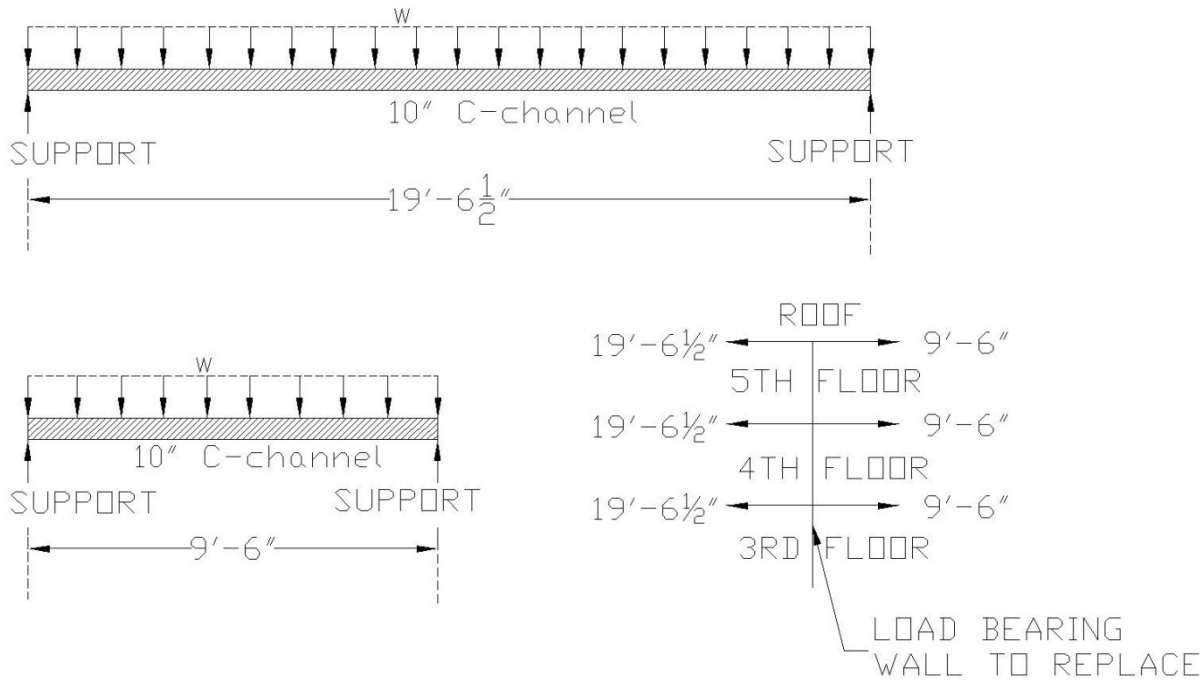


Calculate a beam to replace a load bearing wall in the residence at 3801 St. Charles Ave. Unit #301

GIVEN: This is a 5 Story building, Red Iron framing with 3" concrete decking. The load bearing wall is situated between two rooms. The living room measures 19'-6 1/2" orthogonal to the load bearing wall and the family room measures 9'-6" on the other side of the load bearing wall. There are 2 floors and a roof above the load bearing wall to support.



w loading for each area:

Lighting	1 psf
Hvac ductwork	2 psf
5/8" Sheetrock ceiling	2.8 psf
Metal decking for concrete	2.5 psf
3" concrete floor $3/12 * 120$ pcf =	30 psf
Hardwood floor	4 psf

Each C-channel is approximately 24" o.c. so the area supported by each C-channel is approximately 24" wide x 12" along the C-channel:

$$42.3 \text{ psf} \times 2' \times 1' = 84.6 \text{ plf}$$

Assumption : 10" C-channel weights approx. 7 plf

Adding these together we get  $84.6 \text{ plf} + 7 \text{ plf} = 91.6 \text{ plf}$  along each C-channel

The DEAD LOAD from each C-channel supported by load bearing wall =

$$[(19.5' / 2) + (9.5' / 2)] \times 91.6 \text{ plf} = 1328.2 \# \text{ (1.3k)}$$

LIVE LOAD on each C-channel @ 40 psf =

$$[(19.5' / 2) + (9.5' / 2)] \times 2\text{s.f.} \times 40\text{psf} = 1160 \# \text{ (1.2k)}$$

LRFD Loads  $1.2 D + 1.6 L$

$$[(1.3\text{k} \times 1.2) + (1.2\text{k} \times 1.6)] = 3.48 \text{ k @ 24'' o.c.}$$

Also include the dead loads from the load bearing walls on the 4<sup>th</sup> and 5<sup>th</sup> floors

$$(9' \times 2' \text{ o.c.}) \times 10 \text{ psf} = 180 \# / 24'' \text{ o.c.} \text{ (.2k @ 24'' o.c.)}$$

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Total load from load bearing wall 3.68k @ 24'' o.c.

Length of load bearing wall = 13'-2'' (13.2')

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$$\text{Deflection Limit } \Delta = (13.2' \times 12''/\text{ft}) / 360 = 0.44''$$

w from 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> ceiling loads

$$w = 3.68\text{k} \times 3 = 11.04 \text{ k @ 24'' o.c.}$$

$$\Delta_{\max} = 5wL^4 \frac{1}{(384EI)}$$

$$I_{\min} = 5wL^4 \frac{(1728)}{(384E\Delta)}$$

For I use unfactored w

$$I_{\min} = 5 \times (8.1/2) \times (13.2)^4 \times 1728 / (384 \times 29,000 \times .44)$$

$$I_{\min} = 216.8 \text{ in}^4$$

$$M_{\max} = w \frac{L^2}{8} = (11.04/2) (13.2)^2 / 8 = 120.2 \text{ ft-k}$$

$$V_{\max} = w \frac{L}{2} = (11.04/2) (13.2) / 2 = 36.43 \text{ k}$$

$$Z = \frac{M_{\max}}{(.9 \times F_y)} = 120.2 \text{ ft-k} \times 12 \text{ "/ft} / (.9 \times 50 \text{ ksi}) = 32.5 \text{ in}^3$$

Wide Flange Options:

W8x58	A = 17.1,	d=8.75,	t <sub>w</sub> = 0.510
	I <sub>xx</sub> = 228 > 216.8		Z <sub>xx</sub> = 59.8 > 32.05

W10x45	A=13.3,	d=10.1,	t <sub>w</sub> = 0.350
	I <sub>xx</sub> = 248 > 216.8		Z <sub>xx</sub> = 54.9 > 32.05

W12x30	A=8.79,	d=12.3,	t <sub>w</sub> = 0.26
	I <sub>xx</sub> = 238 > 216.8		Z <sub>xx</sub> = 443.1 > 32.05

Check Shear  $d \cdot t_w \cdot F_y$

W8x58 = 223k > 36.48k

W10x45 = 176.7k > 36.48k

W12x30 = 159.9k > 36.48k

Column Selection:

$$V_{\text{Total}} = w \times L = (11.04/2) (13.2) / 2 = 72.86 \text{ k}$$

Each column supports half the load = 72.86k / 2 = 36.43k

Column Slenderness factor K = 1.5

Column height = KL = 1.5 x 10 = 15

HSS4x 1/4" F<sub>y</sub> = 46 ksi

