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Vibration Control in Blasting Formulas

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List of 39 Vibration Control in Blasting Formulas

Vibration Control in Blasting

1) Acceleration of Particles disturbed by Vibrations

$$\text{fx } a = \left(4 \cdot (\pi \cdot f)^2 \cdot A \right)$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b_img.jpg\)](#)

$$\text{ex } 1.580716\text{m/s}^2 = \left(4 \cdot (\pi \cdot 2.001\text{Hz})^2 \cdot 10\text{mm} \right)$$

2) Diameter of Borehole using Minimum Length of Borehole

$$\text{fx } D_h = \left(\frac{L}{2} \right)$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d_img.jpg\)](#)

$$\text{ex } 10.1\text{ft} = \left(\frac{20.2\text{ft}}{2} \right)$$

3) Diameter of Drill Bit using Burden Suggested in Langefors' Formula

$$\text{fx } d_b = (B_L \cdot 33) \cdot \sqrt{\frac{c \cdot D_f \cdot EV}{D_p \cdot s}}$$

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d_img.jpg\)](#)

$$\text{ex } 97.71256\text{mm} = (0.01\text{m} \cdot 33) \cdot \sqrt{\frac{1.3 \cdot 2.03 \cdot 0.50}{3.01\text{kg/dm}^3 \cdot 5}}$$



4) Diameter of Explosive using Burden Suggested in Konya Formula

[Open Calculator !\[\]\(4729e517bc6a7cd81c8025b9646574fb_img.jpg\)](#)

$$\text{fx } D_e = \left(\frac{B}{3.15} \right) \cdot \left(\frac{SG_r}{SG_e} \right)^{\frac{1}{3}}$$

$$\text{ex } 56.84036\text{in} = \left(\frac{14\text{ft}}{3.15} \right) \cdot \left(\frac{2.3}{1.9} \right)^{\frac{1}{3}}$$

5) Distance from Blast Hole to Nearest Perpendicular Free Face or Burden

[Open Calculator !\[\]\(e474458956c9a37fbf9586ddb60a7fa1_img.jpg\)](#)

$$\text{fx } B = \sqrt{D_h \cdot L}$$

$$\text{ex } 14.28356\text{ft} = \sqrt{10.1\text{ft} \cdot 20.2\text{ft}}$$

6) Distance of Particle One from Site of Explosion

[Open Calculator !\[\]\(4fe57c3593bf1b21d272ae7ac8dfaf77_img.jpg\)](#)

$$\text{fx } D_1 = D_2 \cdot \left(\frac{v_2}{v_1} \right)^{\frac{2}{3}}$$

$$\text{ex } 2.163374\text{m} = 2\text{m} \cdot \left(\frac{1.8\text{m/s}}{1.6\text{m/s}} \right)^{\frac{2}{3}}$$



7) Distance of Particle Two from Site of Explosion given Velocity

$$\text{fx } D_2 = D_1 \cdot \left(\frac{v_1}{v_2} \right)^{\frac{2}{3}}$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

$$\text{ex } 1.941412\text{m} = 2.1\text{m} \cdot \left(\frac{1.6\text{m/s}}{1.8\text{m/s}} \right)^{\frac{2}{3}}$$

8) Distance to Exposure given Scaled Distance for Vibration Control

$$\text{fx } D = \sqrt{W} \cdot \left(\frac{D_{\text{scaled}}}{H} \right)^{-\frac{1}{\beta}}$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2_img.jpg\)](#)

$$\text{ex } 5.065376\text{m} = \sqrt{62\text{kg}} \cdot \left(\frac{4.9\text{m}}{2.01} \right)^{-\frac{1}{2.02}}$$

9) Maximum Weight of Explosives given Scaled Distance for Vibration Control

$$\text{fx } W = \left((D)^{-\beta} \cdot \left(\frac{H}{D_{\text{scaled}}} \right) \right)^{-\frac{2}{\beta}}$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7_img.jpg\)](#)

$$\text{ex } 60.65181\text{kg} = \left((5.01\text{m})^{-2.02} \cdot \left(\frac{2.01}{4.9\text{m}} \right) \right)^{-\frac{2}{2.02}}$$



10) Overburden given Stemming at Top of Borehole

$$\text{fx } OB = 2 \cdot (S - (0.7 \cdot B))$$

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a_img.jpg\)](#)

$$\text{ex } 3\text{ft} = 2 \cdot (11.3\text{ft} - (0.7 \cdot 14\text{ft}))$$

11) Scaled Distance for Vibration Control

$$\text{fx } D_{\text{scaled}} = H \cdot \left(\frac{D}{\sqrt{W}} \right)^{-\beta}$$

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021_img.jpg\)](#)

$$\text{ex } 5.01002\text{m} = 2.01 \cdot \left(\frac{5.01\text{m}}{\sqrt{62\text{kg}}} \right)^{-2.02}$$

12) Sound Pressure Level in Decibels

$$\text{fx } \text{dB} = \left(\frac{P}{6.95 \cdot 10^{-28}} \right)^{0.084}$$

[Open Calculator !\[\]\(bd3b31712ad9bab5a241210fa6925cdd_img.jpg\)](#)

$$\text{ex } 245.7875\text{dB} = \left(\frac{20\text{kPa}}{6.95 \cdot 10^{-28}} \right)^{0.084}$$

13) Spacing for Multiple Simultaneous Blasting

$$\text{fx } S_b = \sqrt{B \cdot L}$$

[Open Calculator !\[\]\(7bc43b319a082987e20f7bf78f4bab80_img.jpg\)](#)

$$\text{ex } 16.81666\text{ft} = \sqrt{14\text{ft} \cdot 20.2\text{ft}}$$



14) Specific Gravity of Explosive using Burden Suggested in Konya Formula

$$\text{fx } SG_e = SG_r \cdot \left(\frac{B}{3.15 \cdot D_e} \right)^3$$

[Open Calculator !\[\]\(d3fb9f94af8b26d1c844efa9a98805b0_img.jpg\)](#)

$$\text{ex } 2.097181 = 2.3 \cdot \left(\frac{14\text{ft}}{3.15 \cdot 55\text{in}} \right)^3$$

15) Specific Gravity of Rock using Burden Suggested in Konya Formula

$$\text{fx } SG_r = SG_e \cdot \left(\frac{3.15 \cdot D_e}{B} \right)^3$$

[Open Calculator !\[\]\(e1d6102fe77919492c04879c8450f1f5_img.jpg\)](#)

$$\text{ex } 2.083749 = 1.9 \cdot \left(\frac{3.15 \cdot 55\text{in}}{14\text{ft}} \right)^3$$

16) Stemming at Top of Borehole to Prevent Explosive Gases from Escaping

$$\text{fx } S = (0.7 \cdot B) + \left(\frac{OB}{2} \right)$$

[Open Calculator !\[\]\(ab4e2b3fc7e7887b7a72f548aa6f5e60_img.jpg\)](#)

$$\text{ex } 11.31\text{ft} = (0.7 \cdot 14\text{ft}) + \left(\frac{3.02\text{ft}}{2} \right)$$



17) Velocity of Particle One at Distance from Explosion

$$\text{fx } v_1 = v_2 \cdot \left(\frac{D_2}{D_1} \right)^{1.5}$$

[Open Calculator !\[\]\(9dfdaff1d86ba3c1f8353b4d1b61b8c5_img.jpg\)](#)

$$\text{ex } 1.672972\text{m/s} = 1.8\text{m/s} \cdot \left(\frac{2\text{m}}{2.1\text{m}} \right)^{1.5}$$

18) Velocity of Particle Two at distance from Explosion

$$\text{fx } v_2 = v_1 \cdot \left(\frac{D_1}{D_2} \right)^{1.5}$$

[Open Calculator !\[\]\(2b376d1a92330ab09dad2665d2f89bf5_img.jpg\)](#)

$$\text{ex } 1.721488\text{m/s} = 1.6\text{m/s} \cdot \left(\frac{2.1\text{m}}{2\text{m}} \right)^{1.5}$$

19) Velocity of Particles disturbed by Vibrations

$$\text{fx } v = (2 \cdot \pi \cdot f \cdot A)$$

[Open Calculator !\[\]\(c444627dab9fee9a1550c053ffaaaae2_img.jpg\)](#)

$$\text{ex } 125.7265\text{mm/s} = (2 \cdot \pi \cdot 2.001\text{Hz} \cdot 10\text{mm})$$

20) Velocity of Vibrations caused by Blasting

$$\text{fx } V = (\lambda_v \cdot f)$$

[Open Calculator !\[\]\(06a315363e7801bba8c7489a6694af19_img.jpg\)](#)

$$\text{ex } 5.0025\text{m/s} = (2.5\text{m} \cdot 2.001\text{Hz})$$



21) Wavelength of Vibrations caused by Blasting

$$fx \quad \lambda_v = \left(\frac{V}{f} \right)$$

[Open Calculator !\[\]\(6605b201d6f14d9b3bcb8ab5f274d107_img.jpg\)](#)

$$ex \quad 2.498751m = \left(\frac{5m/s}{2.001Hz} \right)$$

22) Weight Strength of Explosive using Burden Suggested in Langefors' Formula

$$fx \quad s = \left(33 \cdot \frac{B_L}{d_b} \right)^2 \cdot \left(\frac{EV \cdot c \cdot D_f}{D_p} \right)$$

[Open Calculator !\[\]\(e8fb589d58dad1692debababa5e928b6_img.jpg\)](#)

$$ex \quad 5.021825 = \left(33 \cdot \frac{0.01m}{97.5mm} \right)^2 \cdot \left(\frac{0.50 \cdot 1.3 \cdot 2.03}{3.01kg/dm^3} \right)$$

Parameters of Vibration Control in Blasting

23) Amplitude of Vibrations given Acceleration of Particles

$$fx \quad A = \left(\frac{a}{4 \cdot (\pi \cdot f)^2} \right)$$

[Open Calculator !\[\]\(e9474ce1d70442456f8fe9c393ea149c_img.jpg\)](#)

$$ex \quad 19.61136mm = \left(\frac{3.1m/s^2}{4 \cdot (\pi \cdot 2.001Hz)^2} \right)$$



24) Amplitude of Vibrations using Velocity of Particle

$$\text{fx } A = \left(\frac{v}{2 \cdot \pi \cdot f} \right)$$

[Open Calculator !\[\]\(71ceb62b681518c82e95d615e7265d66_img.jpg\)](#)

$$\text{ex } 9.942213\text{mm} = \left(\frac{125\text{mm/s}}{2 \cdot \pi \cdot 2.001\text{Hz}} \right)$$

25) Burden given Spacing for Multiple Simultaneous Blasting

$$\text{fx } B = \frac{(S_b)^2}{L}$$

[Open Calculator !\[\]\(fc3a57079704ef1b99671c8cafae23be_img.jpg\)](#)

$$\text{ex } 12.67327\text{ft} = \frac{(16\text{ft})^2}{20.2\text{ft}}$$

26) Burden given Stemming at Top of Borehole

$$\text{fx } B = \frac{S - \left(\frac{OB}{2} \right)}{0.7}$$

[Open Calculator !\[\]\(d5831b2ac75eb48b4c49d27e61d24c03_img.jpg\)](#)

$$\text{ex } 13.98571\text{ft} = \frac{11.3\text{ft} - \left(\frac{3.02\text{ft}}{2} \right)}{0.7}$$

27) Burden Suggested in Konya Formula

$$\text{fx } B = (3.15 \cdot D_e) \cdot \left(\frac{SG_e}{SG_r} \right)^{\frac{1}{3}}$$

[Open Calculator !\[\]\(e97636a3328cdaccd5ffd8fe3bc69ce6_img.jpg\)](#)

$$\text{ex } 13.54671\text{ft} = (3.15 \cdot 55\text{in}) \cdot \left(\frac{1.9}{2.3} \right)^{\frac{1}{3}}$$



28) Burden Suggested in Langefors' Formula

[Open Calculator !\[\]\(6e934896f25e6ce1b0dbb50c23abc197_img.jpg\)](#)

$$\text{fx } B_L = \left(\frac{d_b}{33} \right) \cdot \sqrt{\frac{D_p \cdot s}{c \cdot D_f \cdot EV}}$$

$$\text{ex } 0.009978\text{m} = \left(\frac{97.5\text{mm}}{33} \right) \cdot \sqrt{\frac{3.01\text{kg/dm}^3 \cdot 5}{1.3 \cdot 2.03 \cdot 0.50}}$$

29) Diameter of Borehole using Burden

[Open Calculator !\[\]\(f80254b170d0ecdc443847276e625120_img.jpg\)](#)

$$\text{fx } D_h = \frac{(B)^2}{L}$$

$$\text{ex } 9.70297\text{ft} = \frac{(14\text{ft})^2}{20.2\text{ft}}$$

30) Distance from Explosion to Exposure given Overpressure

[Open Calculator !\[\]\(ac13c516668a3b529e385da83084b241_img.jpg\)](#)

$$\text{fx } D = \left(\left(\frac{226.62}{P} \right) \right)^{\frac{1}{1.407}} \cdot (W)^{\frac{1}{3}}$$

$$\text{ex } 22.22113\text{m} = \left(\left(\frac{226.62}{20\text{kPa}} \right) \right)^{\frac{1}{1.407}} \cdot (62\text{kg})^{\frac{1}{3}}$$



31) Frequency of Vibration given Acceleration of Particles

[Open Calculator !\[\]\(0cc5c4c18dd72a91e21b90220aef9c5d_img.jpg\)](#)

$$fx \quad f = \sqrt{\frac{a}{4 \cdot (\pi)^2 \cdot A}}$$

$$ex \quad 2.802212Hz = \sqrt{\frac{3.1m/s^2}{4 \cdot (\pi)^2 \cdot 10mm}}$$

32) Frequency of Vibration given Velocity of Particle

[Open Calculator !\[\]\(3b71157eab31889e641f7620692f0b92_img.jpg\)](#)

$$fx \quad f = \left(\frac{v}{2 \cdot \pi \cdot A} \right)$$

$$ex \quad 1.989437Hz = \left(\frac{125mm/s}{2 \cdot \pi \cdot 10mm} \right)$$

33) Frequency of Vibrations caused by Blasting

[Open Calculator !\[\]\(94480c799e843c3a4dcfaf8c99e6db79_img.jpg\)](#)

$$fx \quad f = \left(\frac{V}{\lambda_v} \right)$$

$$ex \quad 2Hz = \left(\frac{5m/s}{2.5m} \right)$$



34) Length of Borehole given Spacing for Multiple Simultaneous Blasting



$$\text{fx } L = \frac{(S_b)^2}{B}$$

[Open Calculator](#)

$$\text{ex } 18.28571\text{ft} = \frac{(16\text{ft})^2}{14\text{ft}}$$

35) Length of Borehole using Burden



$$\text{fx } L = \frac{(B)^2}{D_h}$$

[Open Calculator](#)

$$\text{ex } 19.40594\text{ft} = \frac{(14\text{ft})^2}{10.1\text{ft}}$$

36) Minimum Length of Borehole in Feet



$$\text{fx } L = (2 \cdot D_h)$$

[Open Calculator](#)

$$\text{ex } 20.2\text{ft} = (2 \cdot 10.1\text{ft})$$

37) Minimum Length of Borehole in Meter



$$\text{fx } L = (2 \cdot 25.4 \cdot D_{\text{pith}})$$

[Open Calculator](#)

$$\text{ex } 16.66667\text{ft} = (2 \cdot 25.4 \cdot 0.1\text{m})$$



38) Overpressure due to Charge Exploded on Ground Surface

[Open Calculator !\[\]\(ad6ab0b77b86612fcbfecc8e2418b31e_img.jpg\)](#)

$$\text{fx } P = 226.62 \cdot \left(\frac{(W)^{\frac{1}{3}}}{D} \right)^{1.407}$$

$$\text{ex } 0.162652 \text{ kPa} = 226.62 \cdot \left(\frac{(62 \text{ kg})^{\frac{1}{3}}}{5.01 \text{ m}} \right)^{1.407}$$

39) Overpressure given Sound Pressure Level in Decibels

[Open Calculator !\[\]\(ef57557257cbb5c674d51a9e0a98bb4d_img.jpg\)](#)

$$\text{fx } P = (\text{dB})^{\frac{1}{0.084}} \cdot (6.95 \cdot 10^{-28})$$

$$\text{ex } 3 \text{E}^{-14} \text{ kPa} = (25 \text{ dB})^{\frac{1}{0.084}} \cdot (6.95 \cdot 10^{-28})$$



Variables Used

- **a** Acceleration of Particles (Meter per Square Second)
- **A** Amplitude of Vibration (Millimeter)
- **B** Burden (Foot)
- **B_L** Burden in Langefors' Formula (Meter)
- **c** Rock Constant
- **D** Distance from Explosion to Exposure (Meter)
- **D₁** Distance of Particle 1 from Explosion (Meter)
- **D₂** Distance of Particle 2 from Explosion (Meter)
- **d_b** Diameter of Drill Bit (Millimeter)
- **D_e** Diameter of Explosive (Inch)
- **D_f** Degree of Fraction
- **D_h** Diameter of Borehole (Foot)
- **D_p** Degree of Packing (Kilogram per Cubic Decimeter)
- **D_{pith}** Diameter of Bore Pith Circle (Meter)
- **D_{scaled}** Scaled Distance (Meter)
- **dB** Sound Pressure Level (Decibel)
- **EV** Ratio of Spacing to Burden
- **f** Frequency of Vibration (Hertz)
- **H** Constant of Scaled Distance
- **L** Length of Borehole (Foot)
- **OB** Overburden (Foot)
- **P** Overpressure (Kilopascal)



- **S** Weight Strength of Explosive
- **S** Stemming at Top of Borehole (*Foot*)
- **S_b** Blasting Space (*Foot*)
- **SG_e** Specific Gravity of Explosive
- **SG_r** Specific Gravity of Rock
- **v** Velocity of Particle (*Millimeter per Second*)
- **V** Velocity of Vibration (*Meter per Second*)
- **v₁** Velocity of Particle with Mass m1 (*Meter per Second*)
- **v₂** Velocity of Particle with Mass m2 (*Meter per Second*)
- **W** Maximum Weight of Explosives per Delay (*Kilogram*)
- **β** Constant of Scaled Distance β
- **λ_v** Wavelength of Vibration (*Meter*)



Constants, Functions, Measurements used

- **Constant:** **pi**, 3.14159265358979323846264338327950288
Archimedes' constant
- **Function:** **sqrt**, sqrt(Number)
Square root function
- **Measurement:** **Length** in Millimeter (mm), Foot (ft), Meter (m), Inch (in)
Length Unit Conversion 
- **Measurement:** **Weight** in Kilogram (kg)
Weight Unit Conversion 
- **Measurement:** **Pressure** in Kilopascal (kPa)
Pressure Unit Conversion 
- **Measurement:** **Speed** in Meter per Second (m/s), Millimeter per Second (mm/s)
Speed Unit Conversion 
- **Measurement:** **Acceleration** in Meter per Square Second (m/s²)
Acceleration Unit Conversion 
- **Measurement:** **Frequency** in Hertz (Hz)
Frequency Unit Conversion 
- **Measurement:** **Density** in Kilogram per Cubic Decimeter (kg/dm³)
Density Unit Conversion 
- **Measurement:** **Sound** in Decibel (dB)
Sound Unit Conversion 



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