Approximate Analysis

For performing quicker analysis of indeterminate structure, additional approximations (assumptions) are necessary. Methods of analysis involving such approximations are known as approximate method of analysis.

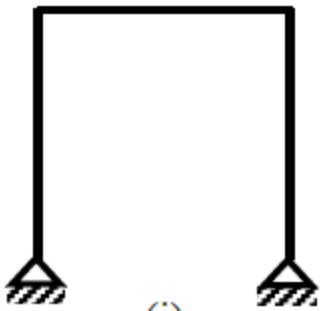
Exact Analysis

Analysis using the usual assumptions that underline structural theory are called exact

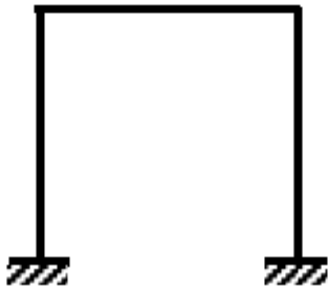
Purposes of Approximate Analysis

- Accurate analysis is time consuming
- Preliminary design and analysis.
- Checking result obtained from computer software
- To enable calculation by hand by reducing the degree of indeterminacy

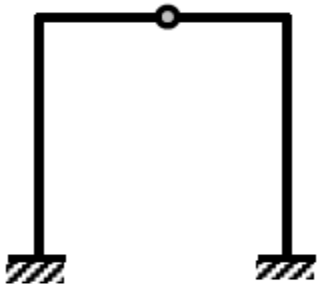
Structural Analysis & Design I



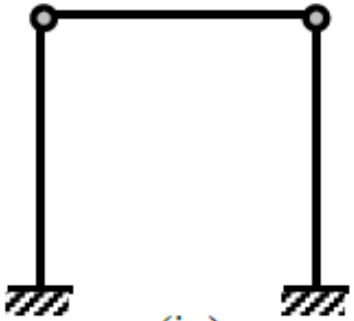
(i)



(ii)



(iii)



(iv)

D of I = (3m + r) – (3J +c)

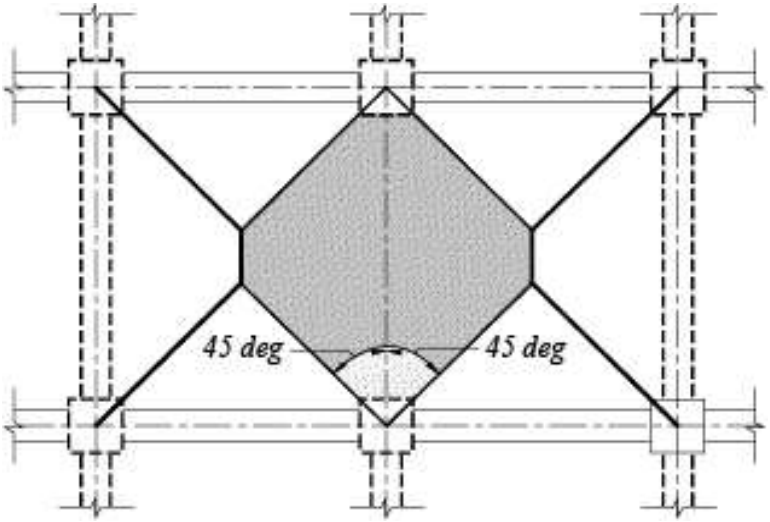
D of i of portal frames shown in (i), (ii), (iii) and (iv) are 1, 3, 2 and 1

Requirement for structural Drawing

Structural analysis

- **Hand calculation of a column capacity**

Slab
(DL+LL+FF+Pwall)
⇩
Beam
⇩
Column

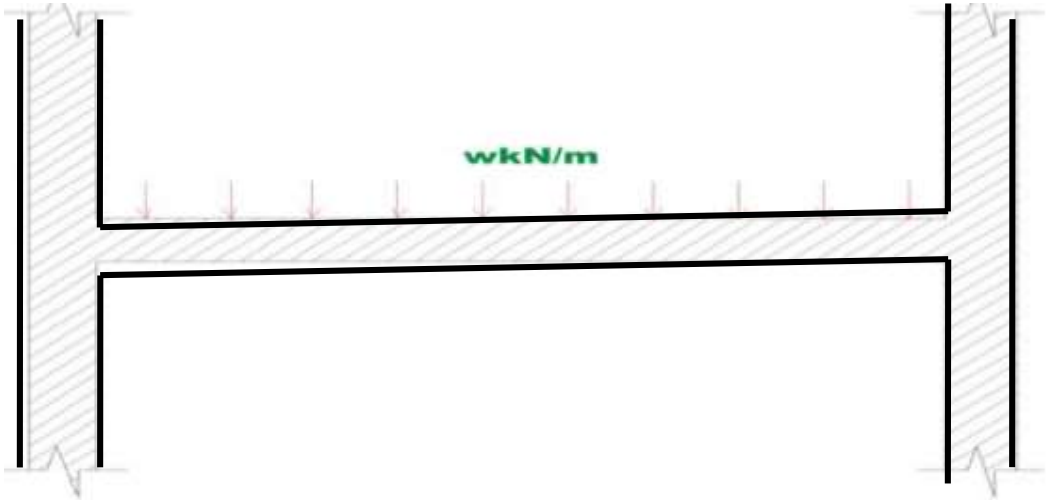


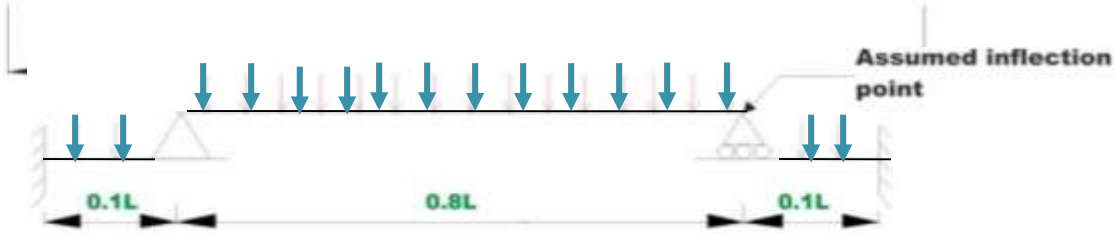
Vertical load Assumption

- There is a hinge at a distance of 0.1 from left and right end of a beam
- Moment distributed among the column at the joint as per their stiffness (EI/L).
- The third assumption is that axial force in the beams is zero

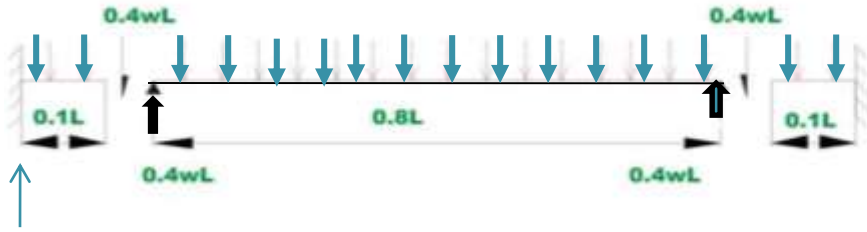
Structural Analysis & Design I

Vertical load

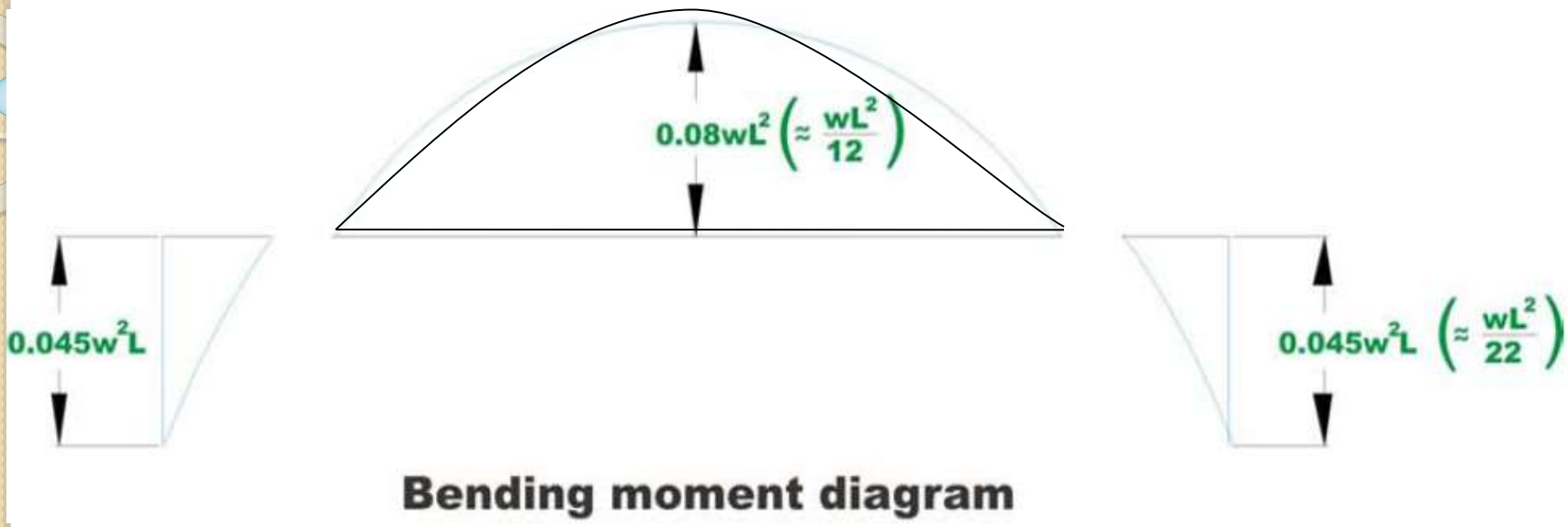




0.4wL+0.1wL=0.5wL



Structural Analysis & Design I



Bending moment diagram

Mmax (+) = (wx (0.8L)^2)/8 = 0.08wL^2

Mmax (-) = 0.4wLx0.1L+ 0.1wLx0.1L/2 = 0.045wL^2

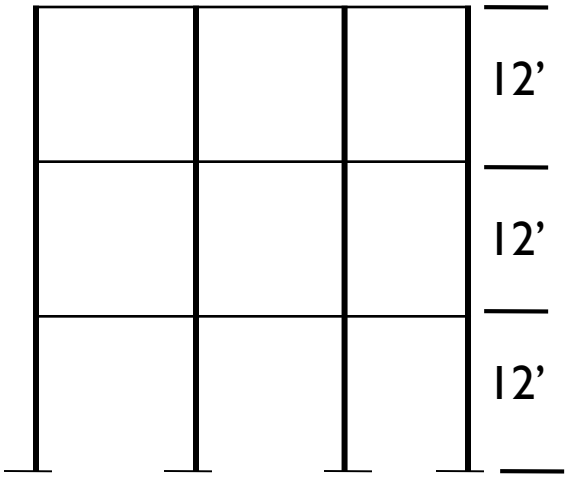
Vertical Load

Given Data

DL= 500lb/ft, LL=300 lb/ft for each girder.

Find the following :

a) Max positive girder moment (Mmax +)
b) Max negative girder moment (Max -)
c) Max girder shear (Vmax)
d) Max exterior column compression
e) Max interior column compression
f) Max exterior column moment



Structural Analysis & Design I

Soln :

DL= 500 lb/ft, LL = 300 lb/ft

= 0.5 K/ft = 0.3 K/ft

w= 0.5+0.3=0.8 Kip/ft

a) Maximum Positive girder moment =

Mmax + (G)= 0.08wL^2

= 0.08x0.8x20^2

= 25.6 Kip-ft

b) Maxm negative girder moment = 0.045wL^2

= 0.045*0.8*20^2

= 14.4 Kip-ft

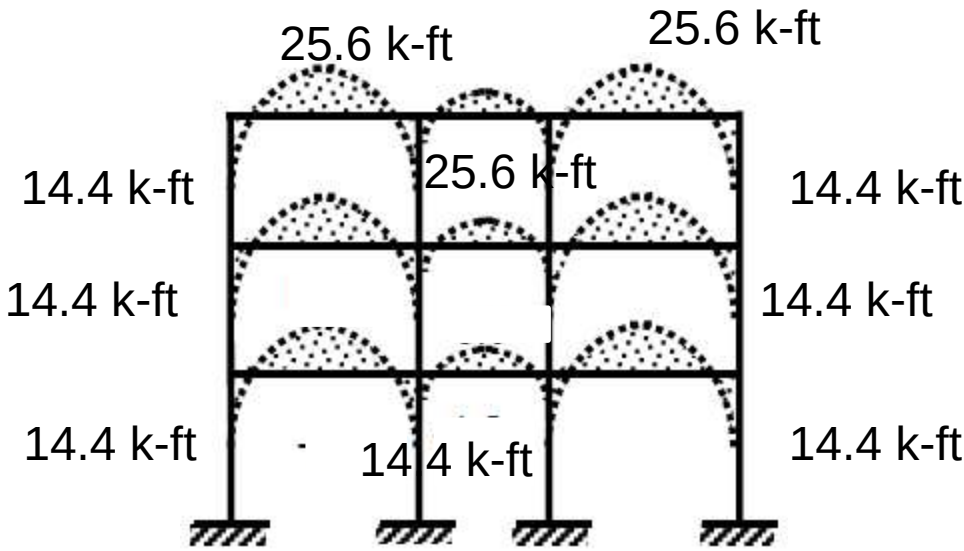
c) Maxm girder shear, Vmax (G) = 0.5wL= 0.5*0.8*20

= 8 Kip

d) Max exterior column compression= 8+8+8

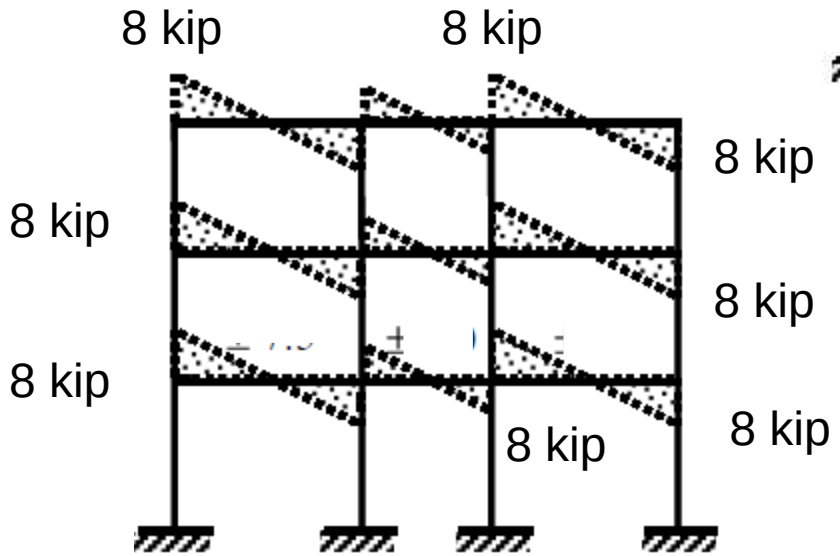
= 24 Kip

Structural Analysis & Design I



Beam BMD (k-ft)

(a and b)

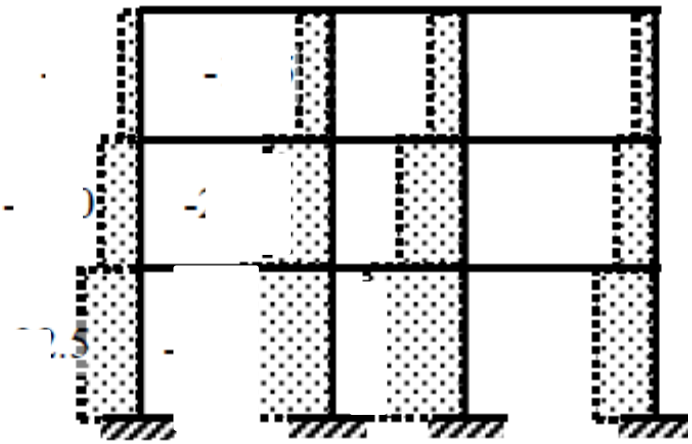


Beam SFD (k)

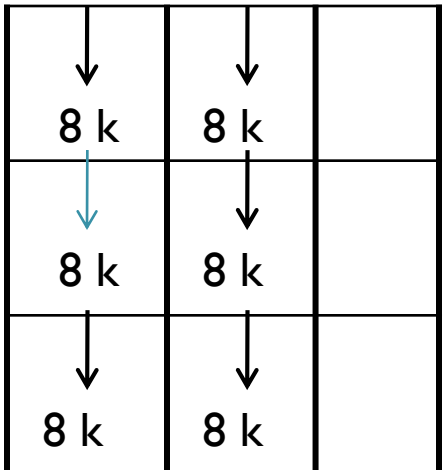
©

Structural Analysis & Design I

e) Max interior column compression
= 2 (8+8+8)
= 48 kN



(d) Column AFD (k)



(e) Max interior column

Structural Analysis & Design I

Approximate analysis of Building
Frames under vertical load
Floor slab (6")
FF = 15 psf
LC= 30 psf
Frame spacing =15'

Soln

DL: (6/12)*150=75 psf
FF=15 psf

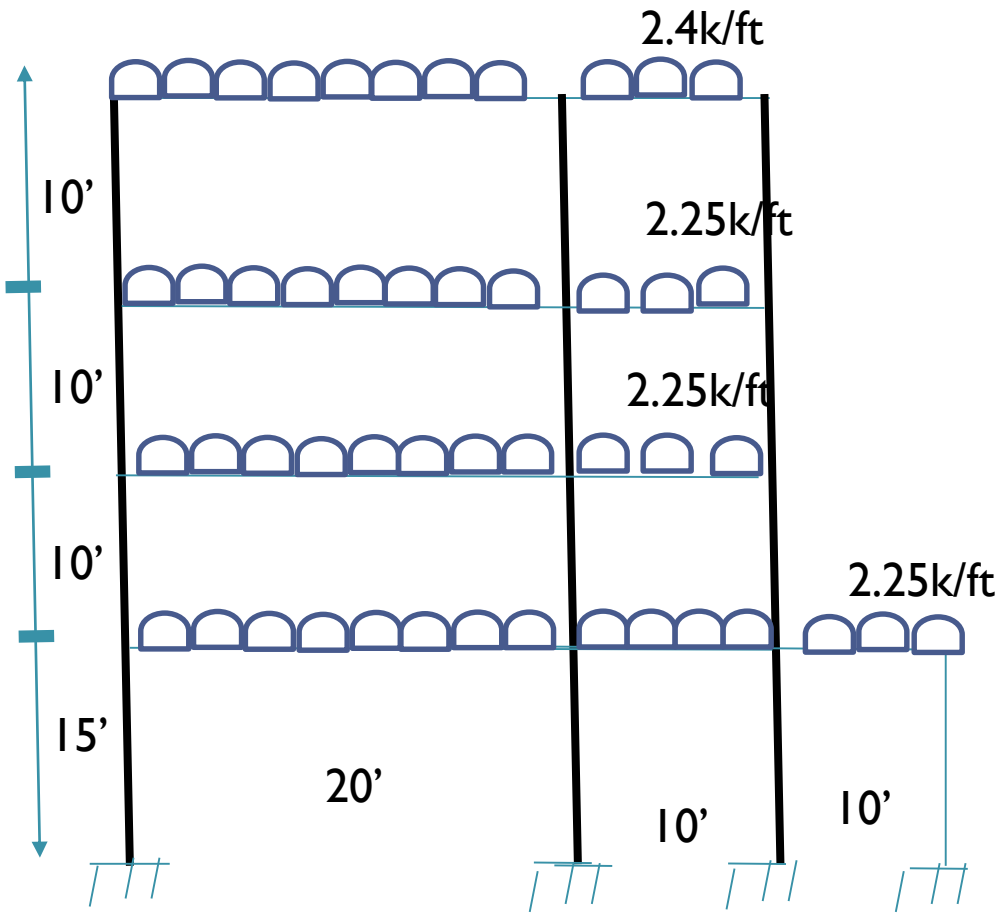
Total DL=90 psf

Roof: (7.2" slab)
(7/12)*150=90 psf
LC =30 psf

Total =120 psf

Load	Roof (kip/ft)	Floor (kip/ft)	Roof (psf)	Floor(psf)
DL	1.8 (120*15)	1.35 (90*15)	120	90
LL	0.6	0.9	40	60
total	2.4 k/ft	2.25 k/ft		

Structural Analysis & Design I



Vertical Load

Given Data

In figure

Find the following :

a) Max positive girder moment (Mmax +)
b) Max negative girder moment (Max -)
c) Girder shear (V)
d) Exterior column compression
e) Interior column compression
f) Column moment

Prob: Approximate analysis of Building Frames under vertical load
Floor slab (6") Roof (7.2")
FF = 15 psf
LC= 30 psf
Frame spacing =15'
LL, Floor 60 psf
Roof 40 psf

Structural Analysis & Design I

BM in Beams

20' Span

Positive Moment (+ve) = 0.08wL^2= 0.08*2.4*20^2

= 76.8 on (roof)

= 72 on (floor)

Negative Moment (-ve) = 0.045wL^2 = 0.045*2.4*20^2

= 43.2 on (roof)

= 40.5 0n (floor)

10' Span

Positive Moment (+ve) = 0.08wL^2= 0.08*2.4*10^2

= 19.2 on (roof)

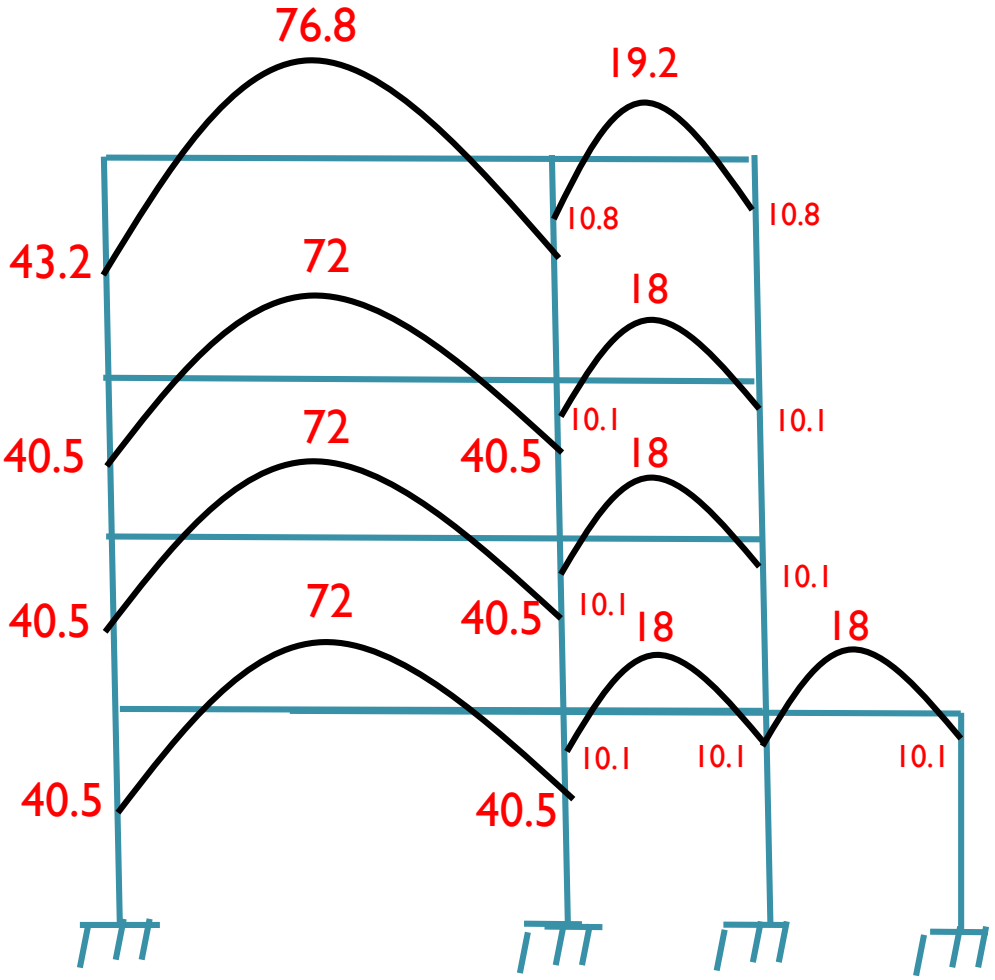
= 18 on (floor)

Negative Moment (-ve)= 0.045wL^2 = 0.045*2.4*10^2

= 10.8 on (roof)

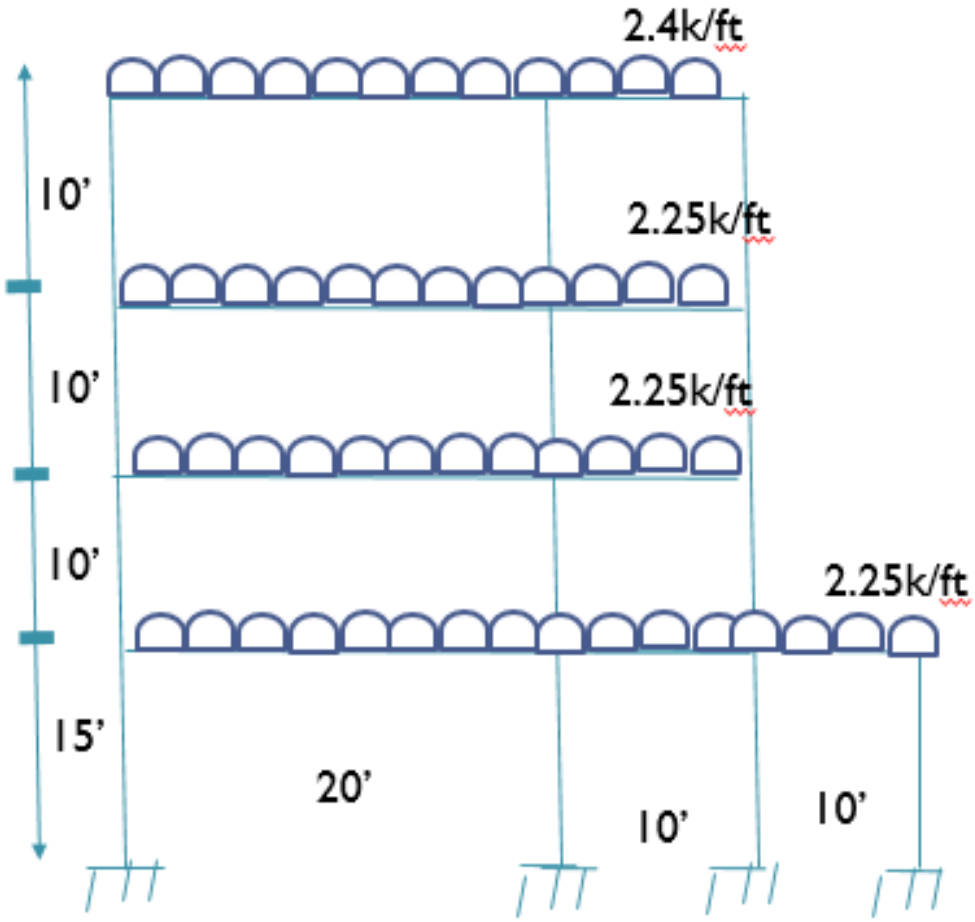
= 10.1 on (floor)

Structural Analysis & Design I

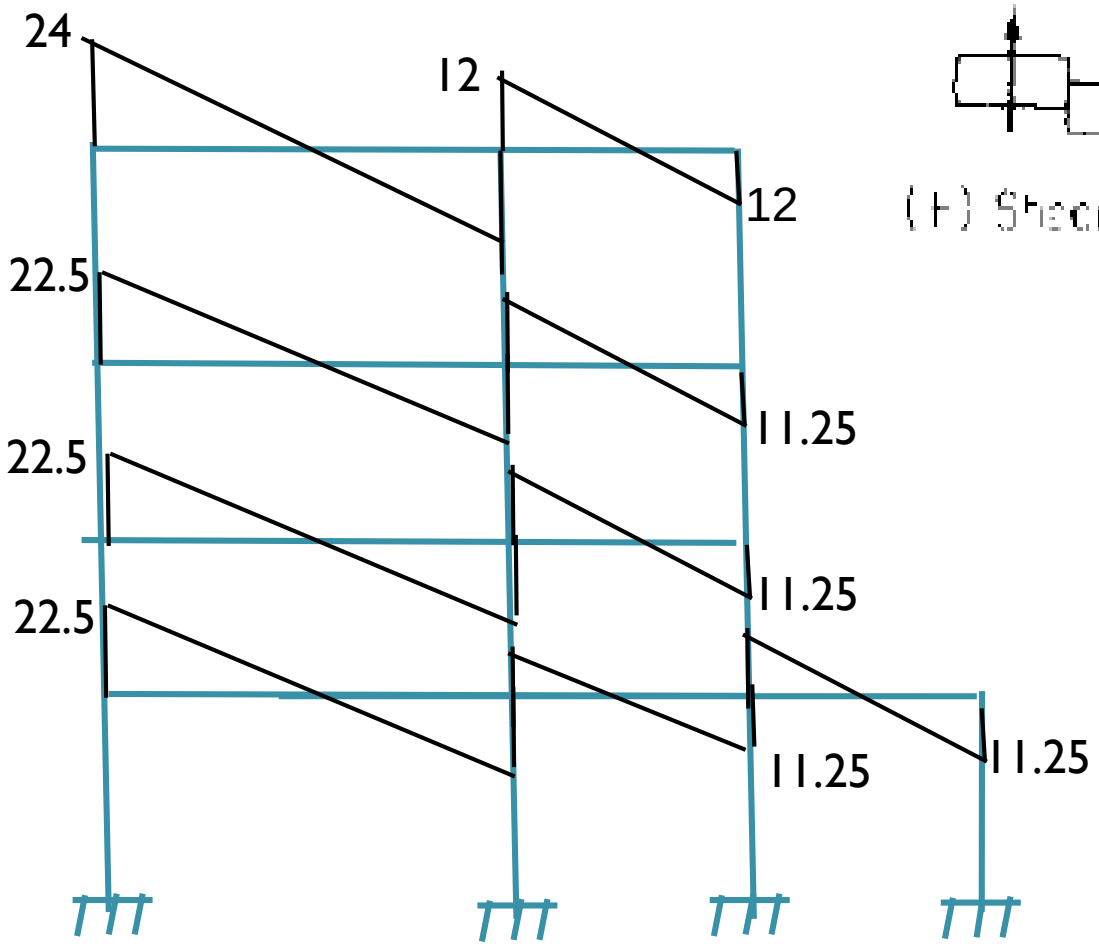


Beam BMD

Structural Analysis & Design I

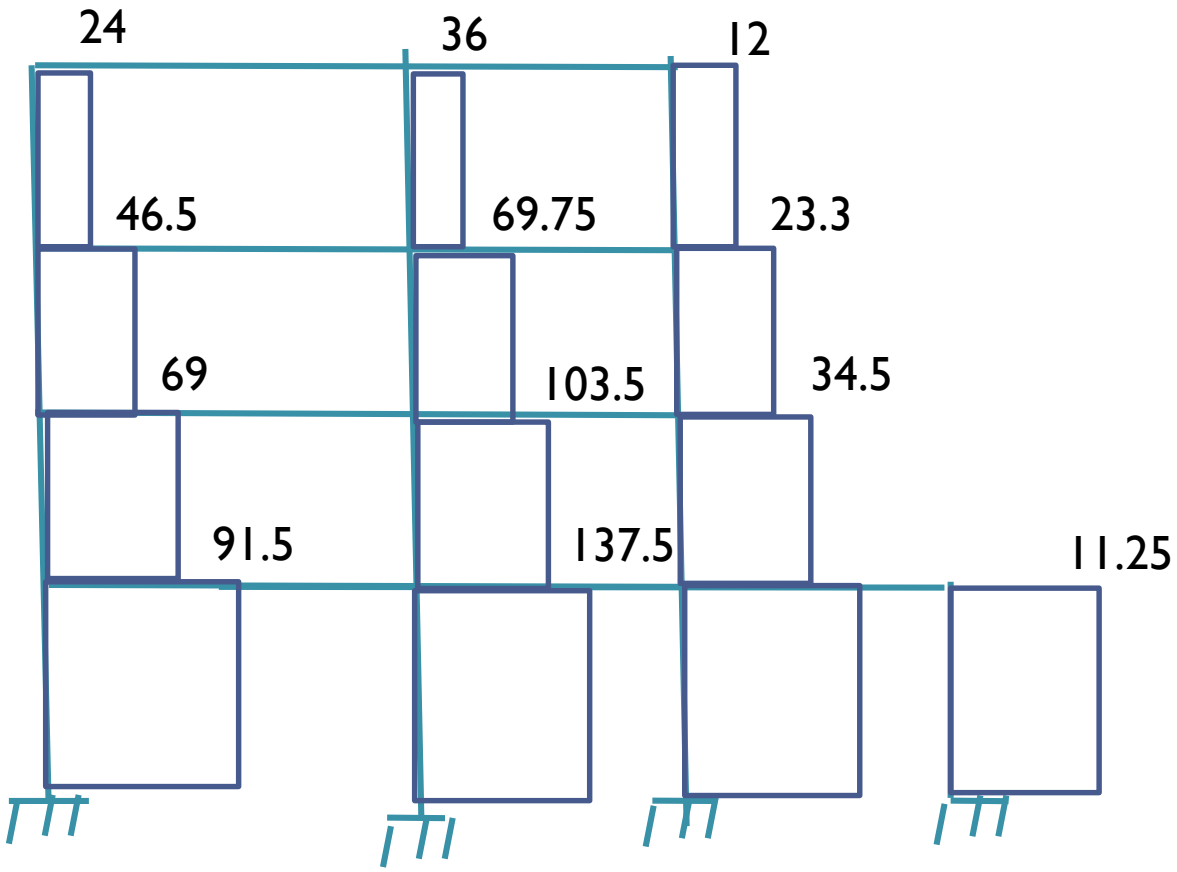


Structural Analysis & Design I



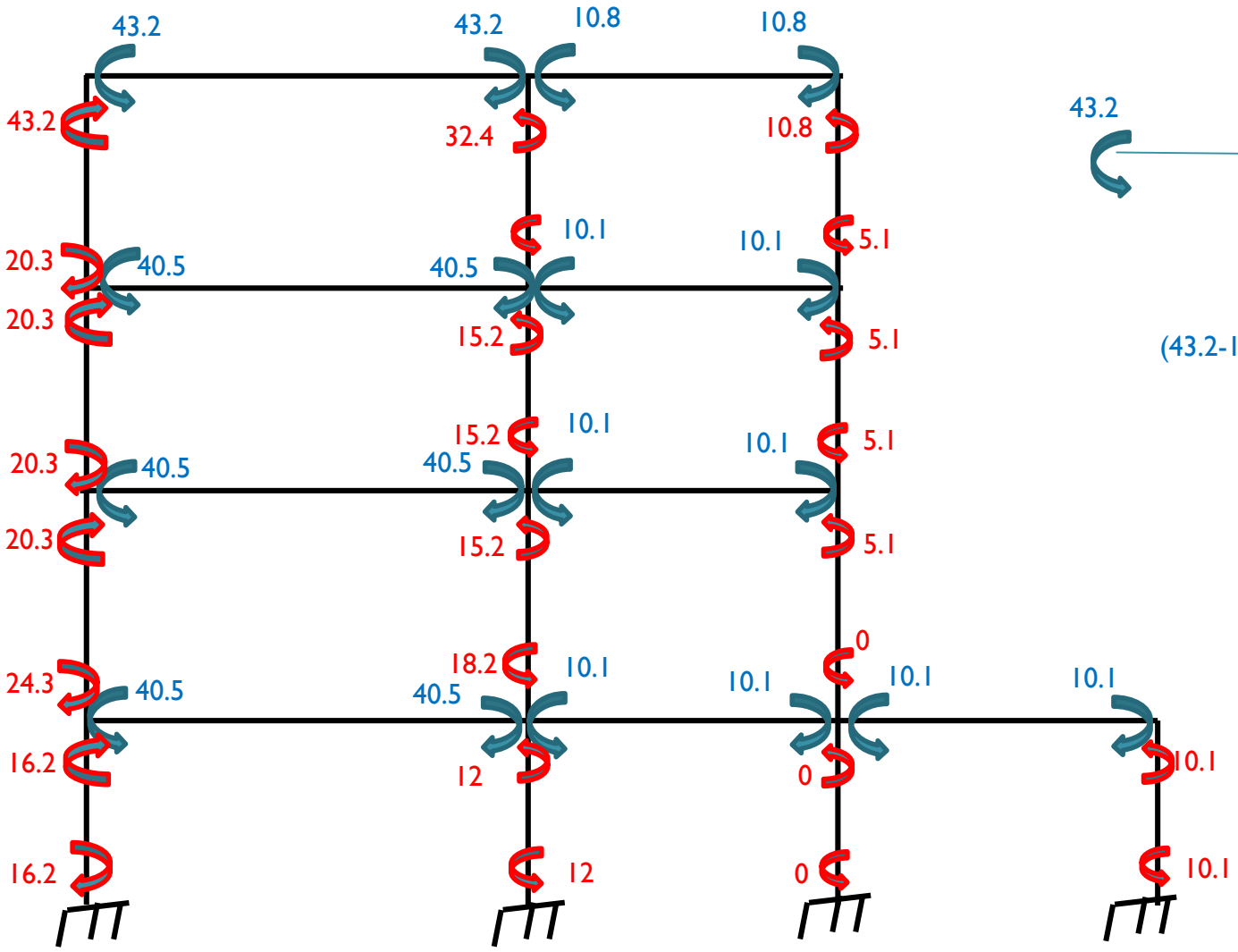
Beam SFD

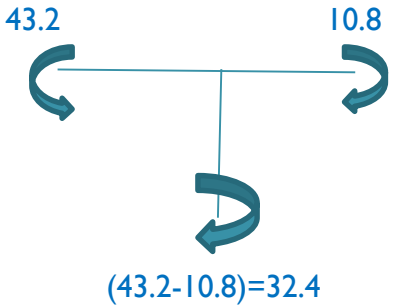
Structural Analysis & Design I

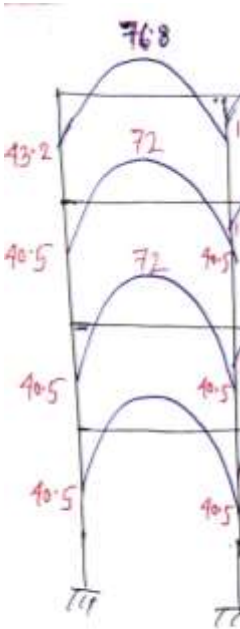


Beam Axial force diagram

Structural Analysis & Design I







BM D

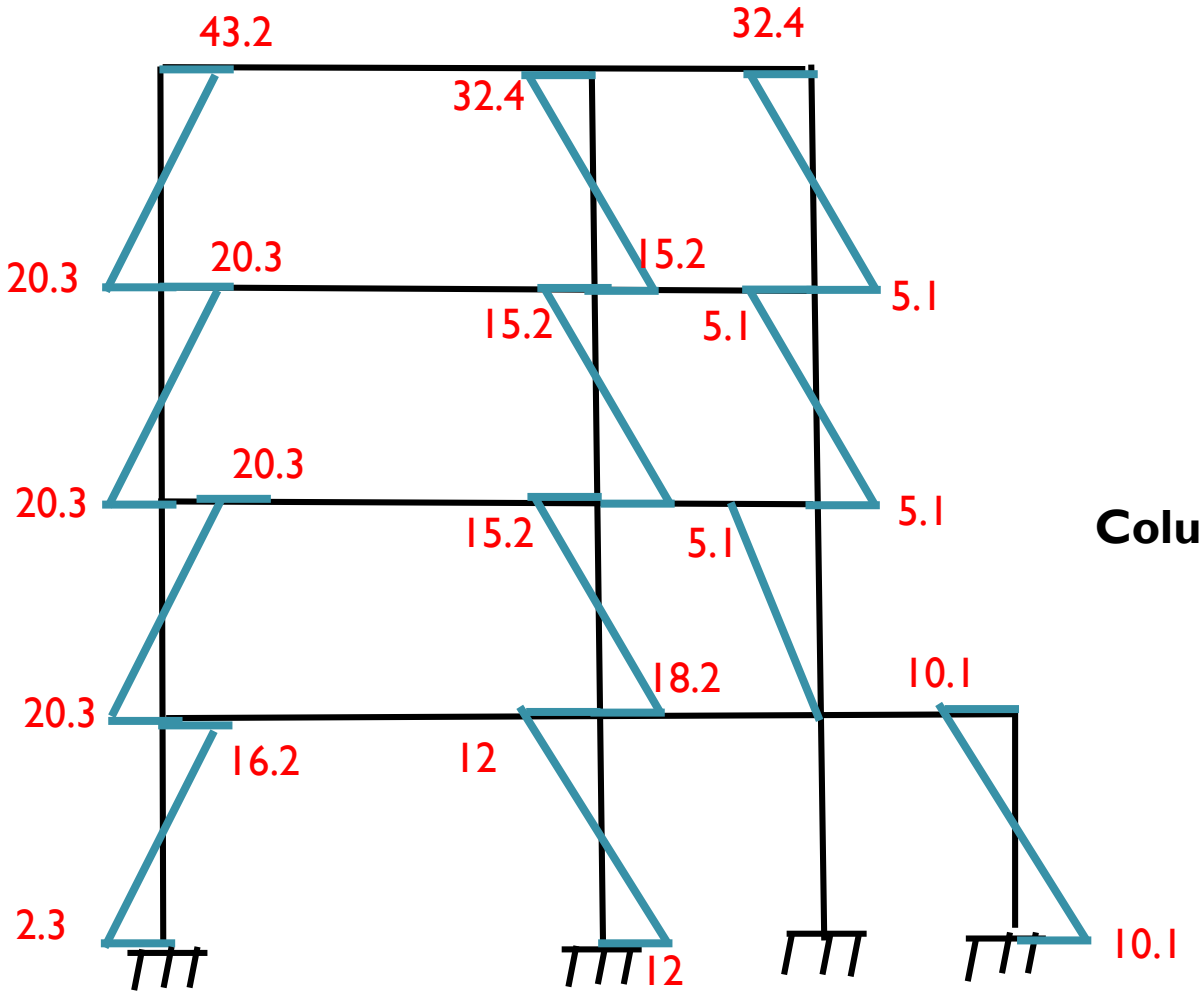
Structural Analysis & Design I

Calculation

(EI/L)= (1/10)
And
(EI/L)=(1/15)
Now
(EI/L)'=(1/10)+(1/15)
=1/6
Again
(EI/L)/(EI/L)'=(1/10)/(1/6)=(6M/10)
(EI/L)/(EI/L)'=(1/15)/(1/6)=(4M/10)

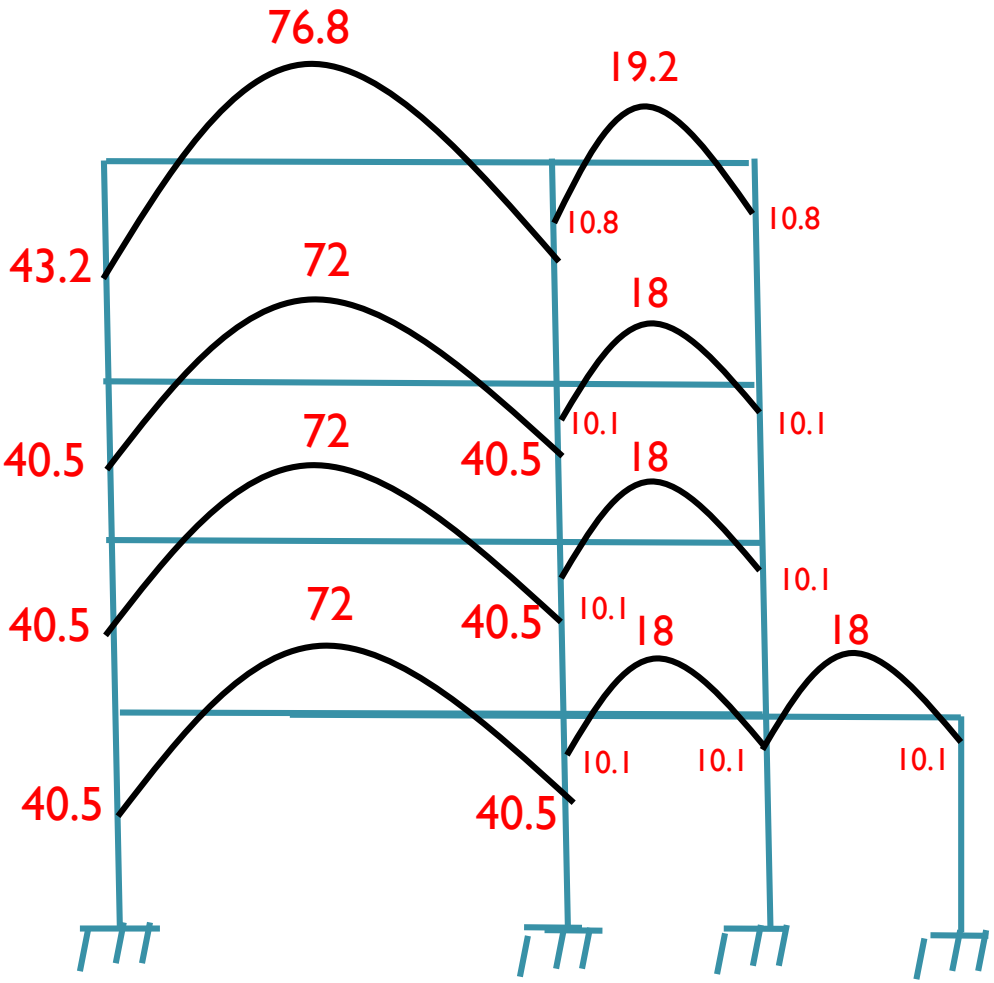
(40.5*6)/10=24.3
(40.5*4)/10=16.2

Structural Analysis & Design I



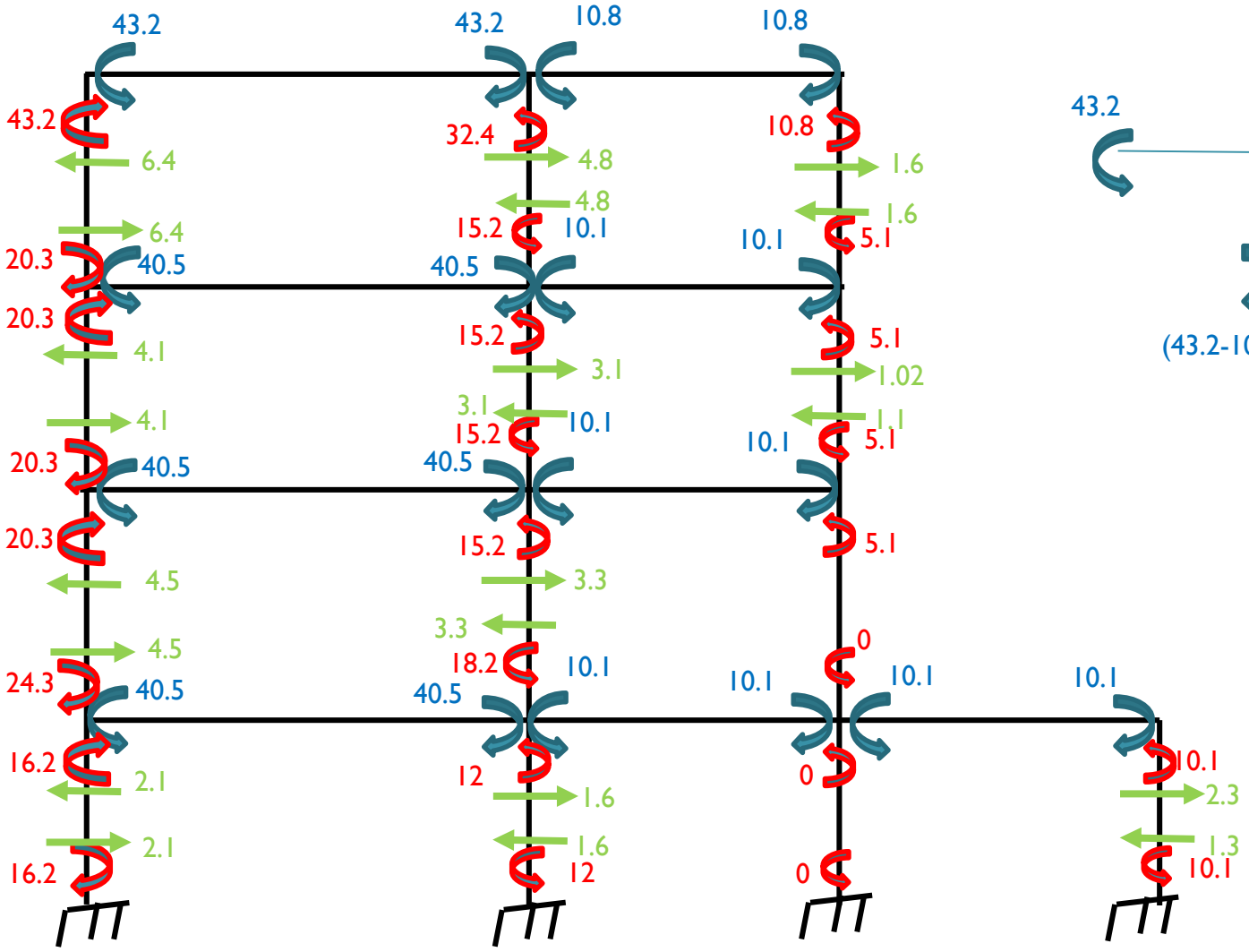
Column BMD

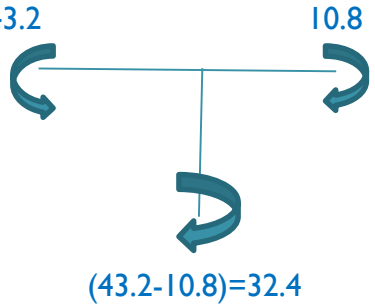
Structural Analysis & Design I

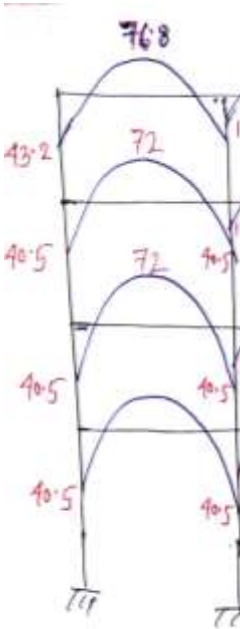


Beam BMD

Structural Analysis & Design I







Structural Analysis & Design I

- Assignment 6

