Important Vibration Control in Blasting Formulas PDF

Formulas
Examples
with Units

List of 39
Important Vibration Control in Blasting Formulas

1) Acceleration of Particles disturbed by Vibrations Formula

Evaluate Formula

Formula

$$a = \left(4 \cdot \left(\pi \cdot f\right)^2 \cdot A\right)$$

Example with Units

$$1.5807\,\text{m/s}^2 = \left(4 \cdot \left(3.1416 \cdot 2.001\,\text{Hz}\right)^2 \cdot 10\,\text{mm}\right)$$

2) Diameter of Borehole using Minimum Length of Borehole Formula

Evaluate Formula

Formula

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

Example with Units

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

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

Evaluate Formula

Formula

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

Example with Units

$$97.7126\,\text{mm} = \left(0.01\,\text{m} \cdot 33\right) \cdot \sqrt{\frac{1.3 \cdot 2.03 \cdot 0.50}{3.01\,\text{kg/dm}^3 \cdot 5}}$$

4) Diameter of Explosive using Burden Suggested in Konya Formula Formula

Evaluate Formula

Formula

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

Example with Units

$$56.8404\,\text{in} = \left(\frac{14\,\text{ft}}{3.15}\right) \cdot \left(\frac{2.3}{1.9}\right)^{\frac{1}{3}}$$

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

Evaluate Formula

Formula

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

Example with Units

$$14.2836\,\text{ft} = \sqrt{10.1\,\text{ft} \cdot 20.2\,\text{ft}}$$

6) Distance of Particle One from Site of Explosion Formula

Evaluate Formula

Formula

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

Example with Units

$$2.1634\,\text{m} = 2\,\text{m} \cdot \left(\frac{1.8\,\text{m/s}}{1.6\,\text{m/s}}\right)^{\frac{2}{3}}$$

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

Evaluate Formula

Formula

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

Example with Units

$$1.9414\,\text{m} = 2.1\,\text{m} \cdot \left(\frac{1.6\,\text{m/s}}{1.8\,\text{m/s}} \right)^{\frac{2}{3}}$$

8) Distance to Exposure given Scaled Distance for Vibration Control Formula

Evaluate Formula

Formula

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

Example with Units

$$5.0654\,\text{m} = \sqrt{62\,\text{kg}} \cdot \left(\frac{4.9\,\text{m}}{2.01} \right)^{-\frac{1}{2.02}}$$

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

Evaluate Formula

Formula

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

Example with Units

$$60.6518\,\text{kg} = \left(\left(5.01\,\text{m} \right)^{-2.02} \cdot \left(\frac{2.01}{4.9\,\text{m}} \right) \right)^{-\frac{2}{2.02}}$$

10) Overburden given Stemming at Top of Borehole Formula

Evaluate Formula

Formula

$$OB = 2 \cdot \left(S - \left(0.7 \cdot B \right) \right)$$

Example with Units

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

11) Scaled Distance for Vibration Control Formula

Evaluate Formula

Formula

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

Example with Units

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

12) Sound Pressure Level in Decibels Formula

Evaluate Formula

Formula

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

Example with Units

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

13) Spacing for Multiple Simultaneous Blasting Formula

Evaluate Formula

Formula

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

Example with Units

$$16.8167\,\text{ft} = \sqrt{14\,\text{ft} \cdot 20.2\,\text{ft}}$$

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

Evaluate Formula

Formula

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

Example with Units

$$2.0972 = 2.3 \cdot \left(\frac{14\,\text{ft}}{3.15 \cdot 55\,\text{in}} \right)^3$$

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

Evaluate Formula

Formula

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

Example with Units

$$2.0837 = 1.9 \cdot \left(\frac{3.15 \cdot 55\,\text{in}}{14\,\text{ft}} \right)^3$$

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

Evaluate Formula

Formula

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

Example with Units

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

17) Velocity of Particle One at Distance from Explosion Formula

Evaluate Formula

Formula

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

Example with Units

$$1.673\,\text{m/s} = 1.8\,\text{m/s} \cdot \left(\frac{2\,\text{m}}{2.1\,\text{m}} \right)^{1.5}$$

18) Velocity of Particle Two at distance from Explosion Formula

Evaluate Formula

Formula

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

Example with Units

$$1.7215\,\text{m/s} = 1.6\,\text{m/s} \cdot \left(\frac{2.1\,\text{m}}{2\,\text{m}} \right)^{1.5}$$

19) Velocity of Particles disturbed by Vibrations Formula

Evaluate Formula

Formula

$$v = \left(2 \cdot \pi \cdot f \cdot A \right)$$

Example with Units

$$125.7265\,\text{mm/s} = \left(2 \cdot 3.1416 \cdot 2.001\,\text{Hz} \cdot 10\,\text{mm} \right)$$

20) Velocity of Vibrations caused by Blasting Formula

Evaluate Formula

Formula

$$V = \left(\lambda_v \cdot f \right)$$

Example with Units

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

21) Wavelength of Vibrations caused by Blasting Formula

Evaluate Formula

Formula

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

Example with Units

$$2.4988\,\text{m} = \left(\frac{5\,\text{m/s}}{2.001\,\text{Hz}}\right)$$

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

Evaluate Formula

Formula

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

Example with Units

$$5.0218 = \left(33 \cdot \frac{0.01\,\text{m}}{97.5\,\text{mm}}\right)^2 \cdot \left(\frac{0.50 \cdot 1.3 \cdot 2.03}{3.01\,\text{kg/dm}^3}\right)$$

23) Parameters of Vibration Control in Blasting Formulas

23.1) Amplitude of Vibrations given Acceleration of Particles Formula

Evaluate Formula

Formula

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

Example with Units

$$19.6114\,\text{mm} = \left(\frac{3.1\,\text{m/s}^2}{4 \cdot (3.1416 \cdot 2.001\,\text{Hz})^2}\right)$$

23.2) Amplitude of Vibrations using Velocity of Particle Formula

Evaluate Formula

Formula

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

Example with Units

$$9.9422\,\text{mm} = \left(\frac{125\,\text{mm/s}}{2 \cdot 3.1416 \cdot 2.001\,\text{Hz}}\right)$$

23.3) Burden given Spacing for Multiple Simultaneous Blasting Formula

Evaluate Formula

Formula

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

Example with Units

$$12.6733\,\text{ft} = \frac{(16\,\text{ft})^2}{20.2\,\text{ft}}$$

23.4) Burden given Stemming at Top of Borehole Formula

Evaluate Formula

Formula

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

Example with Units

$$13.9857\,\text{ft} = \frac{11.3\,\text{ft} - \left(\frac{3.02\,\text{ft}}{2}\right)}{0.7}$$

23.5) Burden Suggested in Konya Formula Formula

Evaluate Formula

Formula

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

Example with Units

$$13.5467\,\text{ft} = \left(3.15 \cdot 55\,\text{in}\right) \cdot \left(\frac{1.9}{2.3}\right)^{\frac{1}{3}}$$

23.6) Burden Suggested in Langefors' Formula Formula

Evaluate Formula

Formula

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

Example with Units

$$0.01\,\text{m} = \left(\frac{97.5\,\text{mm}}{33}\right) \cdot \sqrt{\frac{3.01\,\text{kg/dm}^3 \cdot 5}{1.3 \cdot 2.03 \cdot 0.50}}$$

23.7) Diameter of Borehole using Burden Formula

Evaluate Formula

Formula

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

Example with Units

$$9.703\,\text{ft} = \frac{(14\,\text{ft})^2}{20.2\,\text{ft}}$$

23.8) Distance from Explosion to Exposure given Overpressure Formula

Evaluate Formula

Formula

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

Example with Units

$$22.2211\,\text{m} = \left(\left(\frac{226.62}{20\,\text{kPa}}\right)\right)^{\frac{1}{1.407}} \cdot (62\,\text{kg})^{\frac{1}{3}}$$

23.9) Frequency of Vibration given Acceleration of Particles Formula

Evaluate Formula

Formula

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

Example with Units

$$2.8022\,\text{Hz} = \sqrt{\frac{3.1\,\text{m/s}^2}{4 \cdot (3.1416)^2 \cdot 10\,\text{mm}}}$$

23.10) Frequency of Vibration given Velocity of Particle Formula

Evaluate Formula

Formula

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

Example with Units

$$1.9894\,\text{Hz} = \left(\frac{125\,\text{mm/s}}{2 \cdot 3.1416 \cdot 10\,\text{mm}}\right)$$

23.11) Frequency of Vibrations caused by Blasting Formula

Evaluate Formula

Formula

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

Example with Units

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

23.12) Length of Borehole given Spacing for Multiple Simultaneous Blasting Formula

Evaluate Formula

Formula

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

Example with Units

$$18.2857\,\text{ft} = \frac{(16\,\text{ft})^2}{14\,\text{ft}}$$

23.13) Length of Borehole using Burden Formula

Evaluate Formula

Formula

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

Example with Units

$$19.4059\,\text{ft} = \frac{(14\,\text{ft})^2}{10.1\,\text{ft}}$$

23.14) Minimum Length of Borehole in Feet Formula

Evaluate Formula

Formula

$$L = \left(2 \cdot D_h\right)$$

Example with Units

$$20.2\,\text{ft} = \left(2 \cdot 10.1\,\text{ft}\right)$$

23.15) Minimum Length of Borehole in Meter Formula

Evaluate Formula

Formula

$$L = \left(2 \cdot 25.4 \cdot D_{pith}\right)$$

Example with Units

$$16.6667\,\text{ft} = \left(2 \cdot 25.4 \cdot 0.1\,\text{m}\right)$$

23.16) Overpressure due to Charge Exploded on Ground Surface Formula

Evaluate Formula

Formula

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

Example with Units

$$0.1627\,\text{kPa} = 226.62 \cdot \left(\frac{(62\,\text{kg})^{\frac{1}{3}}}{5.01\,\text{m}}\right)^{1.407}$$

23.17) Overpressure given Sound Pressure Level in Decibels Formula

Evaluate Formula

Formula

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

Example with Units

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

Variables used in list of Vibration Control in Blasting Formulas above

- **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)*
- D_1 Distance of Particle 1 from Explosion *(Meter)*
- D_2 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)*
- v_1 Velocity of Particle with Mass m1 *(Meter per Second)*

Constants, Functions, Measurements used in list of Vibration Control in Blasting Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Functions: **sqrt**, sqrt(Number) *A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.*
- 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*

- v_2 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)*

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