#109 COLUMN LOAD ANALYSIS

Column loads, due to distributed and concentrated loadings, are computed by this program. The program has provisions for live load reduction per the Southern Standard Building Code and continuity effects per the ACI Building Code. Loads per floor, as well as cumulative loads are output.

Price $60.00

INPUT

Number of floors
Reduction code
Column type
Floor number
Repititions
Continuity code
Tributary dimensions
Uniform loads
Concentrated loads

OUTPUT

Floor number
Dead load per floor
Live load per floor
Reduction factor
Cumulative dead load
Cumulative live load
Total cumulative load

COMMENTARY CP109

There are four cases of columns that must be distinguished by the column code and by the values of L_1, L_2, L_3, L_4. It is very important that the following pages are carefully studied,.and that values are assigned as noted. The four cases are:

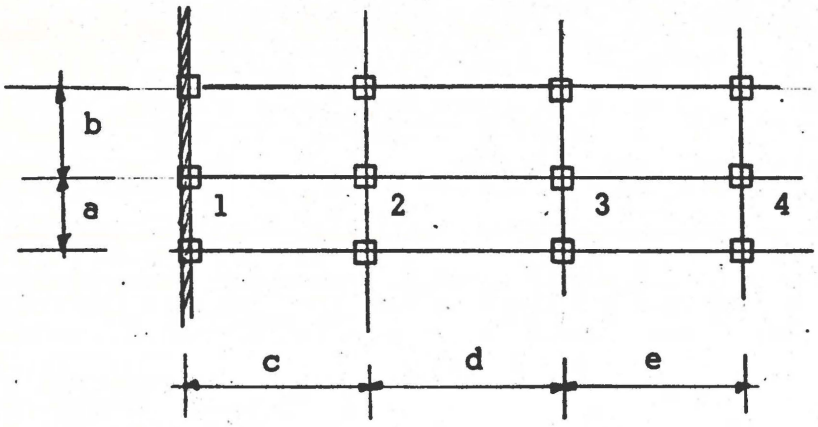
CASE I: Corner column
Column type; CT = 1
$L_1 = 0$
$L_2 = 0$

CASE II: Edge column
Column type; CT = 1
$L_1 = 0$

CASE III: First interior column
Column type; CT = 0

CASE IV: Interior column
Column type; CT = 1

Continuity effects can be considered by inputting 1 for the continuity code (c = 1). If a simple span is desired, input 0 for the continuity code (c = 0). When continuity effects are considered the following factors are used:



Column 1

$$V = \frac{(a+b)(c)(w)(.85)}{4}$$

Column 2

$$V = \frac{1.15(a+b)(c)(w)}{4} + \frac{(a+b)(d)(w)}{4}$$

Column 3

$$V = \frac{(a+b)(d+e)(w)}{4}$$

Commentary cont.

Live loads are reduced per section 1203.1 (e) Southern Standard Building Code. Input 1 if reduction is desired, otherwise input o.

Input item #15 is the number of floors the loading conditions repeat. When the same loading conditions repeat themselves, input the loads only once and input the number of times the loads are repeated.

After the program has been run it clears the files and returns to accept a new column.

Capacity of this program is 50 floors. Should a number greater than 50 be input for input item #7, the program will not accept the number, but will wait until a number of floors less than or equal to 50 has been entered.

EQUATIONS USED

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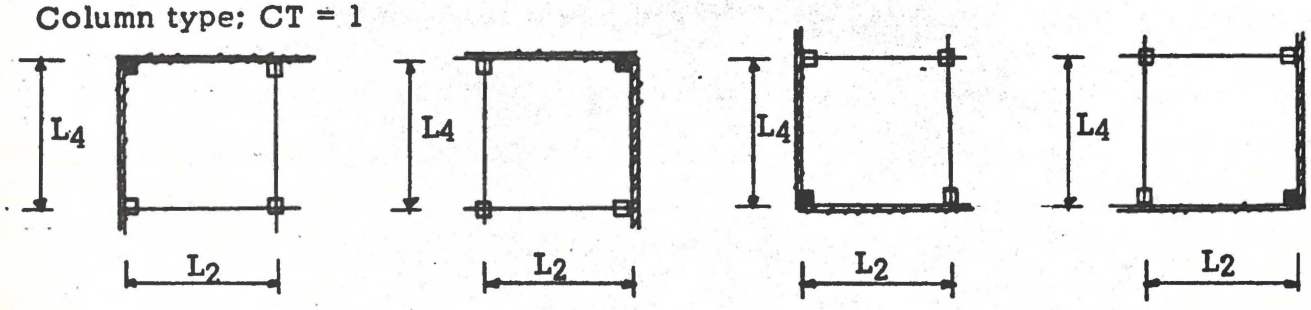
CASE I: Corner column
Column type: CT = 1



$L_1 = 0$
$L_3 = 0$

Assuming continuity: (c = 1)

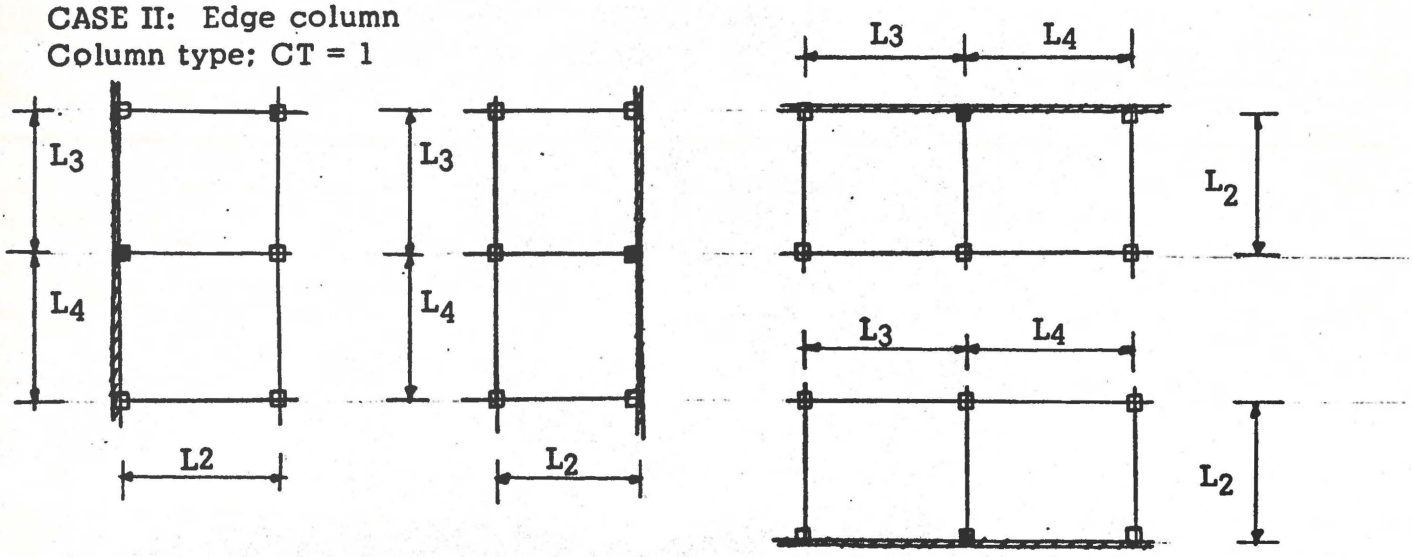
$$Vw = \frac{.85(L_2)(L_4)(w)}{4} = .2125(L_2)(L_4)(w)$$

Assuming simple support: (c = 0)

$$Vw = \frac{(L_2)(L_4)(w)}{4} = .25(L_2)(L_4)(w)$$

w = UDL for Dead load
w = ULL for Live Load

CASE II: Edge column
Column type: CT = 1



$L_1 = 0$

Assuming continuity: (c = 1)

$$Vw = \frac{.85(L_3 + L_4)(L_2)(w)}{4}$$

$$Vw = .2125(L_2)(L_3 + L_4)(w)$$

Assuming simple support: (c = 0)

$$Vw = \frac{L_2(L_3 + L_4)(w)}{2}$$

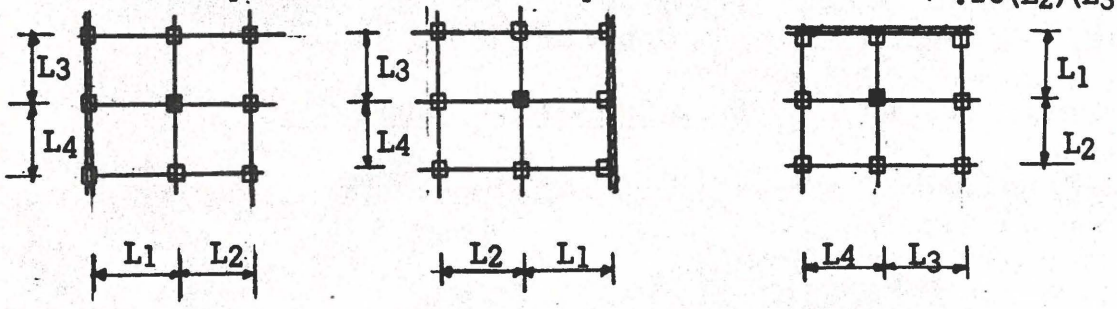
$$Vw = .25(L_2)(L_3 + L_4)(w)$$

w = UDL for Dead Load
w = ULL for Live Load

CASE III: First interior column
Column type: CT = 0

Assuming continuity: (c = 1)

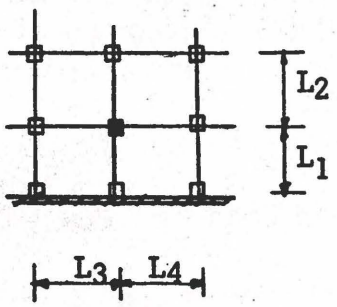
$$Vw = \frac{1.15(L_1)(L_3 + L_4)(w)}{4} + \frac{L_2(L_3 + L_4)(w)}{4} = .2875(L_1)(L_3 + L_4)(w) + .25(L_2)(L_3 + L_4)(w)$$



Assuming simple support: (c = 0)

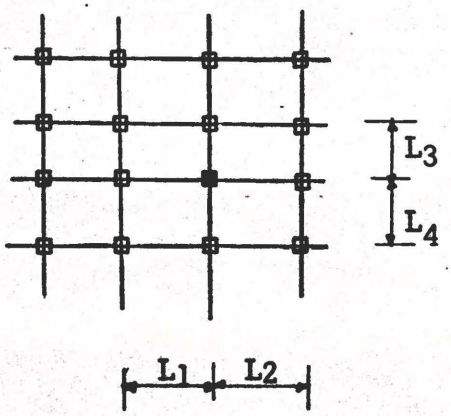
$$Vw = \frac{(L_1)(L_3 + L_4)(w)}{4} + \frac{(L_2)(L_3+L_4)(w)}{4}$$

$$Vw = .25(L_1 + L_2)(L_3 + L_4)(w)$$



w = UDL for Dead Load
w = ULL for Live Load

CASE IV: Interiot columns
Column type: CT = 1



Assuming continuity or simple support: (c = 1 or c = 0)

$$Vw = \frac{(L_1 + L_2)(L_3 + L_4)(w)}{4}$$

w = UDL for Dead Load
w = ULL for Live Load

Dead Load per floor (DL) = Vw + CDL (where w = UDL)

Live Load per floor (LL) = Vw + CLL (where w = ULL)

Use of live load reduction factor:
Reduction code - 1 = yes; 0 = no (input item #9)

Conforms to section 1203.1 (e) Southern Standard Building Code

No reduction for roof load
100% for members carrying one floor
90% for members carrying two floors
80% for members carrying three floors
70% for members carrying four floors
60% for members carrying five floors
50% for members carrying six or more floors

Reduction factor = rf

Cumulative Dead Load = (Vw + CDL).

Cumulative Live Load = (Vw + CLL)roof + (Vw + CLL)(rf)

Total cumulative load = Cumulative DL + Cumulative LL

COMPUTER INSTRUCTIONS

Program Column Load Analysis Program No. 109

Decimal wheel setting
Upper wheel 0
Lower wheel 4

INPUT

1. "RECORD PROGRAM" button out
2. "PRINT PROGRAM" button out
3. Depress "RESET" key on P602
4. Depress "CLEAR" key on MLU600
5. Transfer block 109 to P602
6. Depress "V"
7. Enter number of floors - NF
8. Depress "S"
9. Enter reduction code - 1=yes; 0=no
10. Depress "S"
11. Enter column type - CT
12. Depress "S"
13. Enter floor number - n
14. Depress "S"
15. Enter number of repetitions - nr
16. Depress "S"

OUTPUT

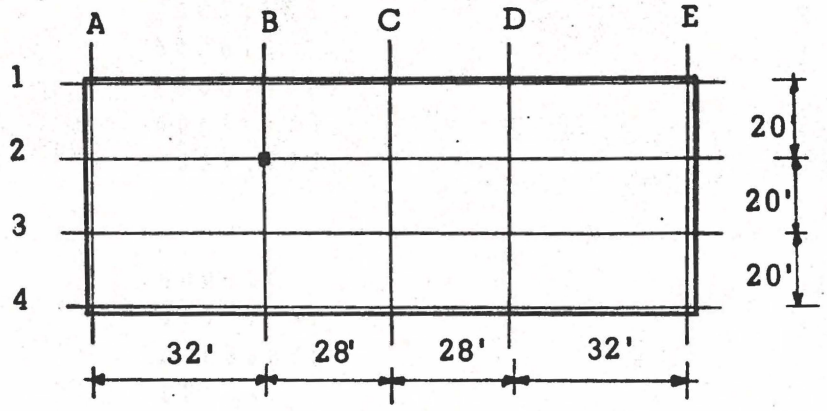
1. Floor number - n
2. Dead load - DL (kips)
3. Live load - LL (kips)
4. Reduction factor - rf
5. Cumulative Dead Load (kips)
6. Cumulative Live Load (kips)
7. Total Cumulative load - Σ(DL + LL) (kips)

17. Continuity code - c
18. Depress "S"
19. Dimension L_1 - (ft.)
20. Depress "S"
21. Dimension L_2 - (ft.)
22. Depress "S"
23. Dimension L_3 - (ft.)
24. Depress "S"
25. Dimension L_4 - (ft.)
26. Depress "S"
27. Uniform dead load - UDL (ksf)
28. Depress "S"
29. Uniform live load - ULL (ksf)
30. Depress "S"
31. Concentrated dead load - CDL (kips)
32. Depress "S"
33. Concentrated live load - CLL (kips)
34. Depress "S"
35. Return to input item #4 for next floor and repeat until all loads are entered.

Note: After the output for each column the program returns to input item #1 for a new column.

CP 109 SAMPLE PROBLEM

Determine the loads on each floor and at the base of column B-2 given the following loading conditions.



Roof load:
DL = .450 psf
LL = .300 psf

Floor loads:
DL = .900 psf
LL = .600 psf

Dead load of the column = 6.0 k/floor

There are six typical floors and then the roof. Assume continuity and reduce the live load.

Data:

NF	= 7		
Reduction code	= 1	Roof load	Floor loads
CT	= 0		
n	= 7		n = 6
nr	= 1		nr = 6
c	= 1		c = 1
L_1	= 32		L_1 = 32
L_2	= 28		L_2 = 28
L_3	= 20		L_3 = 20
L_4	= 20		L_4 = 20
UDL	= .450		UDL = .900
ULL	= .300		ULL = .600
CDL	= 6.0		CDL = 6.0
CLL	= 0.0		CLL = 0.0

Input

NF	=	7	
Reduction code	=	1	5.0000
CT	=	0	589.2000
n	=	7	388.8000
nr	=	1	0.8000
c	=	1	1476.0000
L_1	=	32	816.4800
L2	=	28	2292.4800
L_3	=	20	
L4	=	20	
UDL	=	0.450	4.0000
ULL	=	0.300	589.2000
CDL	=	6.0	388.8000
CLL	=	0	0.7000
n	=	6	2065.2000
nr	=	6	1010.8800
c	=	1	3076.0800
L_1	=	32	
L_2	=	28	
L_3	=	20	3.0000
L_4	=	20	589.2000
UDL	=	0.900	388.8000
ULL	=	0.600	0.6000
CDL	=	6.0	2654.4000
CLL	=	0	1127.5200
			3781.9200

Output

n	=	7.0000	2.0000
DL	=	297.6000	589.2000
LL	=	194.4000	388.8000
rf	=	1.0000	0.5000
cumulative DL	=	297.6000	3243.6000
cumulative LL	=	194.4000	1166.4000
total load	=	492.0000	4410.0000

etc.

6.0000		1.0000
589.2000		589.2000
388.8000		386.8000
0.9000		0.5000
886.8000		3832.8000
544.3200		1360.8000
1431.1200		5193.6000

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Data:

Number of floors (NF)	=	7	
Reduction code (1 = yes, 2 = no)	=	1	
Column type (CT)	=	0	
Floor number (n)	=	7	
Number of repetitions (n)	=	1	
Continuity code	=	1	
Dimension L_1	=	32	ft.
Dimension L_2	=	28	ft.
Dimension L3	=	20	ft.
Dimension L4	=	20	ft.
Uniform dead load (UDL)	=	0.450	ksf
Uniform live load (ULL)	=	0.300	ksf
Concentrated dead load (CDL)	=	6.0	kips
Concentrated live load (CLL)	=	0	kips
Floor number (n)	=	6	
Number of repetitions (nr)	=	6	
Continuity code (c)	=	1	
Dimension L_1	=	32	ft.
Dimension L2	=	28	ft.
Dimension L3	=	20	ft.
Dimension L4	=	20	ft.
Uniform dead load (UDL)	=	0.900	ksf
Uniform live load (ULL)	=	0.600	ksf
Concentrated dead load (CDL)	=	6.0	kips
Concentrated live load (CLL)	=	0	kips
Floor number (n)	=		
Number of repetitions (nr)	=		
Continuity code (c)	=		
Dimension L1	=		ft.
Dimension L_2	=		ft.
Dimension L_3	=		ft.
Dimension L4	=		ft.
Uniform dead load (UDL)	=		ksf
Uniform live load (ULL)	=		ksf
Concentrated dead load (CDL)	=		kips
Concentrated live load (CLL)	=		kips

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Output:

Floor number (n)	=	7.0000	
Dead load (DL)	=	297.6000	kips
Live load (LL)	=	194.4000	kips
Reduction factor (rf)	=	1.0000	
Cumulative dead load	=	297.6000	kips
Cumulative live load	=	194.4000	kips
Total cumulative load	=	492.0000	kips

Floor number (n)	=	6.0000	
Dead load (DL)	=	589.2000	kips
Live load (LL)	=	388.8000	kips
Reduction factor (rf)	=	0.9000	
Cumulative dead load	=	886.8000	kips
Cumulative live load	=	544.3200	kips
Total cumulative load	=	1431.1200	kips

Floor number (n)	=	5.0000	
Dead load (DL)	=	589.2000	kips
Live load (LL)	=	388.8000	kips
Reduction factor (rf)	=	0.8000	
Cumulative dead load	=	1476.0000	kips
Cumulative live load	=	816.4800	kips
Total cumulative load	=	2292.4800	kips

Floor number (n)	=	4.0000	
Dead load (DL)	=	589.2000	kips
Live load (LL)	=	388.8000	kips
Reduction factor (rf)	=	0.7000	
Cumulative dead load	=	2065.2000	kips
Cumulative live load	=	1010.8800	kips
Total cumulative load	=	3076.0800	kips

Floor number (n)	=	3.0000	
Dead load (DL)	=	589.2000	kips
Live load (LL)	=	383.5000	kips
Reduction factor (rf)	=	0.6000	
Cumulative dead load	=	2654.4000	kips
Cumulative live load	=	1127.5200	kips
Total cumulative load	=	3781.9200	kips

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Output:

Floor number (n)	=	2.0000	
Dead load (DL)	=	589.2000	kips
Live load (LL)	=	388.5000	kips
Reduction factor (rf)	=	0.5000	
Cumulative dead load	=	3243.6000	kips
Cumulative live load	=	1166.4000	kips
Total cumulative load	=	4410.0000	kips

Floor number (n)	=	1.0000	
Dead load (DL)	=	589.2000	kips
Live load (LL)	=	386.5000	kips
Reduction factor (rf)	=	0.5000	
Cumulative dead load	=	3832.8000	kips
Cumulative live load	=	1360.9000	kips
Total cumulative load	=	5193.6000	kips

Floor number (n)	=		
Dead load (DL)	=		kips
Live load (LL)	=		kips
Reduction factor (rf)	=		
Cumulative dead load	=		kips
Cumulative live load	=		kips
Total cumulative load	=		kips

Floor number (n)	=		
Dead load (DL)	=		kips
Live load (LL)	=		kips
Reduction factor (rf)	=		
Cumulative dead load	=		kips
Cumulative live load	=		kips
Total cumulative load	=		kips

Floor number (n)	=		
Dead load (DL)	=		kips
Live load (LL)	=		kips
Reduction factor (rf)	=		
Cumulative dead load	=		kips
Cumulative live load	=		kips
Total cumulative load	=		kips

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Data:

Number of floors (NF)	=	
Reduction code (1 = yes, 2 = no)	=	
Column type (CT)	=	
Floor number (n)	=	
Number of repetitions (n)	=	
Continuity code	=	
Dimension L_1	=	ft.
Dimension L_2	=	ft.
Dimension L3	=	ft.
Dimension L4	=	ft.
Uniform dead load (UDL)	=	ksf
Uniform live load (ULL)	=	ksf
Concentrated dead load (CDL)	=	kips
Concentrated live load (CLL)	=	kips
Floor number (n)	=	
Number of repetitions (nr)	=	
Continuity code (c)	=	
Dimension L_1	=	ft.
Dimension L2	=	ft.
Dimension L3	=	ft.
Dimension L4	=	ft.
Uniform dead load (UDL)	=	ksf
Uniform live load (ULL)	=	ksf
Concentrated dead load (CDL)	=	kips
Concentrated live load (CLL)	=	kips
Floor number (n)	=	
Number of repetitions (nr)	=	
Continuity code (c)	=	
Dimension L1	=	ft.
Dimension L_2	=	ft.
Dimension L_3	=	ft.
Dimension L4	=	ft.
Uniform dead load (UDL)	=	ksf
Uniform live load (ULL)	=	ksf
Concentrated dead load (CDL)	=	kips
Concentrated live load (CLL)	=	kips

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Output:

Floor number (n)	=	
Dead load (DL)	=	kips
Live load (LL)	=	kips
Reduction factor (rf)	=	
Cumulative dead load	=	kips
Gumulative live load	=	kips
Total cumulative load	=	kips

Floor number (n)	=	
Dead load (DL)	=	kips
Live load (LL)	=	kips
Reduction factor (rf)	=	
Cumulative dead load	=	kips
Cumulative live load	=	kips
Total cumulative load	=	kips

Floor number (n)	=	
Dead load (DL)	=	kips
Live load (LL)	=	kips
Reduction factor (rf)	=	
Cumulative dead load	=	kips
Cumulative live load	=	kips
Total cumulative load	=	kips

Floor number (n)	=	
Dead load (DL)	=	kips
Live load (LL)	=	kips
Reduction factor (rf)	=	
Cumulative dead load	=	kips
Cumulative live load	=	kips
Total cumulative load	=	kips

Floor number (n)	=	
Dead load (DL)	=	kips
Live load (LL)	=	kips
Reduction factor (rf)	=	
Cumulative dead load	=	kips
Cumulative live load	=	kips
Total cumulative load	=	kips