SOLUTIONS MANUAL FOR

PRINCIPLES OF STRUCTURAL DESIGN

Wood, Steel, and Concrete

SECOND EDITION

by

Ram S. Gupta

CRC Press
Taylor & Francis Group

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Boca Raton London New York

CRC Press is an imprint of the
Taylor & Francis Group, an **informa** business

CRC Press
Taylor & Francis Group
6000 Broken Sound Parkway NW, Suite 300
Boca Raton, FL 33487-2742

Printed on acid-free paper
Version Date: 20140220

International Standard Book Number-13: 978-1-4665-5234-0 (Ancillary)

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CHAPTER 1

1.1

Joists

1. Tributary area/ft = $\frac{24}{1} \times 1 = 2\ ft^2/ft$
2. Design load = 60(2) = 120 lbs/ft

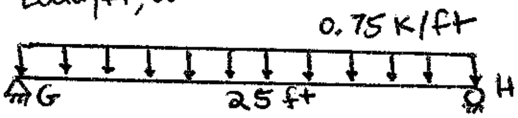
Beam

3. Tributary area/ft = $(6+7) \times 1 = 13\ ft^2/ft$
4. Design load = 60(13) = 780 lbs/ft

1.2

Beam GH

1. Tributary area/ft = $7.5 \times 1 = 7.5\ ft^2/ft$
2. Load/ft, w = 100 (7.5) = 750 lbs/ft



3. Reaction at G = $\frac{0.75}{2}(25) = 9.375K$

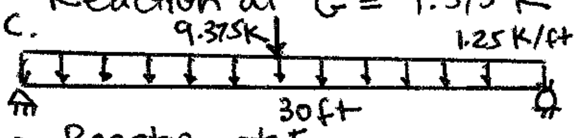
Beam EF

A. Uniformly distributed load

1. Tributary area/ft = $12.5 \times 1 = 12.5\ ft^2/ft$
2. Load/ft, w = 100(12.5) = 1250 lbs/ft OR 1.25 K/ft

B. Concentrated Load = Reaction at G = 9.375 K

C.



D. Reaction at F

$$F_y = \frac{1.25(30) + 9.375}{2} = 23.44k$$

1.2 contd.

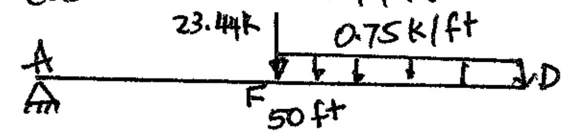
Girder AD

A. Uniform Load

1. Tributary area = $7.5 \times 1 = 7.5\ ft^2/ft$
2. Load on FD = 100 (7.5) = 750 lbs/ft OR 0.75 K/ft

B. Concentrated load at F = Reaction at F = 23.44 K

C.

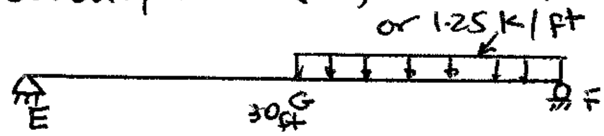


1.3

Beam GH
NO loading

Beam EF
Load only from GF

1. Tributary area = $12.5 \times 1 = 12.5\ ft^2/ft$
2. Load/ft = 100(12.5) = 1250 lbs/ft or 1.25 K/ft



3. Reaction at F

$M@E = 0$

$F_y(30) - 1.25(15)(22.5) = 0$

$F_y = 14.063\ K$

1.3 Contd

Girder AD

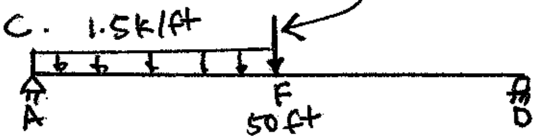
A: Uniform load only from AF

1. Tributary area = 15×1 = 15 ft²/ft

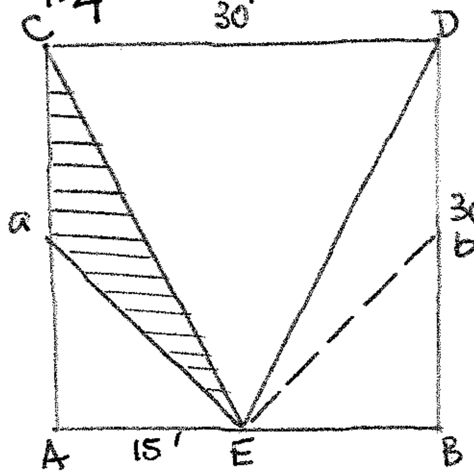
2. Load/ft = 100(15) = 1500 lbs/ft or 1.5 k/ft

B. Concentrated Load = Reaction at F = 14.063 k

C. 1.5 k/ft



1.4



A. Tributary areas are shown above

1. Total area ACE or BDE
$= \frac{1}{2}(50)(30) = 225 \text{ ft}^2$

2. Load on ACE or BDE
= 80(225) = 18000 lbs or 18 K

3. Area AaE or CEa
$= \frac{1}{2}(225) = 112.5 \text{ ft}^2$

4. Load on AaE or CEa
= 80(112.5) = 9000 lbs or 9K

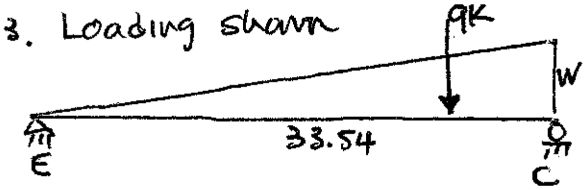
1.4 Contd.

B. Beam CE or DE

1. Triangular load from CaE
= 18 − 9 = 9 k

2. Length of CE or DE = 33.54 ft

3. Loading shown

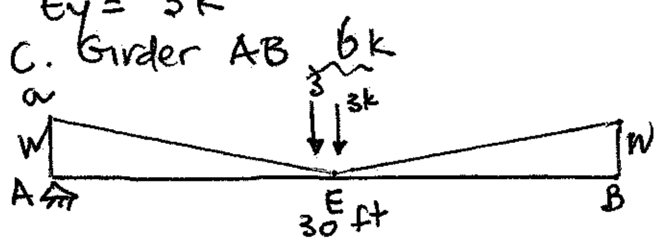


4. Area of load diagram
$= \frac{1}{2}(W)(33.54) = 16.77\,W$

5. Equating item 1 and 4
16.77 W = 9 or W = 0.537 k/ft

6. Reaction at E
M@C = 0
$E_y(33.54) - 9\left(\frac{1}{3} \times 33.54\right) = 0$
$E_y = 3\text{ k}$

C. Girder AB



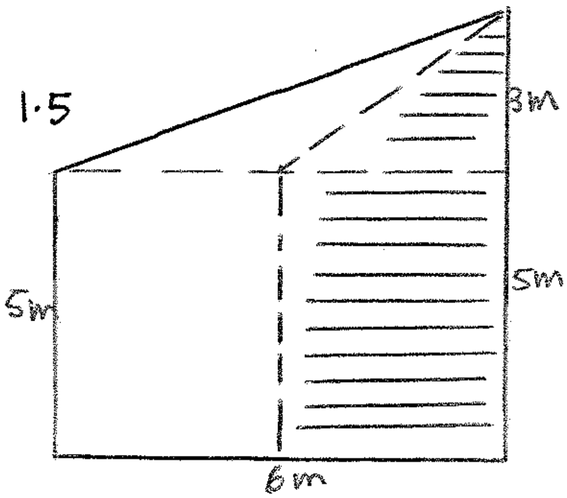
1. Area of each triangular Load $= \frac{1}{2}(15)\,W = 7.5\,W$

2. Triangular load from AaE
= 9 k (from step A(4))

3. Equating 1 and 2
W = 1.2 k/ft

4. Concentrated load
= 3 + 3 = 6 k

1.5

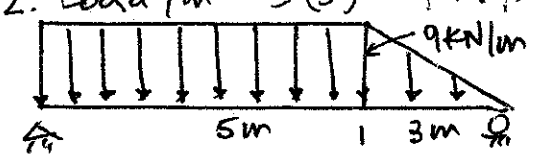


A. Triangular load

1. Area $= \frac{1}{2}(3)(3) = 4.5 ft^2$
2. Load $= 3(4.5) = 13.5 kN$
3. With a triangular load w at end area of load diagram $= \frac{1}{2}(3)w = 1.5w$
4. Equating (2) and (3) $1.5w = 13.5$ $w = 9 kN/m$

B. Rectangular Load

1. Tributary area/m $= 3 \times 1 = 3 m^2/m$
2. Load/m $= 3(3) = 9$ kN/m



1.6

1. Tributary area of column $= \left(\frac{12+14}{2}\right)\left(\frac{20+20}{2}\right) = 260 ft^2$
2. Unit load = 60 psf (assumed factored)
3. Design Load $P_u = 60(260) = 15600$ lbs
4. $P_u = \phi F_y A$
   $15600 = (0.8)(4000)A$
   or $A = 4.88$ in.^{2}
5. Size of a square col. $h = \sqrt{A} = \sqrt{4.88} = 2.2$ in.

1.7

1. Factored Load
   $P_u = 1.2D + 1.6L$
   $= 1.2(10) + 1.6(20) = 44 K$
2. $P_u = \phi F_y A$
   $44 = (0.9)(36)A$
   or $A = 1.36$ in.^{2}
3. $\frac{\pi}{4} d^2 = 1.36$
   $d = 1.32$ in.

1.8

1. Factored uniform load
   $W_u = 1.2(400) + 1.6(1000)$
   $= 2080$ lbs/ft or 2.08 K/ft
2. Maximum BM
   $M_u = \frac{W_u L^2}{8} = \frac{2.08(30)^2}{8}$
   $= 234$ ft-k or 2808 in-k
3. $M_u = \phi F_y S$
   $2808 = (0.9)(50)S$
   or $S = 62.4$ in.^{2}
4. $S = \frac{1}{6}(b)(2b)^2 = 62.4$
   or $b = 4.53$ in.
   $d = 9.06$ in.

Use 5 in. × 10 in.

1.9

1. From Prob 1.1 $W_u = 780$ lbs/ft
2. $M_u = \frac{780(20)^2}{8} = 39000$ ft-lbs or 46800 in lbs
3. $46800 = 0.9(4000)S$
   or $S = 130$ in.^{3}
4. $\frac{1}{6}(b)(3b)^2 = 130$
   $b = 4.42$ in., $d = 13.26$ in

Use $4\frac{1}{2}$ in. × $13\frac{1}{2}$ in.

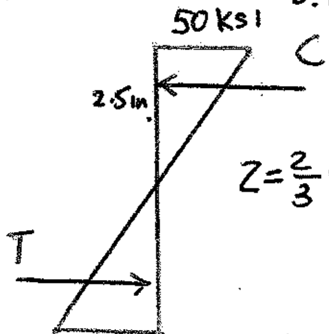
1.10 Elastic capacity

1. $I = \frac{1}{12}bh^3 = \frac{1}{12}(2)(5)^3 = 20.83\ in^4$

2. $S = \frac{I}{c} = \frac{20.83}{2.5} = 8.33\ in.^3$

3. $M_E = \sigma_y S = 50(8.33) = 416.67\ in.\text{-}K$

OR

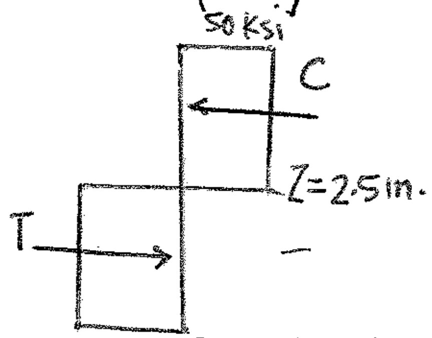


$Z = \frac{2}{3}(5) = 3.33\ in.$

4. $C = T = \bar{\sigma} A = \frac{1}{2}(50)(2\times2.5) = 125\ K$

5. $M_E = Cz = (125)(3.33) = 416.67\ in.\text{-}K$ or

Plastic capacity



1. $C = T = \bar{\sigma} A = (50)(2\times2.5) = 250\ K$

2. $M_P = Cz = (250)(2.5) = 625\ in.\text{-}K$

Shape factor $= \frac{M_P}{M_E} = \frac{625}{416.67} = 1.5$

1.11

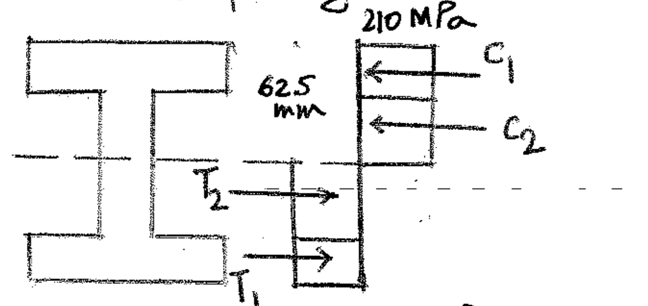
Elastic capacity

1. $I = I_{out} - I_{inside}$
$= \frac{1}{12}(75\times10^{-3})(125\times10^{-3})^3 - \frac{1}{12}(50\times10^{-3})(75\times10^{-3})^3$
$= 10.45\times10^{-6}\ m^4$

2. $S = \frac{I}{c} = \frac{10.45\times10^{-6}}{62.5\times10^{-3}} = 0.167\times10^{-3}\ m^3$

3. $M_E = \sigma_y S = (210\times10^6)(0.167\times10^{-3}) = 35.07\times10^3\ Nm$

Plastic capacity



1. $C_1 = (210\times10^6)(75\times10^{-3})(25\times10^{-3}) = 393.75\times10^3\ N$

2. Distance from na $= (62.5 - 12.5)\times10^{-3} = 50\times10^{-3}$

3. M_{P_1} = Top flange $= (393.75\times10^3)(50\times10^{-3}) = 19.69\times10^3\ Nm$

4. $C_2 = (210\times10^6)(25\times10^{-3})(37.5\times10^{-3}) = 196.875\times10^3\ N$

5. Distance to n.a $= \frac{37.5}{2}\times10^{-3} = 18.75\times10^{-3}$

6. M_{P_2} = Top web $= (196.875\times10^3)(18.75\times10^{-3}) = 3.69\times10^3\ Nm$

1.11 Contd.

7. $M_{P_3} = M_{P_1} = 19.69 \times 10^3$ Nm

8. $M_{P_4} = M_{P_2} = 3.69 \times 10^3$ Nm

9. $M_P = \Sigma M_P = 46.76 \times 10^3$ Nm

Shape factor $= \frac{M_P}{M_E} = \frac{46.76 \times 10^3}{35.07 \times 10^3}$

$= 1.33$

1.12

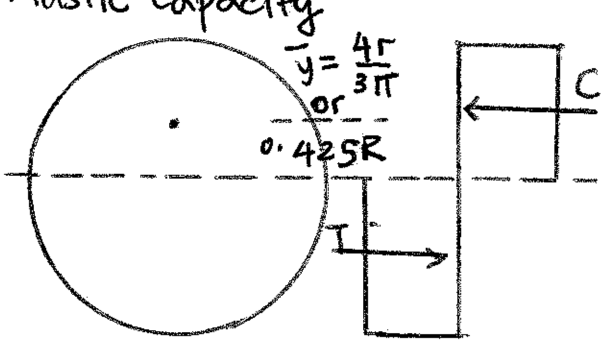
Elastic capacity

1. $S = \frac{\pi}{32} d^3 = \frac{\pi}{32}(10)^3 = 98.125 \text{ in.}^3$

2. $M_E = \sigma_y S = 2000(98.125)$

$= 196250$ in.lbs or 16.35 ft-K

Plastic capacity



1. $C = \sigma A = (2000)(\frac{\pi}{8} d^2)$

$= (2000)(\frac{\pi}{8} \times 10^2) = 78500$ lbs

2 Distance to n.a (top part)

$= 0.425R = 0.425(5) = 2.12$ in.

3 M_{P_1} = Top part

$= CZ = 78500(2.12)$

$= 166420$ in.-lbs

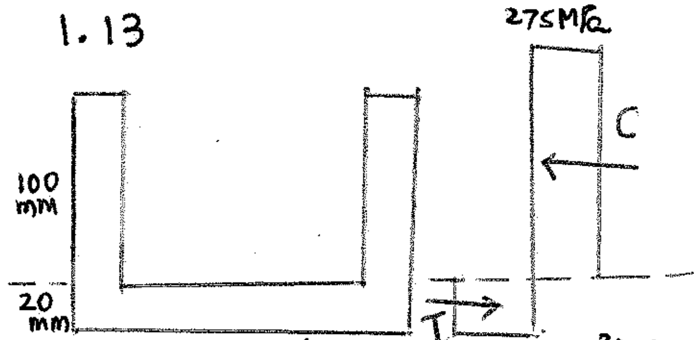
4. $M_{P_2} = M_{P_1} = 166420$ in.-lbs

5. $M_P = \Sigma M_P = 332840$ in.-lbs

or 27.74 ft-K

Shape factor $= \frac{27.74}{16.35} = 1.70$

1.13



1. $C = (275 \times 10^6)(100 \times 10^{-3})(20 \times 10^{-3}) \times 2$

$= 1100 \times 10^3$ N

2. Distance to n.a (top part)

$= 50 \times 10^{-3}$

3. M_{P_1} = Top part

$= (1100 \times 10^3)(50 \times 10^{-3})$

$= 55000$ Nm

4. $= (275 \times 10^6)(200 \times 10^{-3})(20 \times 10^{-3})$

$= 1100 \times 10^3$ N

5. Distance to n.a. (bottom)

$= 10 \times 10^{-3}$

6. M_{P_2} = Bottom part

$= (1100 \times 10^3)(10 \times 10^{-3})$

$= 11000$ Nm

7. $M_P = \Sigma M_P = 66000$ Nm

1.14

Elastic theory

1. $S = \frac{M_u}{\sigma} = \frac{2000(12)}{10000} = 2.4 \text{ in.}^3$

2. $S = \frac{1}{6}(0.6d) d^2 = 2.4$

or $d = 2.88$ in. ≈ 3 in

$b = 0.6(2.88) = 1.73 \approx 2$ in.

Plastic theory

1. $Z = \frac{M_u}{\sigma} = 2.4 \text{ in.}^3$

2 $Z = \frac{1}{4}(0.6d) d^2 = 2.4$

or $d = 2.52$ in ≈ 2.5 in.

$b = 0.6(2.52) = 1.51 \approx 1.5$ in.

1.15

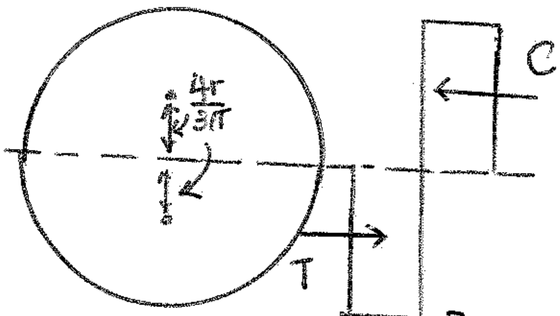
Elastic theory

1. $S = 2.4 \text{ in.}^3$ (from Prob. 1.14)

2. $S = \frac{\pi}{32} d^3 = 2.4$

$d = 2.9 \text{ in.} \approx 3 \text{ in.}$

Plastic theory



1. $C = T = \sigma A = \sigma\left(\frac{\pi}{2} r^2\right)$

2. $Z = 2\left(\frac{4r}{3\pi}\right) = \frac{8r}{3\pi}$

3. $M_p = CZ = \sigma\left(\frac{\pi}{2} r^2\right)\left(\frac{8r}{3\pi}\right)$

$= \frac{4r^3}{3}\sigma$ or $1.33 r^3 \sigma$

or $r^3 = \frac{M_p}{1.33\sigma} = \frac{2000(12)}{1.33(10000)}$

$= 1.80$

or $r = 1.22$ in.

or $d = 2.44 \text{ in.} \approx 2.5 \text{ in.}$

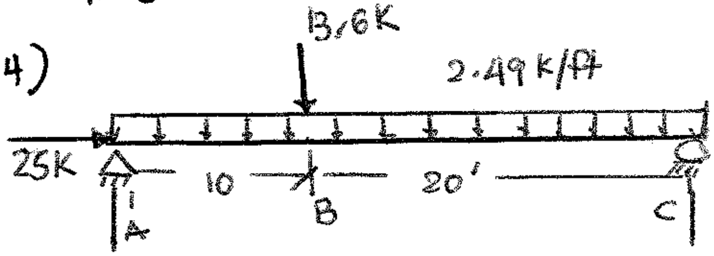
1.16 On Excel

1.17 On Excel

1.18 On Excel

1.19 On Excel

1.20



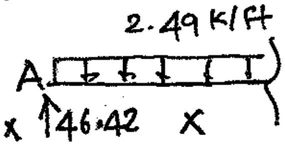
$M_{@C} = 0$

$A_y(30) - 2.49(30)(15) - 13.6(20) = 0$

$A_y = 46.42$ k

$C_y = 13.6 + 2.49(30) - 46.42 = 41.88$k

Section AB



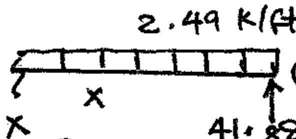
$V_x = 46.42 - 2.49x$

$M_x = 46.42x - 2.49\frac{x^2}{2}$

At A $x=0$ $V_A = 46.42$ $M_A = 0$

At B $x=10$ $V_B = 21.52$ $M_B = 339.7$

Section BC



$V_x = -41.88 + 2.49x$

$M_x = 41.88x - 2.49\frac{x^2}{2}$

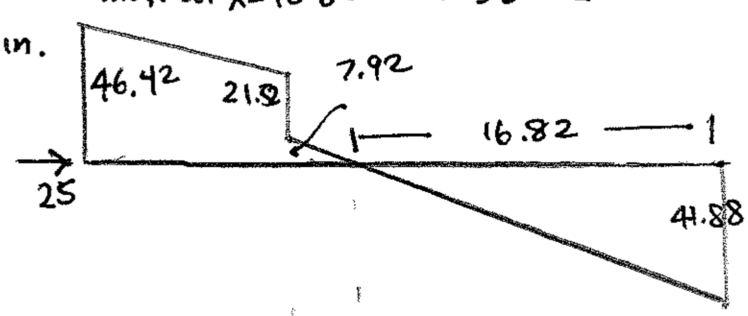
At C $x=0$ $V_c = -41.88$ $M_c = 0$

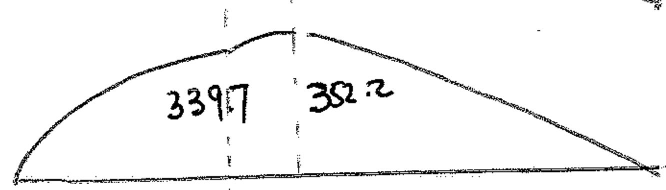
At B $x=20$ $V_B = 7.92$ $M_B = 339.7$

At Mmax $V=0 = -41.88 + 2.49x$

or $x = 16.82$ ft

Mmax at $x = 16.82$ $= 352.2$





1.16

DL on horizontal Projection	10/cos 15	10.35
Seismic Load on Hori. Proj.	2/cos 15	2.07
Roof live load, Lr		20.00
Wind load, vertical		15.00
Snow load		30.00
1. 1.4D	14.49	
2. 1.2D+1.6L+0.5(Lr or S)	27.42	
3. 1.2D+1.6(Lr or S)+.5L or .5W	67.92	
4. 1.2D+W+.5L+.5(Lr or S)	42.42	
5. 1.2D+Ev+Eh+0.5L+0.2S	20.49	
6. 0.9D+W	24.32	
7. 0.9D-Ev+Eh	7.25	

1.17

Dead load, k/ft (D)	1.15
Live load, k/ft (L)	1.85
Wind load, horiz., k, Wh	15.00
Earthquake, horz., k, Eh	20.00
Earthquake, vert., k/ft, Ev	0.30
1. $w_u = 1.4D$	1.61
2. wu=1.2D +1.6L + 0.5(Lr or S)	4.34

3. This has following two cases

3a. 1.2D+1.6(Lr or S) + 0.5L

Source	D, k/ft	Lr or S	L, k/ft	Combination
Load	1.15	0.00	1.85	
Load factor	1.20	1.60	0.50	
Vertical factored load	1.38	0.00	0.93	2.31

3b. 1.2D+1.6(Lr os S)+0.5W

Source	D, k/ft	Lr or S	W, k	Combination
Load	1.15	0.00	15.00	
Load factor	1.20	1.60	0.50	
Vertical load	1.38	0.00		1.38
Horizontal load			7.50	7.50

4. 1.2D+1.0W+0.5L+0.5(Lr or S)

Source	D, k/ft	L, k/ft	W, k	Lr or S	Combination
Load	1.15	1.85	15.00	0.00	
Load factor	1.20	0.50	1.00	0.50	
Vertical load	1.38	0.93		0.00	2.31
Horizontal load			15.00		15.00

5. 1.2D+Ev+Eh+0.5L+0.2S

Source	D, k/ft	L, k/ft	Ev, k/ft	Eh, k	S, k/ft	Combinatic
Load	1.15	1.85	0.30	20.00	0.00	
Load factor	1.20	0.50	1.00	1.00	0.20	
Vertical load	1.38	0.93	0.30		0.00	2.61
Horizontal load				20.00		20.00

6. 0.9D+1W

Source	D, k/ft	W, k	Combination
Load	1.15	15.00	
Load factor	0.90	1.00	
Vertical load	1.04		1.04
Horizontal load		15.00	15.00

7. 0.9D+Eh-Ev

Source	D, k/ft	Eh, K	Ev, k/ft	Combination
Load	1.15	20.00	0.30	
Load factor	0.90	1.00	-1.00	
Vertical load	1.04		-0.30	0.74
Horizontal load		20.00		20.00

1.18

# 1.18	Uniform, k/ft	Conc., k
Dead load, k/ft (D)	1.20	8.00
Live load, k/ft (L)	2.10	
Wind load, horiz., k, Wh		18.00
Earthquake, horz., k, Eh		25.00
Earthquake, vert., k/ft, Ev	0.00	
Snow load, S		20.00
Roof Live load, Lr		15.00
1. $w_u = 1.4D$	1.68	

Source	D, k/ft	D, k
Load	1.20	8.00
Load factor	1.40	1.40
Vertical factored load	1.68	11.20

2. wu=1.2D +1.6L + 0.5(Lr or S)

Source	D, k/ft uniform	D, k conc.	L, k/ft	Lr or S, k	Combined Uniformk/ft	Combined Conc., k
Load	1.20	8.00	2.10	20.00		
Load factor	1.20	1.20	1.60	0.50		
Vertical factored load	1.44	9.60	3.36	10.00	4.80	19.60

3. This has following two cases

3a. 1.2D+1.6(Lr or S) + 0.5L

Source	D, k/ft uniform	D, k conc.	Lr or S, k conc.	L, k/ft uniform	Combined uniform k/ft	Combined conc., k
Load	1.20	8.00	20.00	2.10		
Load factor	1.20	1.20	1.60	0.50		
Vertical factored load	1.44	9.60	32.00	1.05	2.49	41.60

3b. 1.2D+1.6(Lr os S)+0.5W

Source	D, k/ft uniform	D, k conc.	Lr or S conc.	W, k conc.	Combined uniform, k/ft	Combined conc., k
Load	1.20	8.00	20.00	18.00		
Load factor	1.20	1.20	1.60	0.50		
Vertical load	1.44	9.60	32.00		1.44	41.60
Horizontal load				9.00		9.00

4. 1.2D+1.0W+0.5L+0.5(Lr or S)

1.18 Contd.

Source	D, k/ft uniform	D, k conc	L, k/ft uniform	W, k conc.	Lr or S, k conc.	Combined uniform k/ft	Combined conc., k
Load	1.20	8.00	2.10	18.00	20.00		
Load factor	1.20	1.20	0.50	1.00	0.50		
Vertical load	1.44	9.60	1.05		10.00	2.49	19.60
Horizontal load				18.00			18.00

5. 1.2D+Ev+Eh+0.5L+0.2S

Source	D, k/ft uniform	D, k conc.	L, k/ft uniform	Ev, k/ft	Eh, k conc.	S, k Conc., k	Combined uniform,k/ft	Combined conc., k
Load	1.20	8.00	2.10	0.00	25.00	20.00		
Load factor	1.20	1.20	0.50	1.00	1.00	0.20		
Vertical load	1.44	9.60	1.05	0.00		4.00	2.49	13.60
Horizontal load					25.00			25.00

6. 0.9D+1W

Source	D, k/ft uniform	D, k conc.	W, k conc.	Combined uniform, k/ft	Combined con. K
Load	1.20	8.00	18.00		
Load factor	0.90	0.90	1.00		
Vertical load	1.08	7.20		1.08	7.20
Horizontal load			18.00		18.00

7. 0.9D+Eh-Ev

Source	D, k/ft uniform	D, k conc.	Eh, K conc.	Ev, k/ft uniform	Combined uniform,k/ft	Combined conc., k
Load	1.20	8.00	25.00	0.00		
Load factor	0.90	0.90	1.00	-1.00		
Vertical load	1.08	7.20		0.00	1.08	7.20
Horizontal load			25.00			0.00

Load cases (2), (4) and (5) to be evaluated

1.19

	Uniform,k/ft	Conc., k
Dead load, k/ft (D)	1.80	12.00
Live load, k/ft (L)	3.15	
Wind load, horiz., k, Wh		27.00
Earthquake, horz., k, Eh		37.50
Earthquake, vert., k/ft, Ev	0.00	
Snow load, S		30.00
Roof Live load, Lr		

1. $w_u = 1.4D$ 2.52

Source	D, k/ft	D, k
Load	1.80	12.00
Load factor	1.40	1.40
Vertical factored load	2.52	16.80

2. wu=1.2D +1.6L + 0.5(Lr or S)

Source	D, k/ft uniform	D, k conc.	L, k/ft	Lr or S, k	Combined Uniformk/ft	Combined Conc., k
Load	1.80	12.00	3.15	30.00		
Load factor	1.20	1.20	1.60	0.50		
Vertical factored load	2.16	14.40	5.04	15.00	7.20	29.40

3. This has following two cases

3a. 1.2D+1.6(Lr or S) + 0.5L

Source	D, k/ft uniform	D, k conc.	Lr or S, k conc.	L, k/ft uniform	Combined uniform k/ft	Combined conc., k
Load	1.80	12.00	30.00	3.15		
Load factor	1.20	1.20	1.60	0.50		
Vertical factored load	2.16	14.40	48.00	1.58	3.74	62.40

3b. 1.2D+1.6(Lr os S)+0.5W

Source	D, k/ft uniform	D, k conc.	Lr or S conc.	W, k conc.	Combined uniform, k/ft	Combined conc., k
Load	1.80	12.00	30.00	27.00		
Load factor	1.20	1.20	1.60	0.50		
Vertical load	2.16	14.40	48.00		2.16	62.40
Horizontal load				13.50		13.50

4. 1.2D+1.0W+0.5L+0.5(Lr or S)

#1.19 Contd.

Source	D, k/ft uniform	D, k conc	L, k/ft uniform	W, k conc.	Lr or S, k conc.	Combined uniform k/ft	Combined conc., k
Load	1.80	12.00	3.15	27.00	30.00		
Load factor	1.20	1.20	0.50	1.00	0.50		
Vertical load	2.16	14.40	1.58		15.00	3.74	29.40
Horizontal load				27.00			27.00

5. 1.2D+Ev+Eh+0.5L+0.2S

Source	D, k/ft uniform	D, k conc.	L, k/ft uniform	Ev, k/ft	Eh, k conc.	S, k Conc., k	Combined uniform,k/ft	Combined conc., k
Load	1.80	12.00	3.15	0.00	37.50	30.00		
Load factor	1.20	1.20	0.50	1.00	1.00	0.20		
Vertical load	2.16	14.40	1.58	0.00		6.00	3.74	20.40
Horizontal load					37.50			37.50

6. 0.9D+1W

Source	D, k/ft uniform	D, k conc.	W, k conc.	Combined uniform, k/ft	Combined con. K
Load	1.80	12.00	27.00		
Load factor	0.90	0.90	1.00		
Vertical load	1.62	10.80		1.62	10.80
Horizontal load			27.00		27.00

7. 0.9D+Eh-Ev

Source	D, k/ft uniform	D, k conc.	Eh, K conc.	Ev, k/ft uniform	Combined uniform,k/ft	Combined conc., k
Load	1.80	12.00	37.50	0.00		
Load factor	0.90	0.90	1.00	-1.00		
Vertical load	1.62	10.80		0.00	1.62	10.80
Horizontal load			37.50			0.00

Load cases (2), (4) and (5) to be evaluated

1.22

A. Distribution of weight

1. First floor $= \frac{10}{10+9+8}(1000) = 370.37$ K
2. Second floor $= \frac{9}{10+9+8}(1000) = 333.33$ K
3. Third floor $= \frac{8}{10+9+8}(1000) = 296.30$ K

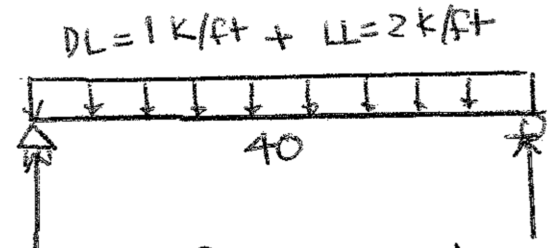
B. Notional lateral force at each floor simultaneously

1. Fx @ first floor $= 0.01(370.37) = 3.7$ K
2. Fx @ second fl. $= 0.01(333.33) = 3.33$ K
3. Fx @ third fl. $= 0.01(296.30) = 2.96$ K

1.23

1. Tributary area of wall at first floor / per foot wall length $= \frac{10}{2} = 5\ ft^2/ft$.
2. Weight of first floor tributary wall $= 40(5) = 200$ lbs/ft
3. Notional horizontal force at first floor $= 0.2(200) = 40$ lbs/ft
4. Tributary wall area at second floor / ft $= \frac{10+9}{2} = 9.5\ ft^2/ft$
5. Weight of second floor trib. wall $= 40(9.5) = 380$ lbs/ft
6. Notional horizontal force at second floor $= 0.2(380) = 76$ lbs/ft
7. Tributary wall area at third floor $= \frac{9+8}{2} = 8.5\ ft^2/ft$
8. Weight of third floor trib. wall $= 40(8.5) = 340$ lbs/ft
9. Notional horizontal force at third floor $= 0.2(340) = 68$ lbs/ft

1.24



Assumed factored Loads

Reactions $= 3(40)/2 = 60$ K

Notional force $= 0.05(60)$
$= 3$ K.

#2.1

	psf
Hardwood	4
Plywood	3
Framing	2.6
Ceiling supports	0.5
Gypsum wallboard	5
Total	15.1

#2.2

1. Concrete slab/unit area		
1 ft x 1ft x 1/12 ft x 150 pcf	12.5	
2. Framing DL adjustment		
Load@ 4 in. OC, i.e 3 sect/ft	2.6	
Load/section	2.6/3	
At 3 in. OC, # sections/ft	4	
Load of 4 sec/ft @ 3 in OC	4*2.6/3 =	3.47

3. Floor DL	
Concrete slab	12.5
Plywood	3
Framing	3.47
Ceiling supports	0.5
Gypsum wallboard	5
Total	24.47

#2.3

1. L_0, psf	40
2. Tribuary area = 20 x 17.5	350
3. For interior beam, K_{LL}	2
4. $K_{LL}A_T$ = 2*350	700
5. $K = 0.25 + \frac{15}{\sqrt{700}}$	0.82
LL = k L_0 = 0.82*40	32.68

2.4

1. Basic LL for office	50		
2. A_T = 40*40	1600		
3. For interior column K_{LL}	4		
4. $K_{LL}A_T$	6400		
5. $K = 0.25 + \frac{15}{\sqrt{6400}}$	0.44	Use min	0.5
LL = 50*0.5	250		

2.5

1. For gymnasium L_o, psf	100.00		
2. $A_T = 50 \times 20$	1000.00		
3. K_{LL}	4.00		
4. $K_{LL}A_T$	4000.00		
5. $K = 0.25 + \frac{15}{\sqrt{4000}}$	0.49	Use min	0.50
LL = 100*0.5	50.00		

2.6

1. K_{LL}	1.00
2. $A_T = 50x20$	1000.00
4. $K_{LL}A_T$	1000.00
5. $K = 0.25 + \frac{15}{\sqrt{1000}}$	0.72
LL = 100*0.72	72.00

2.7

1. Office from 2 floors L_o, psf	100.00	
2. $A_T = 40x40$	1600.00	
3. K_{LL}	4.00	
4. $K_{LL}A_T$	6400.00	
5. $K = 0.25 + \frac{15}{\sqrt{6400}}$	0.44	> 0.4 for two floors
6. LL = 100*0.44	44.00	
7. Alternative LL		
$0.7(L_1 + L_2 + L_3 + \quad) = 0.7*100$	70.00	← Controls

2.8

1. Total load = 30+25+20, psf	75.00	
2. $A_T = 25x30$	750.00	
3. K_{LL}	2.00	
4. $K_{LL}A_T$	1500.00	
5. $K = 0.25 + \frac{15}{\sqrt{1500}}$	0.64	
6. LL = 75*0.64	48.00	
7. Alternative LL		
$0.7(L_1 + L_2 + L_3 + \quad)$		
0.7 (30+ 25 + 20)	52.50	←Controls
8. Min LL = Max on a floor = 30		

2.9

1. LL = L (1 + IF)	
2. IF = 1 for Elevator	
= 0.33 for Hanger	1.33
3. LL = 52.5 (1 + 1.33)	122.325

2.10

1. For gymnasium $L_{o,}$ psf	100.00
2. A_T = 50 x 20	1000.00
3. For interior beam K_{LL}	2.00
4. $K_{LL}A_T$	2000.00
5. $K = 0.25 + \frac{15}{\sqrt{2000}}$	0.585
6. LL = 100*0.585	58.54
7. Design Load	
LL	58.54
Impact factor 50%	29.27
Partition load	15.00
Total	102.81

2.11

1. Roof live load L_0, psf	20.00
2. Roof angle θ= tan-1 (6.3/10)	32.23
3. Horizontal dist = W*cosθ	20.31
4. A_T = 10 x 20.31	203.10
5. R1 = 1.2 - 0.001*A_T	1.00
6. R2 = 1.2 - 0.6*tanθ	0.82
7. L_r = R1*R2*L_0	16.39

2.12

1. Roof live load L_0, psf	20.00	
2. Roof angle θ= tan-1 (6.3/10)	32.23	
3. Horizontal dist = W*cosθ	20.31	
4. A_T = 4 x 20.31	81.22	<200 ft^2 R1 =1
5. Since A_T < 200 R1 =1	1.00	
6. R2 = 1.2 - 0.6*tanθ	0.82	
7. L_r = R1*R2*L_0	16.44	

2.13

1. Roof live load L_0, psf	20		
2. Roof angle θ= tan-1 (1/2)	26.57		
3. Horizontal dist = W	15		
4. $A_T = 15*40$	600		
5. $R1 = 1.2 - 0.001*A_T$	0.6		
6. $R2 = 1.2 - 0.6*\tan\theta$	0.90		
7. $L_r = R1*R2*L_0$	10.80	< 12 psf	Use 12
8. Minimum roof live load	12.00	psf	

2.14

1. Roof live load L_0, psf	20.00
2. Roof angle θ= tan-1 (1/2)	26.57
3. Horizontal wall dist = W	7.50
4. $A_T = 7.5*40$	300.00
5. $R1 = 1.2 - 0.001*A_T$	0.90
6. $R2 = 1.2 - 0.6*\tan\theta$	0.90
7. $L_r = R1*R2*L_0$	16.20

2.15

Special roof live load are not reduced by roof live load reductions R1 and R2. However, these will be reduced by the provisions of floor live loads

1. For garden roof L_o, psf	100.00
2. $A_T = 250$	250.00
3. K_{LL}	4.00
4. $K_{LL}A_T$	1000.00
5. $K = 0.25 + \frac{15}{\sqrt{1000}}$	0.724
$L_r = 100*0.72$	72.43

SNOW LOADS COMPUTATIONS #3.1

Balanced Snow Loads

DATA:

Ground snow load, p_g		20
Flat snow load for upper roof if separately given p_f		
Roof slope, degree		2.38
Eve to ridge width, W		130
For drift, higher roof length, L_u		
For drift, lower roof length, L_L		
For drift, difference of roofs elev.		
For Unbalanced, prismatic/light gauge rafters		
For drift, are structures separated?		
Separation horizontal distance		
Separation vertical distance		
For sliding, upper roof slippery		
For sliding, are structures separated?		
Separation horizontal distance		
Separation vertical distance		
Importance Factor		
Type of structure	ordinary	
I		1
Thermal Factor		
Hot/warm/ventilated/cold or unheated	ventilated	
C_t		1.1
Exposure Factor		
Terrain	suburban	
Fully exp/partially exp/shelter	partial	
C_e		1
Roof Slope Factor		
Slippery/other	other	
C_s		1

COMPUTATIONS

Check for Low slope		
Is low-slope applies? $\theta < 15$	Yes	
Minimum snow load, pm		20
Balanced Snow Load		15.4
Rain on snow check		
$p_g \leq 20$	Yes	
$\theta < W/50$	Yes	
Rain surcharge applies	TRUE	
Rain on Snow Surcharge		5
Balance Snow Load+Rain-on-snow,if applicable		20.4
Controlling Balanced OR Min. Load		20.4

SNOW LOADS COMPUTATIONS #3.2

Balanced Snow Loads

DATA:

Ground snow load, p_g		20
Flat snow load for upper roof if separately given p_f		
Roof slope, degree		2.38
Eve to ridge width, W		30
For drift, higher roof length, L_u		
For drift, lower roof length, L_L		
For drift, difference of roofs elev.		
For Unbalanced, prismatic/light gauge rafters		
For drift, are structures separated?		
Separation horizontal distance		
Separation vertical distance		
For sliding, upper roof slippery		
For sliding, are structures separated?		
Separation horizontal distance		
Separation vertical distance		
Importance Factor		
Type of structure	ordinary	
I		1
Thermal Factor		
Hot/warm/ventilated/cold or unheated	ventilated	
C_t		1.1
Exposure Factor		
Terrain	suburban	
Fully exp/partially exp/shelter	partial	
C_e		1
Roof Slope Factor		
Slippery/other	other	
C_s		1
COMPUTATIONS:		
Check for Low slope		
Is low-slope applies? $\theta < 15$	Yes	
Minimum snow load, pm		20
Balanced Snow Load		15.4
Rain on snow check		
$p_g \leq 20$	Yes	
$\theta < W/50$	No	
Rain surcharge applies	FALSE	
Rain on Snow Surcharge		0
Balance Snow Load+Rain-on-snow,if applicable		15.4
Controlling Balanced OR Min. Load		20

SNOW LOADS COMPUTATIONS #3.3

Balanced Snow Loads

DATA:

Ground snow load, p_g		30
Flat snow load for upper roof if separately given p_f		
Roof slope, degree		15.64
Eve to ridge width, W		25
For drift, higher roof length, L_u		
For drift, lower roof length, L_L		
For drift, difference of roofs elev.		
For Unbalanced, prismatic/light gauge rafters		
For drift, are structures separated?		
Separation horizontal distance		
Separation vertical distance		
For sliding, upper roof slippery		
For sliding, are structures separated?		
Separation horizontal distance		
Separation vertical distance		
Importance Factor		
Type of structure	ordinary	
I		1
Thermal Factor		
Hot/warm/ventilated/cold or unheated	heated	
C_t		1
Exposure Factor		
Terrain	urban	
Fully exp/partially exp/shelter	shltered	
C_e		1.2
Roof Slope Factor		
Slippery/other	other	
C_s		1

COMPUTATIONS:

Check for Low slope		
Is low-slope applies? $\theta < 15$	No	
Minimum snow load, pm	Not applicable	
Balanced Snow Load		25.2
Rain on snow check		
$p_g \leq 20$	No	
$\theta < W/50$	No	
Rain surcharge applies	FALSE	
Rain on Snow Surcharge		0
Balance Snow Load+Rain-on-snow,if applicable		25.2
Controlling Balanced OR Min. Load		25.2

SNOW LOADS COMPUTATIONS #3.4

Balanced Snow Loads

DATA:

Ground ~~snow~~ load, p_g	25
Flat snow load for upper roof if separately given p_f	
Roof slope, degree	11.305
Eve to ridge width, W	20
For drift, higher roof length, L_u	
For drift, lower roof length, L_L	
For drift, difference of roofs elev.	-
For Unbalanced, prismatic/light gauge rafters	
For drift, are structures separated?	
Separation horizontal distance	
Separation vertical distance	
For sliding, upper roof slippery	
For sliding, are structures separated?	
Separation horizontal distance	
Separation vertical distance	
Importance Factor	
Type of structure	High occupancy
I	1.1
Thermal Factor	
Hot/warm/ventilated/cold or unheated	Ventilated
C_t	1.1
Exposure Factor	
Terrain	urban
Fully exp/partially exp/shelter	Fully exposed
C_e	0.9
Roof Slope Factor	
Slippery/other	other
C_s	1

COMPUTATIONS:

Check for Low slope	—
Is low-slope applies? $\theta < 15$	Yes
Minimum snow load, pm	22
Balanced Snow Load	19.06
Rain on snow check	
$p_g \leq 20$	No
$\theta < W/50$	No
Rain surcharge applies	FALSE
Rain on Snow Surcharge	0
Balance Snow Load+Rain-on-snow,if applicable	19.0575
Controlling Balanced OR Min. Load	22

SNOW LOADS COMPUTATIONS #3.5

Balanced Snow Loads

DATA:

Ground snow load, p_g		20
Flat snow load for upper roof if separately given p_f		
Roof slope, degree		2.38
Eve to ridge width, W		130
For drift, higher roof length, L_u		
For drift, lower roof length, L_L		
For drift, difference of roofs elev.	-	
For Unbalanced, prismatic/light gauge rafters	yes	
For drift, are structures separated?		
Separation horizontal distance		
Separation vertical distance		
For sliding, upper roof slippery		
For sliding, are structures separated?		
Separation horizontal distance		
Separation vertical distance		
Importance Factor		
Type of structure	ordinary	
I		1
Thermal Factor		
Hot/warm/ventilated/cold or unheated	ventilated	
C_t		1.1
Exposure Factor		
Terrain	suburban	
Fully exp/partially exp/shelter	partial	
C_e		1
Roof Slope Factor		
Slippery/other	other	
C_s		1

COMPUTATIONS

Check for Low slope	—	
Is low-slope applies? $\theta < 15$	Yes	
Minimum snow load, pm		20
Balanced Snow Load		15.4
Rain on snow check		
$p_g \leq 20$	Yes	
$\theta < W/50$	Yes	
Rain surcharge applies	TRUE	
Rain on Snow Surcharge		5
Balance Snow Load+Rain-on-snow,if applicable		20.4
Controlling Balanced OR Min. Load		20.4

SNOW LOADS COMPUTATIONS #3.6

Balanced Snow Loads

DATA:

Ground snow load, p_g		20
Flat snow load for upper roof if separately given p_f		
Roof slope, degree		2.38
Eve to ridge width, W		30
For drift, higher roof length, L_u		
For drift, lower roof length, L_L		
For drift, difference of roofs elev.		-
For Unbalanced, prismatic/light gauge rafters		
For drift, are structures separated?		
Separation horizontal distance		
Separation vertical distance		
For sliding, upper roof slippery		
For sliding, are structures separated?		
Separation horizontal distance		
Separation vertical distance		
Importance Factor		
Type of structure	ordinary	
I		1
Thermal Factor		
Hot/warm/ventilated/cold or unheated	ventilated	
C_t		1.1
Exposure Factor		
Terrain	suburban	
Fully exp/partially exp/shelter	partial	
C_e		1
Roof Slope Factor		
Slippery/other	other	
C_s		1

COMPUTATIONS:

Check for Low slope		—
Is low-slope applies? $\theta < 15$	Yes	
Minimum snow load, pm		20
Balanced Snow Load		15.4
Rain on snow check		
$p_g \leq 20$	Yes	
$\theta < W/50$	No	
Rain surcharge applies	FALSE	
Rain on Snow Surcharge		0
Balance Snow Load+Rain-on-snow,if applicable		15.4
Controlling Balanced OR Min. Load		20

SNOW LOADS COMPUTATIONS #3.7

Balanced Snow Loads

DATA:

Ground snow load, p_g		30
Flat snow load for upper roof if separately given p_f		
Roof slope, degree		15.64
Eve to ridge width, W		25
For drift, higher roof length, L_u		
For drift, lower roof length, L_L		
For drift, difference of roofs elev.		-
For Unbalanced, prismatic/light gauge rafters	yes	
For drift, are structures separated?		
Separation horizontal distance		
Separation vertical distance		
For sliding, upper roof slippery		
For sliding, are structures separated?		
Separation horizontal distance		
Separation vertical distance		
Importance Factor		
Type of structure	ordinary	
I		1
Thermal Factor		
Hot/warm/ventilated/cold or unheated	heated	
C_t		1
Exposure Factor		
Terrain	urban	
Fully exp/partially exp/shelter	shltered	
C_e		1.2
Roof Slope Factor		
Slippery/other	other	
C_s		1
COMPUTATIONS:		
Check for Low slope		
Is low-slope applies? $\theta < 15$	No	
Minimum snow load, pm	Not applicable	
Balanced Snow Load		25.2
Rain on snow check		
$p_g \leq 20$	No	
$\theta < W/50$	No	
Rain surcharge applies	FALSE	
Rain on Snow Surcharge		0
Balance Snow Load+Rain-on-snow,if applicable		25.2
Controlling Balanced OR Min. Load		25.2

SNOW LOADS COMPUTATIONS #3.8

Balanced Snow Loads

DATA:

Ground snow load, p_g		25
Flat snow load for upper roof if separately given p_f		
Roof slope, degree		11.305
Eve to ridge width, W		20
For drift, higher roof length, L_u		
For drift, lower roof length, L_L		
For drift, difference of roofs elev.		
For Unbalanced, prismatic/light gauge rafters	yes	
For drift, are structures separated?		
Separation horizontal distance		
Separation vertical distance		
For sliding, upper roof slippery		
For sliding, are structures separated?		
Separation horizontal distance		
Separation vertical distance		
Importance Factor		
Type of structure	High occupancy	
I		1.1
Thermal Factor		
Hot/warm/ventilated/cold or unheated	Ventilated	
C_t		1.1
Exposure Factor		
Terrain	urban	
Fully exp/partially exp/shelter	Fully exposed	
C_e		0.9
Roof Slope Factor		
Slippery/other	other	
C_s		1

COMPUTATIONS:

Check for Low slope		
Is low-slope applies? $\theta < 15$	Yes	
Minimum snow load, pm		22
Balanced Snow Load		19.06
Rain on snow check		
$p_g \leq 20$	No	
$\theta < W/50$	No	
Rain surcharge applies	FALSE	
Rain on Snow Surcharge		0
Balance Snow Load+Rain-on-snow,if applicable		19.0575
Controlling Balanced OR Min. Load		22

SNOW LOADS COMPUTATIONS #3.9

Balanced Snow Loads

DATA:

Ground snow load, p_g		30
Flat snow load for upper roof if separately given p_f		
Roof slope, degree		22.61
Eve to ridge width, W		30
For drift, higher roof length, L_u		100
For drift, lower roof length, L_L		100
For drift, difference of roofs elev.		5
For Unbalanced, prismatic/light gauge rafters	yes	
For drift, are structures separated?	No	
Separation horizontal distance		
Separation vertical distance		
For sliding, upper roof slippery		
For sliding, are structures separated?		
Separation horizontal distance		
Separation vertical distance		
Importance Factor		
Type of structure	storage	
I		0.8
Thermal Factor		
Hot/warm/ventilated/cold or unheated	unheated	
C_t		1.2
Exposure Factor		
Terrain	open country	
Fully exp/partially exp/shelter	partial	due to upper
C_e		1
Roof Slope Factor		
Slippery/other	slippery	
C_s		0.86

COMPUTATIONS:

Check for Low slope		
Is low-slope applies? θ < 15	No	
Minimum snow load, pm	Not applicable	
Balanced Snow Load		17.34
Rain on snow check		
$p_g \leq 20$	No	
$\theta < W/50$	No	
Rain surcharge applies	FALSE	
Rain on Snow Surcharge		0
Balance Snow Load+Rain-on-snow,if applicable		17.34
Controlling Balanced OR Min. Load		17.34

SNOW LOADS COMPUTATIONS #3.10

Balanced Snow Loads

DATA:

Ground snow load, p_g		30	
Flat snow load for upper roof if separately given p_f			
Roof slope, degree		22.61	
Eve to ridge width, W		30	
For drift, higher roof length, L_u		100	
For drift, lower roof length, L_L		100	
For drift, difference of roofs elev.		3	
For Unbalanced, prismatic/light gauge rafters	yes		
For drift, are structures separated?	No		
Separation horizontal distance			
Separation vertical distance			
For sliding, upper roof slippery			
For sliding, are structures separated?			
Separation horizontal distance			
Separation vertical distance			
Importance Factor			
Type of structure	storage		
I		0.8	
Thermal Factor			
Hot/warm/ventilated/cold or unheated	unheated		
C_t		1.2	
Exposure Factor			
Terrain	open country		
Fully exp/partially exp/shelter	partial		due to upper
C_e		1	
Roof Slope Factor			
Slippery/other	slippery		
C_s		0.86	

COMPUTATIONS:

Check for Low slope		
Is low-slope applies? $\theta < 15$	No	
Minimum snow load, pm	Not applicable	
Balanced Snow Load		17.34
Rain on snow check		
$p_g \leq 20$	No	
$\theta < W/50$	No	
Rain surcharge applies	FALSE	
Rain on Snow Surcharge		0
Balance Snow Load+Rain-on-snow,if applicable		17.34
Controlling Balanced OR Min. Load		17.34

SNOW LOADS COMPUTATIONS #3.11

Balanced Snow Loads

DATA:

Ground snow load, p_g		30	
Flat snow load for upper roof if separately given p_f			
Roof slope, degree		0	
Eve to ridge width, W		30	
For drift, higher roof length, L_u		70	
For drift, lower roof length, L_L		60	
For drift, difference of roofs elev.		5	
For Unbalanced, prismatic/light gauge rafters	yes		
For drift, are structures separated?	No		
Separation horizontal distance			
Separation vertical distance			
For sliding, upper roof slippery			
For sliding, are structures separated?			
Separation horizontal distance			
Separation vertical distance			
Importance Factor			
Type of structure	storage		
I		0.8	
Thermal Factor			
Hot/warm/ventilated/cold or unheated	unheated		
C_t		1.2	
Exposure Factor			
Terrain	open country		
Fully exp/partially exp/shelter	partial		due to upper
C_e		1	
Roof Slope Factor			
Slippery/other	slippery		
C_s		1	

COMPUTATIONS:

Check for Low slope			
Is low-slope applies? $\theta < 15$	Yes		
Minimum snow load, pm		16	
Balanced Snow Load		20.16	
Rain on snow check			
$p_g \leq 20$	No		
$\theta < W/50$	Yes		
Rain surcharge applies	FALSE		
Rain on Snow Surcharge		0	
Balance Snow Load+Rain-on-snow,if applicable		20.16	
Controlling Balanced OR Min. Load		20.16	

SNOW LOADS COMPUTATIONS #3.12

Balanced Snow Loads

DATA:

Ground snow load, p_g	30	
Flat snow load for upper roof if separately given p_f		
Roof slope, degree	22.61	
Eve to ridge width, W	30	
For drift, higher roof length, L_u	100	
For drift, lower roof length, L_L	100	
For drift, difference of roofs elev.	5	
For Unbalanced, prismatic/light gauge rafters	yes	
For drift, are structures separated?	yes	
For drift, Separation horizontal distance	15	
For drift, Separation vertical distance	5	
For sliding, upper roof slippery		
For sliding, are structures separated?		
Separation horizontal distance		
Separation vertical distance		
Importance Factor		
Type of structure	storage	
I	0.8	
Thermal Factor		
Hot/warm/ventilated/cold or unheated	unheated	
C_t	1.2	
Exposure Factor		
Terrain	open country	
Fully exp/partially exp/shelter	partial	due to upper
C_e	1	
Roof Slope Factor		
Slippery/other	slippery	
C_s	0.86	

COMPUTATIONS:

Check for Low slope	
Is low-slope applies? $\theta < 15$	No
Minimum snow load, pm	Not applicable
Balanced Snow Load	17.34
Rain on snow check	
$p_g \leq 20$	No
$\theta < W/50$	No
Rain surcharge applies	FALSE
Rain on Snow Surcharge	0
Balance Snow Load+Rain-on-snow,if applicable	17.34
Controlling Balanced OR Min. Load	17.34

SNOW LOADS COMPUTATIONS #3.13

Balanced Snow Loads

DATA:

Ground snow load, p_g		30	
Flat snow load for upper roof if separately given p_f			
Roof slope, degree		0	
Eve to ridge width, W		30	
For drift, higher roof length, L_u		70	
For drift, lower roof length, L_L		60	
For drift, difference of roofs elev.		5	
For Unbalanced, prismatic/light gauge rafters	yes		
For drift, are structures separated?	yes		
For drift, Separation horizontal distance		10	
For drift, Separation vertical distance		5	
For sliding, upper roof slippery			
For sliding, are structures separated?			
Separation horizontal distance			
Separation vertical distance			
Importance Factor			
Type of structure	storage		
I		0.8	
Thermal Factor			
Hot/warm/ventilated/cold or unheated	unheated		
C_t		1.2	
Exposure Factor			
Terrain	open country		
Fully exp/partially exp/shelter	partial		due to upper
C_e		1	
Roof Slope Factor			
Slippery/other	slippery		
C_s		0.86	

COMPUTATIONS:

Check for Low slope			
Is low-slope applies? $\theta < 15$	Yes		
Minimum snow load, pm		16	
Balanced Snow Load		17.34	
Rain on snow check			
$p_g \leq 20$	No		
$\theta < W/50$	Yes		
Rain surcharge applies	FALSE		
Rain on Snow Surcharge		0	
Balance Snow Load+Rain-on-snow,if applicable		17.34	
Controlling Balanced OR Min. Load		17.34	

#3.14

SLIDING SNOW LOAD

Flat snow load, p_f	18.9	
Controlling angle	2.38	
Sliding Snow Load Applicable	TRUE	See below
Skip the following steps if	**B3 is No**	
Upper roof W	35	
Sliding Snow Load, $S_{L, psf}$	17.64	
Distributed on length	15	
Sliding snow load/ft	264.6	
SLIDING ON SEPARATED	**STRUCT**	
Separation dist s <15	FALSE	
Vertical dist h > horiz. dis s	FALSE	
Sliding case applies?	FALSE	
Sliding load, S_L, psf	0	
Distrubuted on length	0	
Sliding snow load , pounds/ft	0	

#3.15

SLIDING SNOW LOAD

Flat snow load, p_f	23.1	
Controlling angle	9.5	
Sliding Snow Load Applicable	TRUE	See below
Skip the following steps if	**B3 is No**	
Upper roof *W*	50	
Sliding Snow Load, $S_{L,\ psf}$	30.8	
Distributed on length	15	
Sliding snow load, pounds/ft	462	
SLIDING ON SEPARATED	**STRUCT**	
Separation dist s <15	FALSE	
Vertical dist h > horiz. dis s	FALSE	
Sliding case applies?	FALSE	
Sliding load, S_L, psf	0	
Distrubuted on max length	0	
Sliding snow load, pounds/ft	0	

#3.16

SLIDING SNOW LOAD

Flat snow load, p_f	12.6	
Controlling angle	9.5	
Sliding Snow Load Applicable	TRUE	See below
Skip the following steps if	**B3 is No**	
Upper roof W	20	
Sliding Snow Load, $S_{L, psf}$	6.72	
Distributed on max length	12	
Sliding snow load, pounds/ft	80.64	
SLIDING ON SEPARATED	**STRUCT**	
Separation dist s <15	FALSE	
Vertical dist h > horiz. dis s	FALSE	
Sliding case applies?	FALSE	
Sliding load, S_L, psf	0	
Distrubuted on max length	0	
Sliding snow load, pounds/ft	0	

#3.17

SLIDING SNOW LOAD

Flat snow load, p_f	23.1	
Controlling angle	9.5	
Sliding Snow Load Applicable	FALSE	sL= 0
Skip the following steps if	**B3 is No**	
Upper roof W	50	
Sliding Snow Load, $S_{L, psf}$	0	
Distributed on max length	15	
Sliding snow load, pounds/ft	0	
SLIDING ON SEPARATED	**STRUCT**	
Separation dist s <15	TRUE	
Vertical dist h > horiz. dis s	TRUE	
Sliding case applies?	TRUE	
Sliding load, S_L, psf	30.8	
Distrubuted on max length	13	
Sliding snow load, pounds/ft	400.4	

3.18

SLIDING SNOW LOAD

Flat snow load, p_f	12.6	
Controlling angle	9.5	
Sliding Snow Load Applicable	FALSE	sL= 0
Skip the following steps if	**B3 is No**	
Upper roof W	20	
Sliding Snow Load, $S_{L, psf}$	0	
Distributed on length	12	
Sliding snow load, pounds/ft	0	
SLIDING ON SEPARATED	**STRUCT**	
Separation dist s <15	TRUE	
Vertical dist h > horiz. dis s	TRUE	
Sliding case applies?	TRUE	
Sliding load, S_L, psf	6.72	
Distrubuted on max length	12	
Sliding snow load, pounds/ft	80.64	

WIND LOADS MWFRS #4.5

Parameters							
Length	100						
Width	50						
First floor height	0						
Second floor height	14						
Roof slope, degree	15.64	Roof ht	7.00				
Basic wind speed, mph	140						
Wind speed data: Write on sheet 4							
Risk Category	standard						
Exposure Factor							
Exposure category	B						
Mean roof height	17.50						
λ	1						
Topographic Factor, K_{zt}	1						
DATA TRANSFERRED FROM INTERPOLATOR ON SHEET 4							
Horizontal pressures for slope θ	A	B	C	D			
Standard design values, p_{s30}	39.51	-12.71	26.35	-7.26			
Vertical pressures for slope θ	E	F	G	H			
Standard design values, ps30	-37.30	-24.60	-26.00	-18.74			
* For Longitudinal direction roof angle to be taken zero							
FOR ZERO ROOF ANGLE	A	C	E	F	G	H	
Standard design values, ps30	31.10	20.60	-37.30	-21.20	-26.00	-16.40	
h = mean ht or eave ht if θ<10	17.50						
End zone dimension, a	5						
Net wind pressure, p_s	1 p_{s30}						

Transverse Wind Direction #4.5Cont

A. Horizontal Force Roof Level	Zone	Height	Width	Area	$p_s = p30\lambda K$	Load, lbs
End wall	A	14	10	140.00	39.512	5531.68
End roof	B	7.00	10	70.02	0.000	0.00
Interior wall	C	14	90	1260.00	26.346	33195.46
Interior roof	D	7.00	90	630.17	0.000	0.00
TOTAL				2100.19		38727.14

If Pressures in Zone B and D are negative treat to be zero

B.Horizontal Second Floor Level	Zone	Height	Width	Area	$ps = p30\lambda K$	Load, lbs
End wall	A	0.00	10.00	0.00	39.51	0.00
Interior wall	C	0.00	90.00	0.00	26.35	0.00
TOTAL				0.00		0.00

C. Vertical Force on Roof	Zone	Length	Width	Area	$p_s = p30\lambda K$	Load, lbs
End Windward	E	25.00	10.00	250.00	-37.30	-9325.00
Interior Windward	G	25.00	90.00	2250.00	-26.00	-58500.00
TOTAL Windward						-67825.00
End Leeward	F	25.00	10.00	250.00	-24.60	-6151.20
Interior Leeward	H	25.00	90.00	2250.00	-18.74	-42166.80
TOTAL Leeward						-48318.00

D. Minimum Wind Force* 28001.524

* Minimum wind force is 16 psf X area on zones A, and C + 8 psf X area on B and D and zero on zones E, F, G, and H

Applicable wind force: Following two cases for maximum effect

(1) Combined items A, B, and C

(2) Minimum Force at item D