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Roof Live Loads Formulas

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List of 48 Roof Live Loads Formulas

Roof Live Loads ⌕

1) Roof Live Load ⌕

fx $L_f = 20 \cdot R_1 \cdot R_2$

Open Calculator ⌕

ex $18.18N = 20 \cdot 1.01 \cdot 0.90$

2) Roof Live Load when Tributary Area Les in Range 200 to 600 square feet ⌕

fx $L_f = 20 \cdot (1.2 - 0.001 \cdot A_t) \cdot R_2$

Open Calculator ⌕

ex $17.94983N = 20 \cdot (1.2 - 0.001 \cdot 2182.782ft^2) \cdot 0.90$

3) Tributary Area given Roof Live Load ⌕
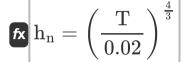
fx $A_t = 1000 \cdot \left(1.2 - \left(\dfrac{L_f}{20 \cdot R_2}\right)\right)$

Open Calculator ⌕

ex $2092.983ft^2 = 1000 \cdot \left(1.2 - \left(\dfrac{18.1N}{20 \cdot 0.90}\right)\right)$

Seismic Loads 🔗
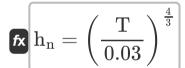
4) Building Height for other Buildings given Fundamental Period 🔗

Open Calculator 🔗

$$fx \quad h_n = \left(\frac{T}{0.02} \right)^{\frac{4}{3}}$$

$$ex \quad 56.91284ft = \left(\frac{0.170s}{0.02} \right)^{\frac{4}{3}}$$
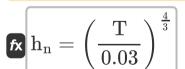
5) Building Height for Reinforced Concrete Frames given Fundamental Period 🔗

Open Calculator 🔗

$$fx \quad h_n = \left(\frac{T}{0.03} \right)^{\frac{4}{3}}$$

$$ex \quad 33.1453ft = \left(\frac{0.170s}{0.03} \right)^{\frac{4}{3}}$$

6) Building Height for Steel Eccentrically Braced Frames given Fundamental Period 🔗

Open Calculator 🔗

$$fx \quad h_n = \left(\frac{T}{0.03} \right)^{\frac{4}{3}}$$

$$ex \quad 33.1453ft = \left(\frac{0.170s}{0.03} \right)^{\frac{4}{3}}$$

7) Building Height for Steel Frame given Fundamental Period 🔗

Open Calculator 🔗

fx $$h_n = \left(\frac{T}{0.035} \right)^{\frac{4}{3}}$$

ex $$26.98731 ft = \left(\frac{0.170s}{0.035} \right)^{\frac{4}{3}}$$

8) Fundamental Period for other Buildings 🔗

Open Calculator 🔗

fx $$T = 0.02 \cdot h_n^{\frac{3}{4}}$$

ex $$0.110383s = 0.02 \cdot (32ft)^{\frac{3}{4}}$$

9) Fundamental Period for Reinforced Concrete Frames 🔗

Open Calculator 🔗

fx $$T = 0.03 \cdot h_n^{\frac{3}{4}}$$

ex $$0.165575s = 0.03 \cdot (32ft)^{\frac{3}{4}}$$
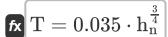
10) Fundamental Period for Steel Eccentrically Braced Frames 🔗

Open Calculator 🔗

fx $$T = 0.03 \cdot h_n^{\frac{3}{4}}$$

ex $$0.165575s = 0.03 \cdot (32ft)^{\frac{3}{4}}$$
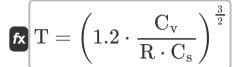
11) Fundamental Period for Steel Frames 📲

fx $T = 0.035 \cdot h_n^{\frac{3}{4}}$

Open Calculator 📲

ex $0.193171s = 0.035 \cdot (32ft)^{\frac{3}{4}}$
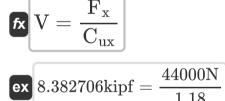
12) Fundamental Period given Seismic Response Coefficient 📲

fx $T = \left(1.2 \cdot \frac{C_v}{R \cdot C_s}\right)^{\frac{3}{2}}$

Open Calculator 📲

ex $0.171409s = \left(1.2 \cdot \frac{0.54}{6 \cdot 0.35}\right)^{\frac{3}{2}}$

13) Lateral Force 📲

fx $V = \frac{F_x}{C_{ux}}$

Open Calculator 📲

ex $8.382706kipf = \frac{44000N}{1.18}$

14) Lateral Seismic Force 📲

fx $F_x = C_{ux} \cdot V$

Open Calculator 📲

ex $44090.77N = 1.18 \cdot 8.40kipf$
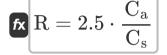
15) Response Modification Factor ↗

Open Calculator ↗

$$fx \quad R = 1.2 \cdot \frac{C_v}{C_s \cdot T^{\frac{2}{3}}}$$

$$ex \quad 6.033107 = 1.2 \cdot \frac{0.54}{0.35 \cdot (0.170s)^{\frac{2}{3}}}$$
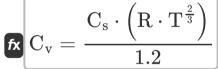
16) Response Modification Factor by Velocity Dependent Structures ↗

Open Calculator ↗

$$fx \quad R = 2.5 \cdot \frac{C_a}{C_s}$$

$$ex \quad 10.71429 = 2.5 \cdot \frac{1.5}{0.35}$$

17) Seismic Coefficient for Short Period Structures ↗

Open Calculator ↗

$$fx \quad C_v = \frac{C_s \cdot \left(R \cdot T^{\frac{2}{3}} \right)}{1.2}$$

$$ex \quad 0.537037 = \frac{0.35 \cdot \left(6 \cdot (0.170s)^{\frac{2}{3}} \right)}{1.2}$$

18) Seismic Coefficient for Velocity Dependent Structures 🔗

Open Calculator 🔗

fx $$C_a = C_s \cdot \frac{R}{2.5}$$

ex $$0.84 = 0.35 \cdot \frac{6}{2.5}$$

19) Seismic Response Coefficient given Base Shear 🔗

Open Calculator 🔗

fx $$C_s = \frac{V}{W}$$

ex $$0.350024 = \frac{8.40\text{kipf}}{106.75\text{kN}}$$

20) Seismic Response Coefficient given Fundamental Period 🔗

Open Calculator 🔗

fx $$C_s = 1.2 \cdot \frac{C_v}{R \cdot T^{\frac{2}{3}}}$$

ex $$0.351931 = 1.2 \cdot \frac{0.54}{6 \cdot (0.170\text{s})^{\frac{2}{3}}}$$

21) Seismic Response Coefficient given Seismic Coefficient for Velocity Dependent Structures 🔗
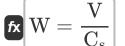
Open Calculator 🔗

fx $$C_s = 2.5 \cdot \frac{C_a}{R}$$

ex $$0.625 = 2.5 \cdot \frac{1.5}{6}$$
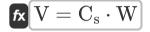
22) Total Dead Load given Base Shear

Open Calculator

fx $W = \dfrac{V}{C_s}$

ex $106.7573 \text{kN} = \dfrac{8.40 \text{kipf}}{0.35}$
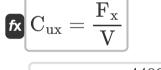
23) Total Lateral Force Acting in Direction of each of Principal Axis

Open Calculator

fx $V = C_s \cdot W$

ex $8.399424 \text{kipf} = 0.35 \cdot 106.75 \text{kN}$

24) Vertical Distribution Factor given Lateral Force

Open Calculator

fx $C_{ux} = \dfrac{F_x}{V}$

ex $1.177571 = \dfrac{44000 \text{N}}{8.40 \text{kipf}}$

Snow Loads

25) Ground Snow Load given Roof Snow Load

Open Calculator

fx $P_g = \dfrac{P_f}{0.7 \cdot C_e \cdot C_t \cdot I}$
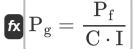
ex $22.13695 \text{psf} = \dfrac{12 \text{psf}}{0.7 \cdot 0.80 \cdot 1.21 \cdot 0.8}$
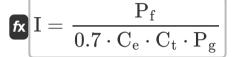
26) Ground Snow Load using Roof Type 🔗

fx $\quad P_g = \dfrac{P_f}{C \cdot I}$

$\boxed{\text{Open Calculator } 🔗}$

ex $\quad 5\text{psf} = \dfrac{12\text{psf}}{3 \cdot 0.8}$

27) Importance Factor for End Use using Roof Snow Load 🔗

fx $\quad I = \dfrac{P_f}{0.7 \cdot C_e \cdot C_t \cdot P_g}$

$\boxed{\text{Open Calculator } 🔗}$

ex $\quad 0.983865 = \dfrac{12\text{psf}}{0.7 \cdot 0.80 \cdot 1.21 \cdot 18\text{psf}}$

28) Importance Factor using Roof Type 🔗

fx $\quad I = \dfrac{P_f}{C \cdot P_g}$

$\boxed{\text{Open Calculator } 🔗}$

ex $\quad 0.222222 = \dfrac{12\text{psf}}{3 \cdot 18\text{psf}}$

29) Roof Snow Load 🔗

fx $\quad P_f = 0.7 \cdot C_e \cdot C_t \cdot I \cdot P_g$

$\boxed{\text{Open Calculator } 🔗}$

ex $\quad 9.75744\text{psf} = 0.7 \cdot 0.80 \cdot 1.21 \cdot 0.8 \cdot 18\text{psf}$

30) Roof Snow Load given Roof Type 📲

Open Calculator 📲

fx $$P_f = I \cdot C \cdot P_g$$

ex $$43.2\text{psf} = 0.8 \cdot 3 \cdot 18\text{psf}$$

31) Thermal Effects factor given Roof Snow Load 📲

Open Calculator 📲

fx $$C_t = \frac{P_f}{0.7 \cdot C_e \cdot I \cdot P_g}$$

ex $$1.488095 = \frac{12\text{psf}}{0.7 \cdot 0.80 \cdot 0.8 \cdot 18\text{psf}}$$

32) Wind Exposure Factor given Roof Snow Load 📲

Open Calculator 📲

fx $$C_e = \frac{P_f}{0.7 \cdot C_t \cdot I \cdot P_g}$$

ex $$0.983865 = \frac{12\text{psf}}{0.7 \cdot 1.21 \cdot 0.8 \cdot 18\text{psf}}$$

Wind Loads 📲
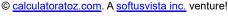
33) Basic Wind given Velocity Pressure 📲

Open Calculator 📲

fx $$V_B = \sqrt{\frac{q}{0.00256 \cdot K_z \cdot K_{zt} \cdot K_d \cdot I}}$$

ex $$29.6107\text{m/s} = \sqrt{\frac{20\text{pdl/ft}^2}{0.00256 \cdot 0.85 \cdot 25 \cdot 0.78 \cdot 0.8}}$$

34) Equivalent Static Design Wind Pressure 📲

fx $p = q \cdot G \cdot C_p$

Open Calculator 📲

ex $14.88 \text{pdl/ft}^2 = 20 \text{pdl/ft}^2 \cdot 1.20 \cdot 0.62$
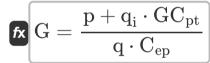
35) External Pressure Coefficient as given by ASCE 7 📲

fx $C_{ep} = \dfrac{p + q_i \cdot GC_{pt}}{G \cdot q}$

Open Calculator 📲

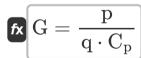*ex* $1.18875 = \dfrac{14.88 \text{pdl/ft}^2 + 15 \text{pdl/ft}^2 \cdot 0.91}{1.20 \cdot 20 \text{pdl/ft}^2}$

36) Gust Effect Factor as given by ASCE 7 📲

fx $G = \dfrac{p + q_i \cdot GC_{pt}}{q \cdot C_{ep}}$
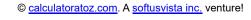
Open Calculator 📲

ex $1.501579 = \dfrac{14.88 \text{pdl/ft}^2 + 15 \text{pdl/ft}^2 \cdot 0.91}{20 \text{pdl/ft}^2 \cdot 0.95}$

37) Gust Response Factor using Wind Pressure 📲

fx $G = \dfrac{p}{q \cdot C_p}$

Open Calculator 📲

ex $1.2 = \dfrac{14.88 \text{pdl/ft}^2}{20 \text{pdl/ft}^2 \cdot 0.62}$

38) Importance Factor given Velocity Pressure ⤢

Open Calculator ⤢

$$fx \quad I = \frac{q}{0.00256 \cdot K_z \cdot K_{zt} \cdot K_d \cdot V_B^2}$$

$$ex \quad 0.8 = \frac{20 \text{pdl/ft}^2}{0.00256 \cdot 0.85 \cdot 25 \cdot 0.78 \cdot (29.6107 \text{m/s})^2}$$

39) Importance Factor using Velocity Pressure ⤢

Open Calculator ⤢

$$fx \quad I = \frac{q}{0.00256 \cdot K_z \cdot K_{zt} \cdot K_d \cdot V_B^2}$$

$$ex \quad 0.8 = \frac{20 \text{pdl/ft}^2}{0.00256 \cdot 0.85 \cdot 25 \cdot 0.78 \cdot (29.6107 \text{m/s})^2}$$

40) Internal Pressure Coefficient as given by ASCE 7 ⤢

Open Calculator ⤢

$$fx \quad GC_{pt} = \frac{(q \cdot G \cdot C_{ep}) - p}{q_i}$$

$$ex \quad 0.528 = \frac{(20 \text{pdl/ft}^2 \cdot 1.20 \cdot 0.95) - 14.88 \text{pdl/ft}^2}{15 \text{pdl/ft}^2}$$

41) Pressure Coefficient using Wind Pressure ⤢

Open Calculator ⤢

$$fx \quad C_p = \frac{p}{q \cdot G}$$

$$ex \quad 0.62 = \frac{14.88 \text{pdl/ft}^2}{20 \text{pdl/ft}^2 \cdot 1.20}$$

42) Topographic Factor given Velocity Pressure ⧉

Open Calculator ⧉

fx $$K_{zt} = \frac{q}{0.00256 \cdot K_z \cdot I \cdot K_d \cdot V_B^2}$$

ex $$25 = \frac{20\text{pdl/ft}^2}{0.00256 \cdot 0.85 \cdot 0.8 \cdot 0.78 \cdot (29.6107\text{m/s})^2}$$

43) Velocity Pressure ⧉

Open Calculator ⧉

fx $$q = 0.00256 \cdot K_z \cdot K_{zt} \cdot K_d \cdot \left(V_B^2\right) \cdot I$$

ex $$20\text{pdl/ft}^2 = 0.00256 \cdot 0.85 \cdot 25 \cdot 0.78 \cdot \left((29.6107\text{m/s})^2\right) \cdot 0.8$$

44) Velocity Pressure as given by ASCE 7 ⧉

Open Calculator ⧉

fx $$q = \frac{p + q_i \cdot GC_{pt}}{G \cdot C_{ep}}$$

ex $$25.02632\text{pdl/ft}^2 = \frac{14.88\text{pdl/ft}^2 + 15\text{pdl/ft}^2 \cdot 0.91}{1.20 \cdot 0.95}$$

45) Velocity Pressure at given Point as given by ASCE 7 ⧉

Open Calculator ⧉

fx $$q_i = \frac{(q \cdot G \cdot C_{ep}) - p}{GC_{pt}}$$

ex $$8.703297\text{pdl/ft}^2 = \frac{(20\text{pdl/ft}^2 \cdot 1.20 \cdot 0.95) - 14.88\text{pdl/ft}^2}{0.91}$$
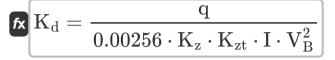
46) Velocity Pressure using Wind Pressure 🔗

Open Calculator 🔗

fx $q = \dfrac{p}{G \cdot C_p}$

ex $20\text{pdl/ft}^2 = \dfrac{14.88\text{pdl/ft}^2}{1.20 \cdot 0.62}$

47) Wind Directionality Factor given Velocity Pressure 🔗

Open Calculator 🔗

fx $K_d = \dfrac{q}{0.00256 \cdot K_z \cdot K_{zt} \cdot I \cdot V_B^2}$

ex $0.78 = \dfrac{20\text{pdl/ft}^2}{0.00256 \cdot 0.85 \cdot 25 \cdot 0.8 \cdot (29.6107\text{m/s})^2}$

48) Wind Pressure as given by ASCE 7 🔗

Open Calculator 🔗

fx $p = q \cdot G \cdot C_{ep} - q_i \cdot GC_{pt}$

ex $9.15\text{pdl/ft}^2 = 20\text{pdl/ft}^2 \cdot 1.20 \cdot 0.95 - 15\text{pdl/ft}^2 \cdot 0.91$

Variables Used

- **A_t** Tributary Area *(Square Foot)*
- **C** Roof Type
- **C_a** Seismic Coefficient for Velocity Dependent
- **C_e** Wind Exposure Factor
- **C_{ep}** External Pressure Coefficient
- **C_p** Pressure Coefficient
- **C_s** Seismic Response Coefficient
- **C_t** Thermal Effects Factor
- **C_{ux}** Vertical Distribution Factor
- **C_v** Seismic Coefficient for Short Period Structures
- **F_x** Lateral Seismic Force *(Newton)*
- **G** Gust Response Factor
- **GC_{pt}** Internal Pressure Coefficient
- **h_n** Height of Building *(Foot)*
- **I** Importance Factor for End Use
- **K_d** Wind Directionality Factor
- **K_z** Velocity Exposure Coefficient
- **K_{zt}** Topographic Factor
- **L_f** Roof Live Load *(Newton)*
- **p** Wind Pressure *(Poundal per Square Foot)*
- **P_f** Roof Snow Load *(Pounds per Square Foot)*

- P_g Ground Snow Load *(Pounds per Square Foot)*

- q Velocity Pressure *(Poundal per Square Foot)*

- q_i Velocity Pressure at Point *(Poundal per Square Foot)*

- R Response Modification Factor

- R_1 Reduction Factor for Size of Tributary Area

- R_2 Reduction Factor for Slope of Roof

- T Fundamental Period *(Second)*

- V Lateral Force *(Kilopound-Force)*

- V_B Basic Wind Speed *(Meter per Second)*

- W Total Dead Load *(Kilonewton)*

Constants, Functions, Measurements used

- Function: **sqrt**, sqrt(Number)
  Square root function
- Measurement: **Length** in Foot (ft)
  Length Unit Conversion ⬈
- Measurement: **Time** in Second (s)
  Time Unit Conversion ⬈
- Measurement: **Area** in Square Foot (ft²)
  Area Unit Conversion ⬈
- Measurement: **Pressure** in Pounds per Square Foot (psf), Poundal per Square Foot (pdl/ft²)
  Pressure Unit Conversion ⬈
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion ⬈
- Measurement: **Force** in Newton (N), Kilopound-Force (kipf), Kilonewton (kN)
  Force Unit Conversion ⬈

Check other formula lists

- **Roof Live Loads Formulas**

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