DOOR 103A, 103B
CALCULATE FORCES:

6" STUD WALL x 14.33 ft above door (20#/FT^2 x 14.33 = 286.6#/LFT

ROLL-UP DOOR WEIGHT FROM FACTORY = 4100#

4100#/21FT = 100 #/LF

TOTAL DEAD LOAD = 386.6 #/LF or .4k/LF

IBC 2009 Eqn 16-1
1.4D
1.4(0.4k/LF) = 0.56k/LF

Delta Max □= 5wL^4/384EI (AISC Pg 3-220)
I min = 5wL^4 * 1728 / (384E □) □= L*12"/ft /200
= 5 (0.56k/LF) * (20ft)^4 *1728 / (384 * 29,000 * (20*12/200))
= 57.9 in^4

Mmax = (1/8) wL^2 = (1/8) * 0.56 *20.0^2 = 28.0 (ft-k)
Vmax = wL/2 = 0.56 * 20.0/2 = 5.6 k
Z required = Mmax / (.9 Fy) = (28 x 12"/ft) / (.9 * 50ksi) = 7.46 in^3
I required = 57.9 in^4

Select W12X14 A=4.16 d=11.9 tw=0.20 Zxx=17.4>7.46 Ixx=88.6 > 57.9
Check Shear (d * tw * ksi) > Vmax (11.9 * .2 * 50) = 119 > 5.6

5.6k Each Column
18' Each Column

Select HSS 4x4x ¼"

HSS 4x4x 1/4"

AISC Pg 1-92

$t = 0.233$
$A = 12.18$
$r = 1.52$

Pg 16:1-240 $k=2$ ∴ $KL/r = 18' \times 2 \times 12''/ft / 1.52 = 284.2$

$$F_e = \frac{\pi^2 \times E}{(KL/r)^2} > .44 F_y$$

$$F_e = \frac{\pi^2 \times 29{,}000}{(284.2)^2} > .44(46)$$

$F_e = 3.547 > 20.24$

$$F_{cr} = 0.658^{F_y/F_e} \times F_y$$
$$= 0.658^{46/3.54} \times 46 = 0.658^{12.994} \times 46$$
$F_{cr} = 0.1998$

$\phi_c = 0.9$

$\phi_c \times P_n = \phi_c \times F_{cr} \times Area$
$= (.9)(.1998)(12.18)$
$= 2.19^k$

$2.19^k > 0.56^k$ Ok