Blast Burden by Ash's Burden Ratio

Burden ratio Kb adjusted for rock and explosive density and detonation velocity, then burden, stemming, subdrill and spacing (Ash 1963).

Input parameters

Unit system: SI

Parameter	Value	Unit
Explosive (hole) diameter	6.0000	in
Rock density	165.00	lb/ft³
Explosive density (specific gravity)	0.85000	
Velocity of detonation	12,000	ft/s
Bench height	30.000	ft

Calculated results

Parameter	Value	Unit
Burden ratio	25.821	
Burden	12.910	ft
Stemming	9.0373	ft
Subdrill	3.8731	ft
Spacing, instantaneous holes	25.821	ft
Spacing, individually delayed holes	12.910	ft
Hole depth over burden (keep 1.5-4)	2.6237	

Notes for this case

- Ash's base ratio is 30 for an average explosive (SG 1.3, 12,000 ft/s) in average rock (160 lb/ft³); his table gives 20-40 for other combinations.

Formula and method

$$K_b = 30\left(\frac{160}{G_r}\right)^{0.33}\left(\frac{SG_e\,VOD^2}{187\times10^6}\right)^{0.33}, \quad B = K_b\frac{D_e}{12}$$

$$T = 0.7B, \quad J = 0.3B, \quad 1.5B < L + J < 4B$$

Variables

D_e	Explosive (hole) diameter	m
G_r	Rock density	kg/m³
SG_e	Explosive density (specific gravity)	-
VOD	Velocity of detonation	m/s
L	Bench height	m
K_b	Burden ratio	-
B	Burden	m
T	Stemming	m
J	Subdrill	m
S_i	Spacing, instantaneous holes	m
S_d	Spacing, individually delayed holes	m

$(L+J)/B$	Hole depth over burden (keep 1.5-4)	-

Method and standards

Ash's burden ratio method.

Assumptions and limits

- Empirical; first approximation.

Report details

Report reference	FCC-KCMS-0XR3 (the same inputs always give the same reference)
Generated	23 November 2026, 17:26 UTC
Calculator	Blast Burden by Ash's Burden Ratio
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 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/mine-design/blast-burden-ash-method

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.