frac{V_d}{\pi d_f^2/4}, \quad t = \frac{V_d}{\dot{V}}$$

Variables

V	Part volume	m³
ϕ	Infill density	-
s	Share of volume in solid walls and skins	-
ρ	Filament density	kg/m³
d_f	Filament diameter	m
$\dot{V}$	Average volumetric print rate	m³/s
m	Material mass	kg
L_f	Filament length	m
t	Print time	s

Method and standards

Volume balance.

Assumptions and limits

- Average print rate.

References

- Volume balance: deposited volume = V(s + (1 − s)φ)

Report details

Report reference	FCC-WJVY-QM77 (the same inputs always give the same reference)
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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/mechanical/manufacturing/print-3d-time-material

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.