FDTAS D&B QUICK REFERENCE 001

K = 25–45?

BUT WHICH K?

Baseline Burden Selection

A practical starting point for bench blast burden selection — and why hole diameter alone is not enough.

A common field rule of thumb is to relate burden to blasthole diameter using a burden ratio, K, with values such as 25–45 often used as an initial screening range. Ash's empirical approach expresses burden as B = K_B × D and recognises that the appropriate ratio varies with both rock and explosive conditions. Published summaries of Ash's work place the practical burden-ratio range at approximately 20–40, with about 30 used for average conditions. The important point is not to treat any single range as universal.

$$B = K^B \times D$$

Use consistent units. If D is in millimeters: $B\ (m) = K^B \times D\ (mm) / 1000$

Where:

B	Burden — distance from the blasthole to the effective free face
K^B	Empirical burden ratio / burden constant
D	Blasthole diameter
Important	K^B is a starting design ratio, not a universal constant.

FDTAS FIELD NOTE

The equation gives a baseline burden, not permission to drill it. Check the result against bench height, rock mass, explosive energy, drilling accuracy, available relief, required fragmentation and wall/floor control.

1. What should influence K?

The burden ratio is empirical. The same hole diameter can require a different burden when the rock mass, explosive, geometry or performance objective changes. Treat K as a design variable to be selected and then calibrated from measured blast performance.

Condition	General tendency	Why it matters
Strong / massive / competent rock	Lower K / tighter burden	More resistance and less natural breakage.
Weak / weathered / highly fractured rock	Potentially higher K	Rock mass may require less explosive energy per unit volume.
Higher explosive energy / density	Potentially higher K	More energy may be available to break a larger burden.
Lower-energy or low-density charge	Lower K	Less energy available per unit charge length.
Poor relief / difficult geometry	Lower K	Rock has less freedom to move.
Tight fragmentation requirement	Often lower K	More intensive energy distribution may be required.
High hole deviation / poor drilling accuracy	Lower K / review pattern	Actual toe burden may differ significantly from planned burden.

These tendencies are qualitative design prompts, not fixed correction factors.

2. Quick K-factor comparison

For rapid checking, the table below shows the burden produced by several burden ratios. The 20–40 range reflects published summaries of Ash's practical burden-ratio limits; actual design must be verified for site conditions.

Hole Ø (mm)	K=20	K=25	K=30	K=35	K=40
89	1.78 m	2.23 m	2.67 m	3.12 m	3.56 m
102	2.04 m	2.55 m	3.06 m	3.57 m	4.08 m
115	2.30 m	2.88 m	3.45 m	4.03 m	4.60 m
127	2.54 m	3.17 m	3.81 m	4.45 m	5.08 m
140	2.80 m	3.50 m	4.20 m	4.90 m	5.60 m
165	3.30 m	4.12 m	4.95 m	5.78 m	6.60 m
203	4.06 m	5.08 m	6.09 m	7.11 m	8.12 m

Worked example — 140 mm blasthole

A 140 mm blasthole produces very different baseline burdens depending on the selected K:

K	Calculated burden
20	2.80 m
25	3.50 m
30	4.20 m
35	4.90 m
40	5.60 m

SANITY CHECK

If a calculated burden becomes large relative to the bench height, available free face, charge geometry or drilling accuracy, stop and review the design. A mathematically correct K calculation can still produce an operationally poor pattern.

3. Moving beyond a simple K

A useful next step is to incorporate rock and explosive density directly. A widely cited Konya relationship for burden is:

$$B = 0.0378 \times D \times (\rho_e / \rho_r)^{(1/3)}$$

B in meters; D in millimeters; ρ_e = explosive bulk density; ρ_r = rock bulk density

This does not replace engineering judgement, but it demonstrates why the same blasthole diameter should not automatically receive the same burden in every rock/explosive combination.

4. Rock-mass parameters worth recording

Rock-mass blastability approaches such as Lilly/Cunningham show why burden selection should consider more than intact-rock strength. Useful field and geotechnical inputs include:

- Rock density / specific gravity
- Uniaxial compressive strength (UCS) and, where available, Young's modulus
- Joint spacing and persistence
- Joint orientation relative to the free face
- Joint condition, weathering and infill
- Rock mass description / degree of fracturing
- Changes in lithology across the blast

5. The best K is usually site-calibrated

Once an operation has reliable blast-performance data, a site-calibrated burden ratio is more useful than blindly applying a generic range.

Ksite = Bsuccessful / D

Use the same units for B and D. Example: 5.0 m burden / 0.165 m hole diameter = Ksite ≈ 30.3

A site K should only be considered successful when the blast result is successful. Record the ratio alongside measurable outcomes:

- Fragmentation and oversize
- Toe and floor condition
- Backbreak, crest condition and wall damage
- Muck pile shape and displacement
- Diggability and loading productivity
- Crusher feed / downstream performance
- Drilling meters and explosive consumption
- Hole deviation and actual burden at depth
- Vibration, air blast and flyrock performance where applicable

6. FDTAS baseline burden workflow

1	**Select a preliminary burden ratio**	Use a recognised empirical method as a starting point.
2	**Calculate the baseline burden**	B = K × D, with units checked.
3	**Check rock and explosive conditions**	Density, strength, structure, explosive density/energy and coupling.
4	**Check geometry and drilling**	Bench height, free face, stemming, subdrill, hole angle and deviation.
5	**Check the performance objective**	Fragmentation, movement, wall/floor control and downstream requirements.
6	**Trial under controlled conditions**	Use approved site procedures and competent authorised personnel.
7	**Measure the result**	Do not judge only from the muckpile appearance.
8	**Calibrate the site ratio**	Retain what works; adjust when geology, explosive or geometry changes.

REMEMBER

Burden is one part of a blast system. Spacing, bench height, subdrill, stemming, charge distribution, timing, geology and drilling accuracy interact. Changing K without checking the rest of the system can simply move the problem elsewhere.

Professional reference disclaimer

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References & further reading

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