Example 8.22 — Mccormac's book

Using the given sections, all of A992 steel, and the plastic theory, determine the values of P_n and w_n as indicated.

8-22.

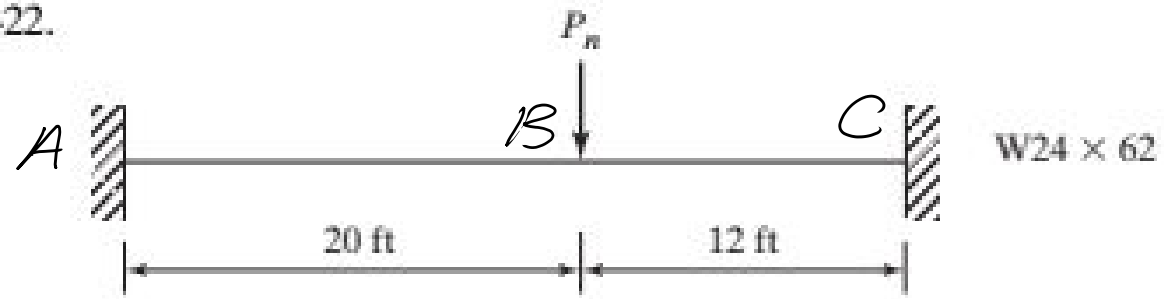


FIGURE P8-22

Solution For A992 $F_y = 50$ ksi

Use table 1-1 From AISC CM #15 Pg 1-19

$\Rightarrow Z_x = 153$ inch^3

For $Z_x = 154$ inch^4

$M_p = F_y Z_x = 50(153) = 7650$ inch.kips $\Rightarrow$ 637.5 FT.kips

But for $Z_x = 154 \Rightarrow 50(154) = 7700$ inch.kips $\Rightarrow$ 641.66 FT.kips

W24X62

MASTAN2

$Z_{zz} = 154\ inch^3$

AISC in table : 153 $inch^3$

Select Section # for properties and attached elements	<	1	>	Name:	W24X62	Status:	
Area =	18.3	Izz =	1560	Iyy =	34.5	J =	1.77	Cw =	4620
Zzz =	154	Zyy =	15.8	Ayy =	Inf	Azz =	Inf	Cancel	

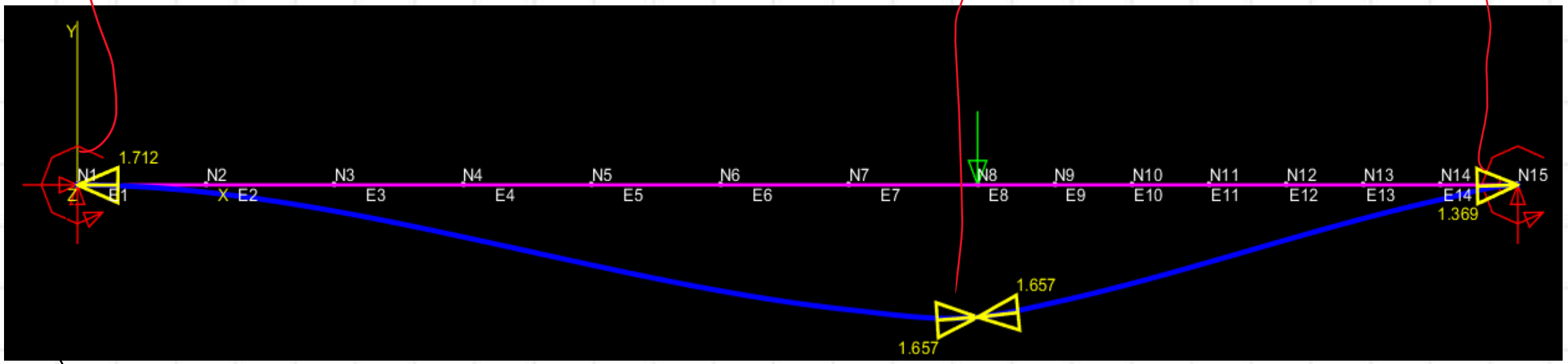
Applied Load : 100 kips

increment 30, Each increment = 0.10

$\lambda_1 = 1.657$ kip

$\lambda_1 = 1.369$

N3

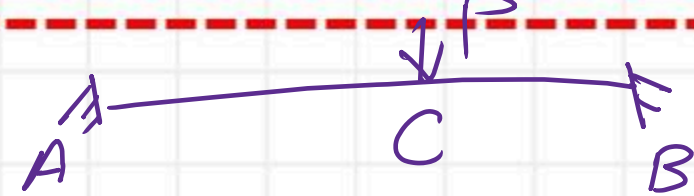


Applied Load ratio : 1.72

N1 ⇒ first hinge at 1.369

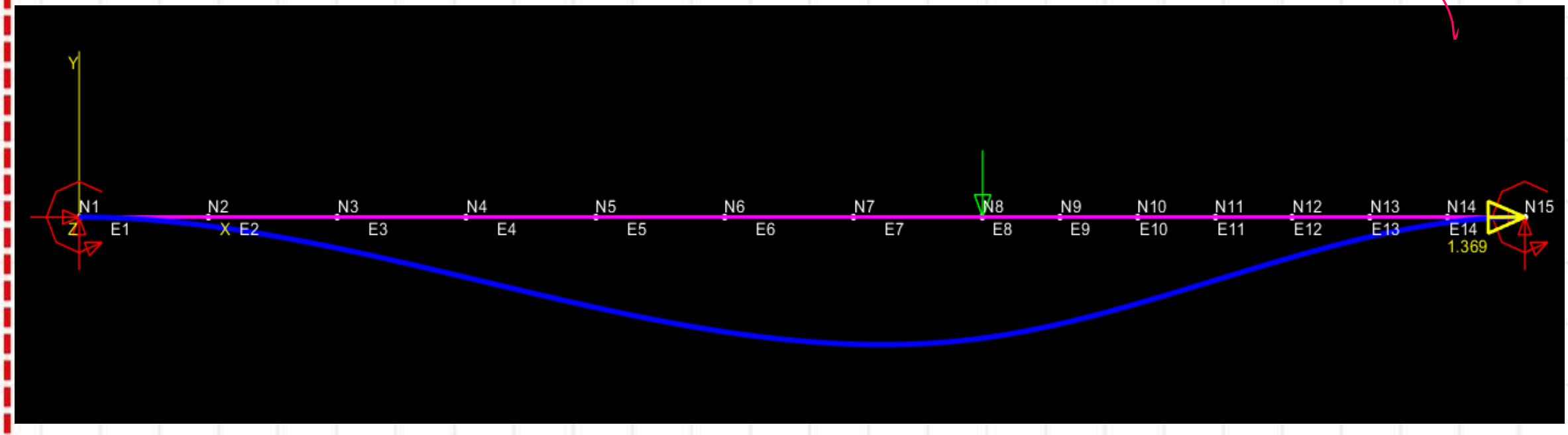
First hinge is at B

A



Load multiplier $\lambda_1 = 1.369$

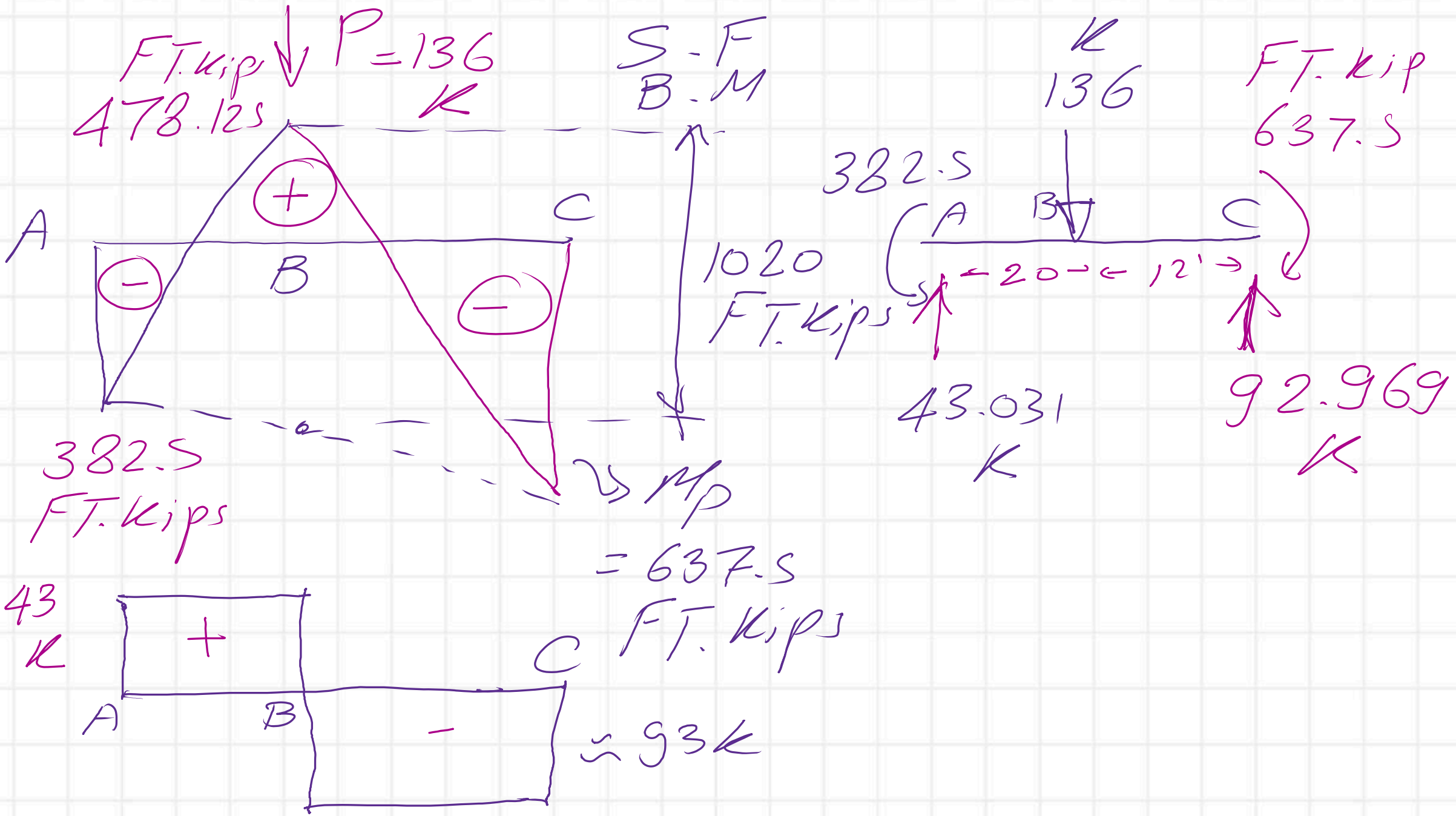
at B



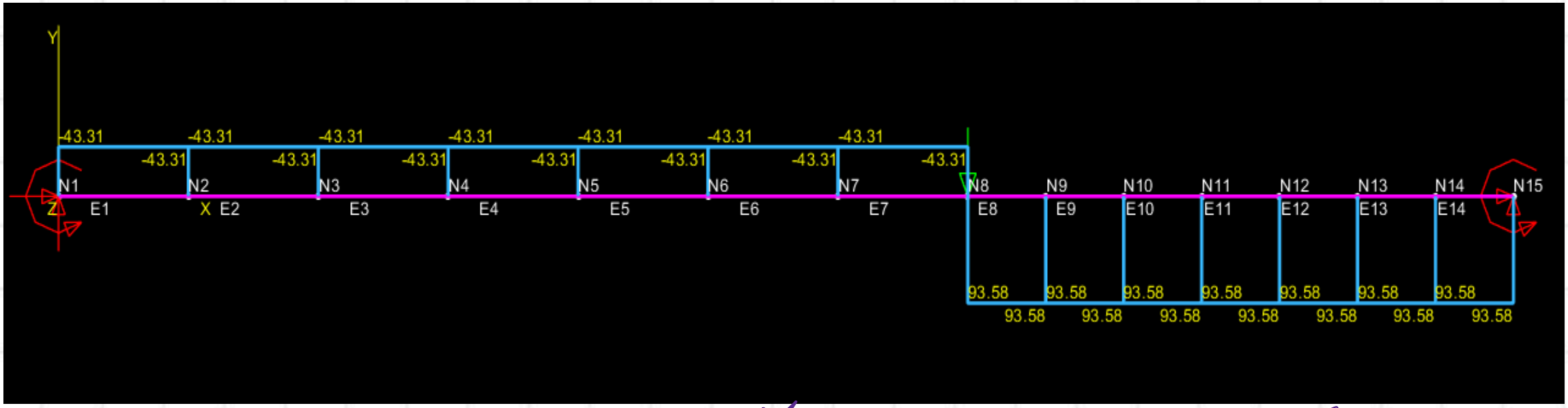
Deflected Shape: 1st-Order Inelastic, Incr # 14, Applied Load Ratio = 1.3689

increment 14 From 1.3 $\Rightarrow$ 1.4

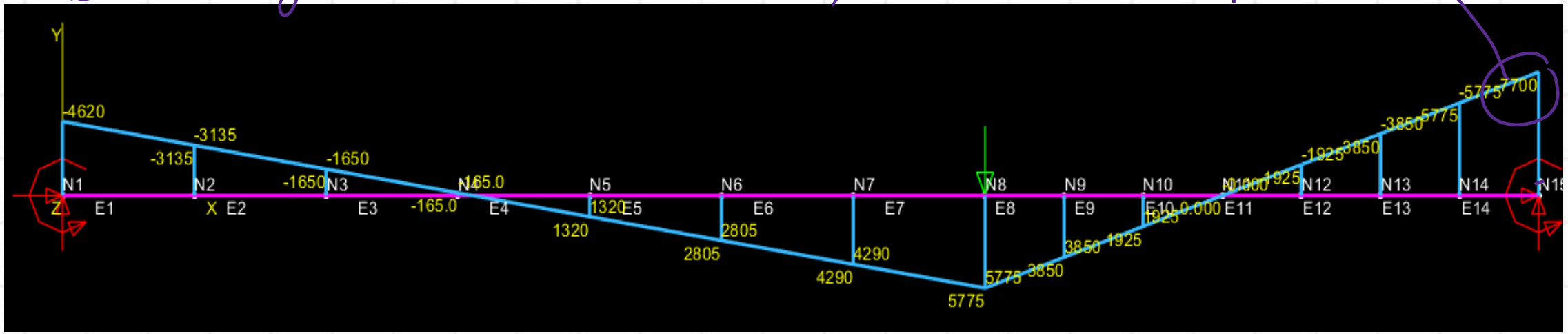
$14\,(0.10) = 1.40$

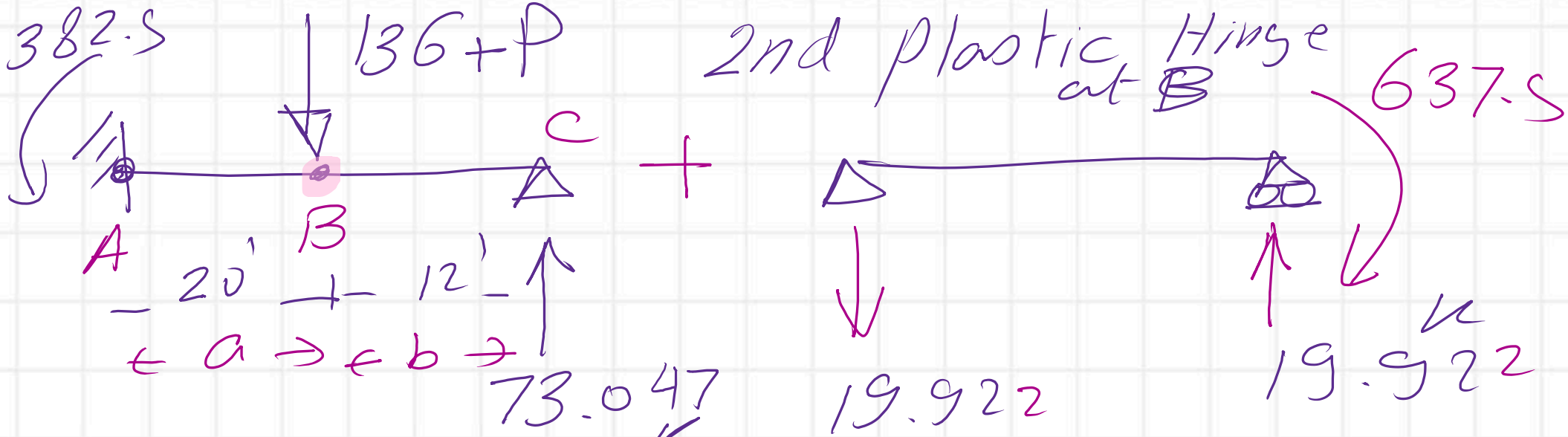

FT.kip
P=136
K
478.125
A
B
C
382.5
FT.kips
S.F
B.M
1020
FT.kips
Mp
=637.5
FT.kips
K
136
FT.kip
637.5
382.5
A
B
C
20'
12'
43.031
K
92.969
K
43
K
A
B
C
≃93K

Shear Diagram P = 136. k VA = 43.31 VB = 93.58 k first P. hinge



B.M Diagram Mp = 7700 inch-kips





$R_1 \uparrow 13.281$ K

P

$P = 2nd\ Load = 136 + 28.629 = 164.629$ K

Check if $P = 28.629$

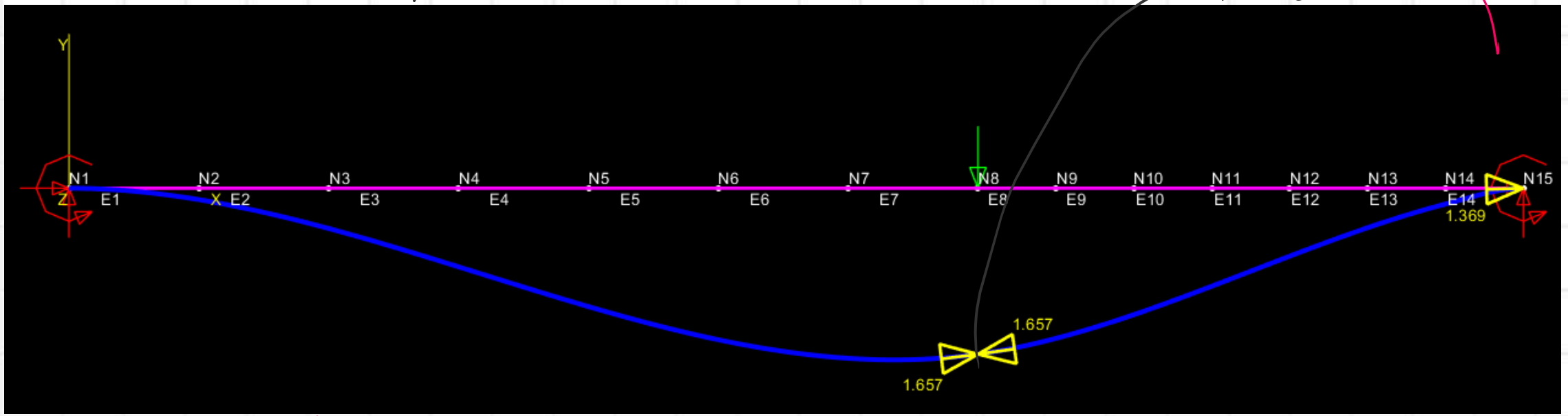
$\Delta M = \frac{Pab(b+L)}{2L^2} = 28.629\frac{(20)(12)(44)}{2(32)^2} = 147.618$ Ft.kip

Fixed $M_{Fixed} =$

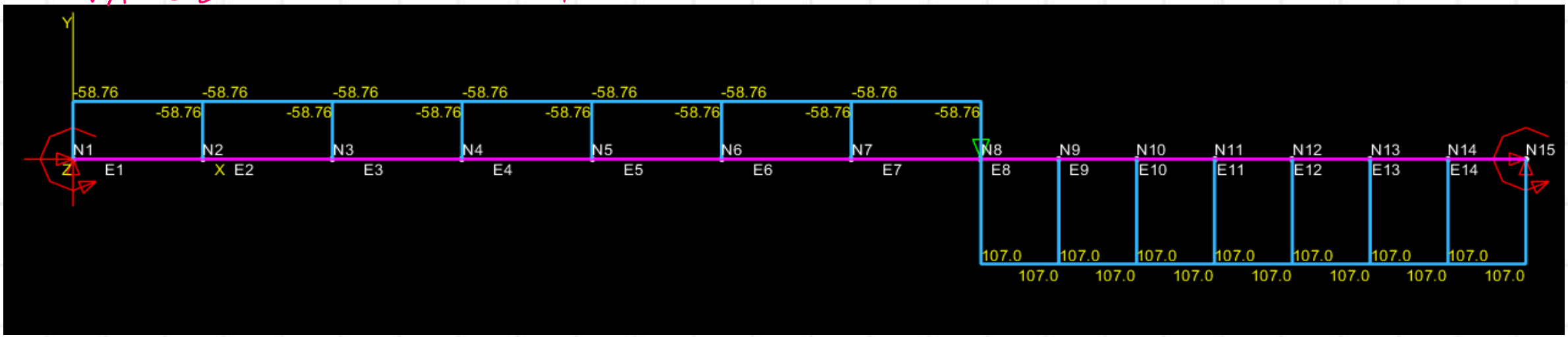
$\lambda_2 = 1.657 \Rightarrow$ Two plastic hinges $P_{n2} = 165.76$ kips

2nd pl hinge

First plastic hinge



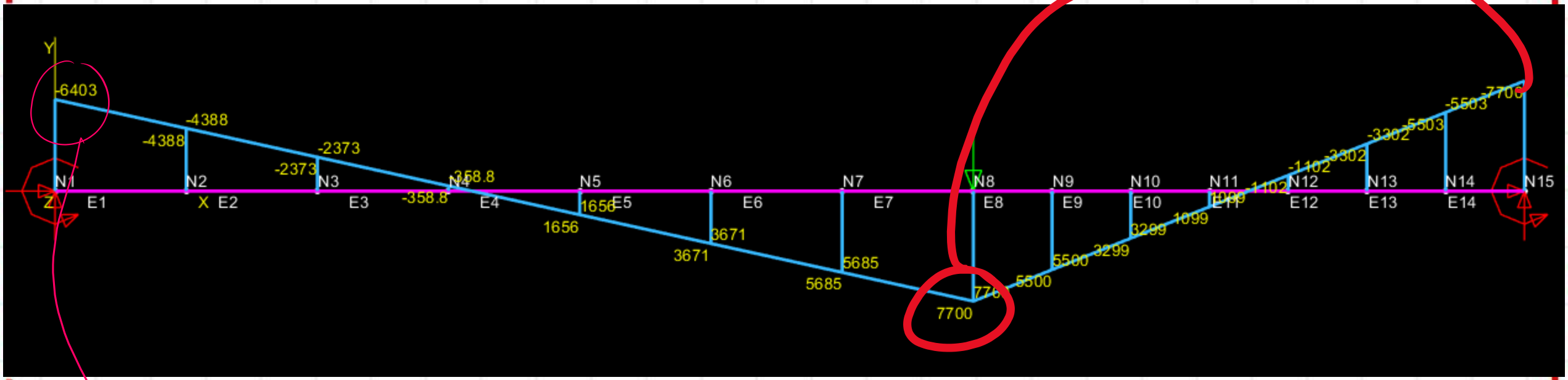
$V_A = 58.76$ k $\quad V_B = 107.0$ k



B.M.D For P_{n_2} = 165.70 kips

Based on
Z_x = 154 inch³

7700
inch.kips

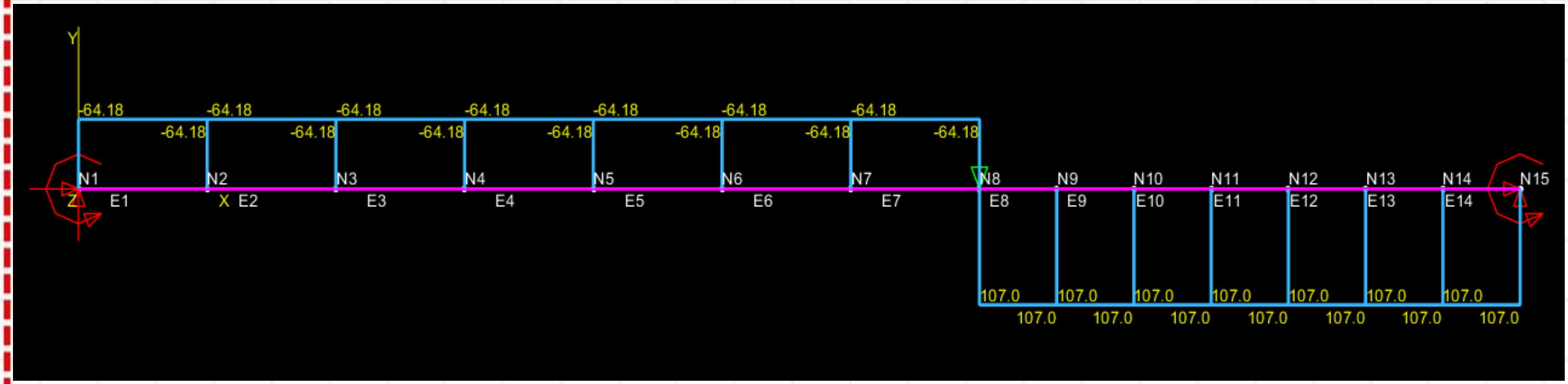


6403
inch.kips

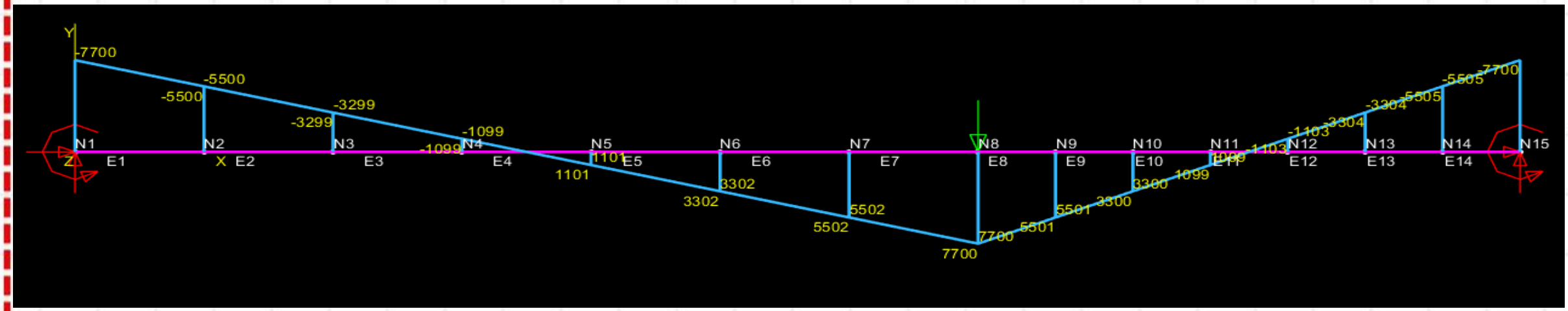
⇓

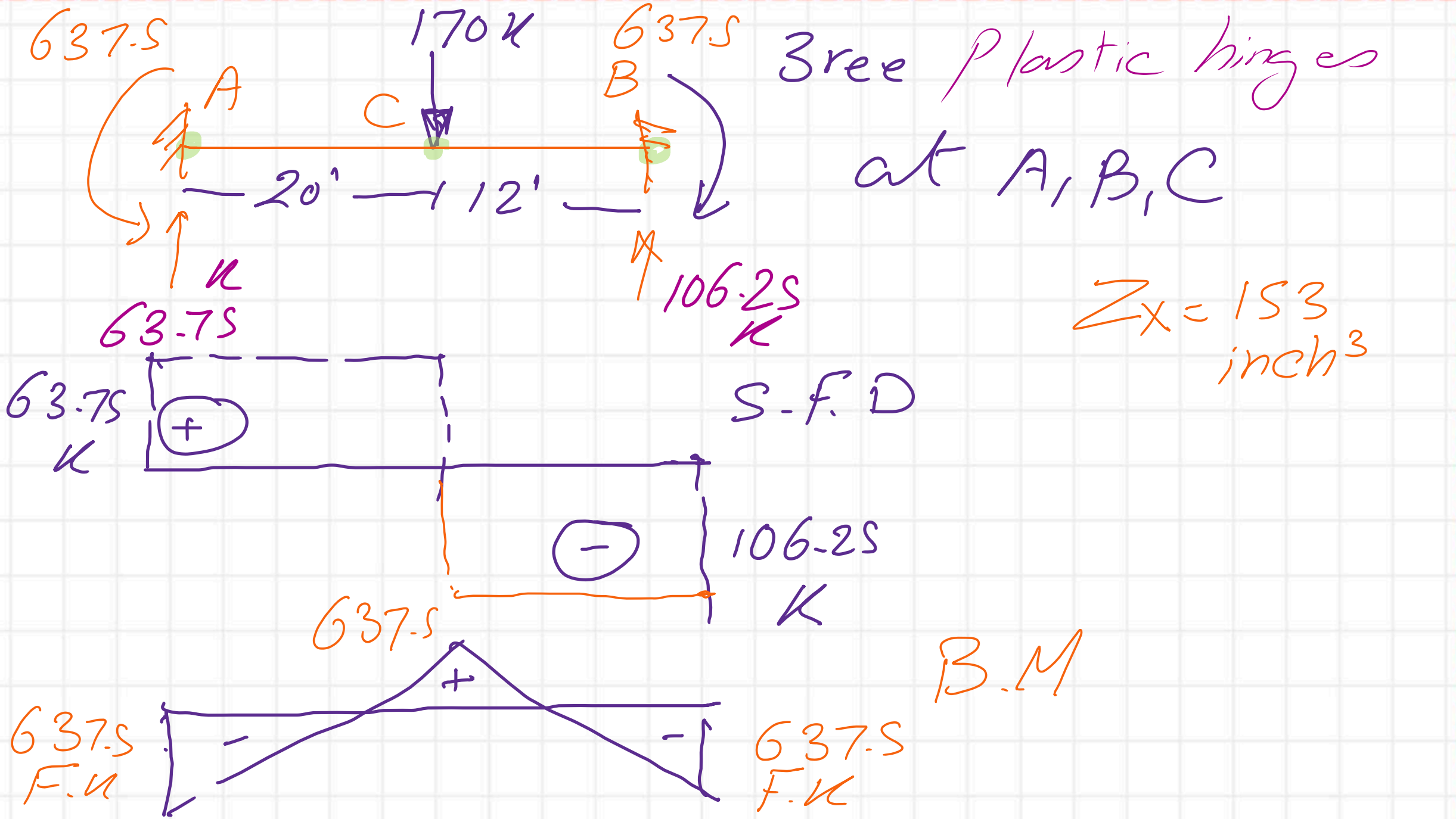
533583 Ft.kips

$\lambda_3 = 1.7118$ $P_n = 171.18$ kips $Z_x = 154$ inch^3



$V_A = 64.13$ k, $V_B = 107.0$ kips





3ree Plastic hinges at A, B, C

$Z_x = 153$ inch^3