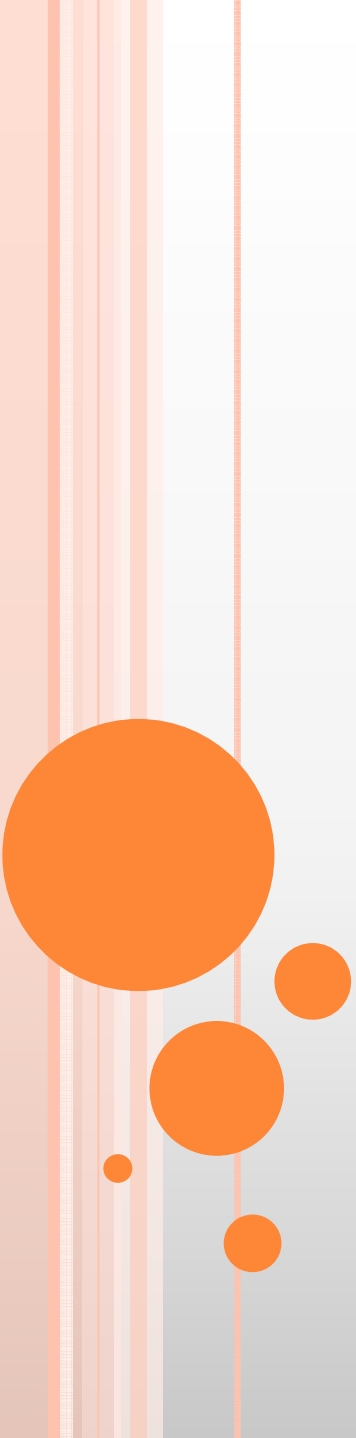




OPTIMUM DESIGN OF TRIANGLE MODE BEAM

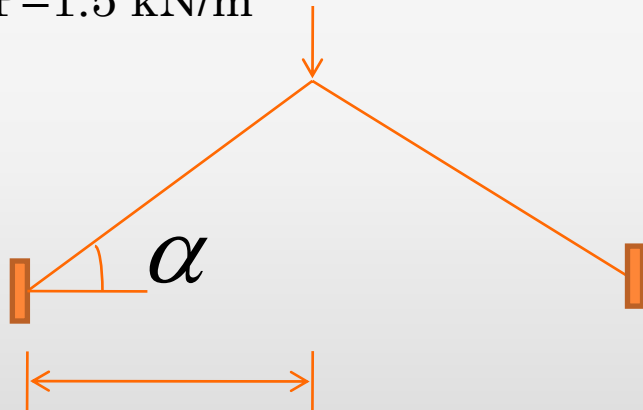
Determine optimum angle and mass

Trigon



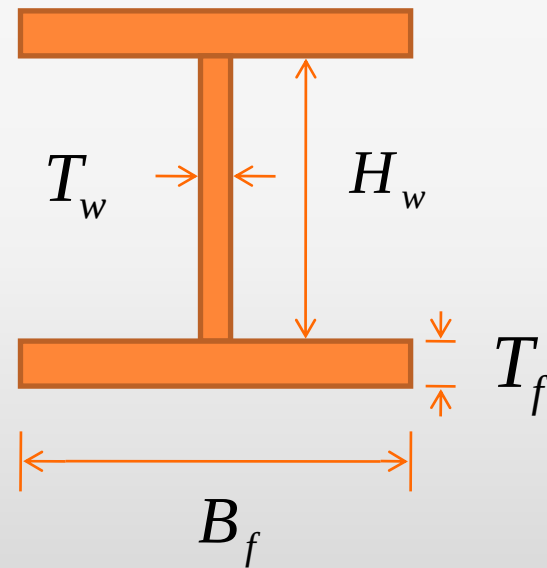
BEAM SUBJECTED TO DISTRIBUTED LOADS

$P = 1.5 \text{ kN/m}$



Mildsteel

Shape of section



MINIMIZE OBJECT FUNCTION

- Object function

$$W = \frac{(H_w T_w + 2 B_f T_f) \rho L}{\cos \alpha}$$
$$\rho = 7850 \text{Kg} / \text{m}^3$$
$$L = 5 \text{m}$$

- Variables

$$\alpha, T_f, B_f, T_w, H_w$$



CONSTRAINTS

- 1) Prevent Buckling

$$\frac{H_w}{T_w} - 50 \leq 0, \frac{T_f}{T_w} - 1.5 \leq 0, \frac{B_f}{T_f} - 18 \leq 0$$

- 2) Cross sectional area

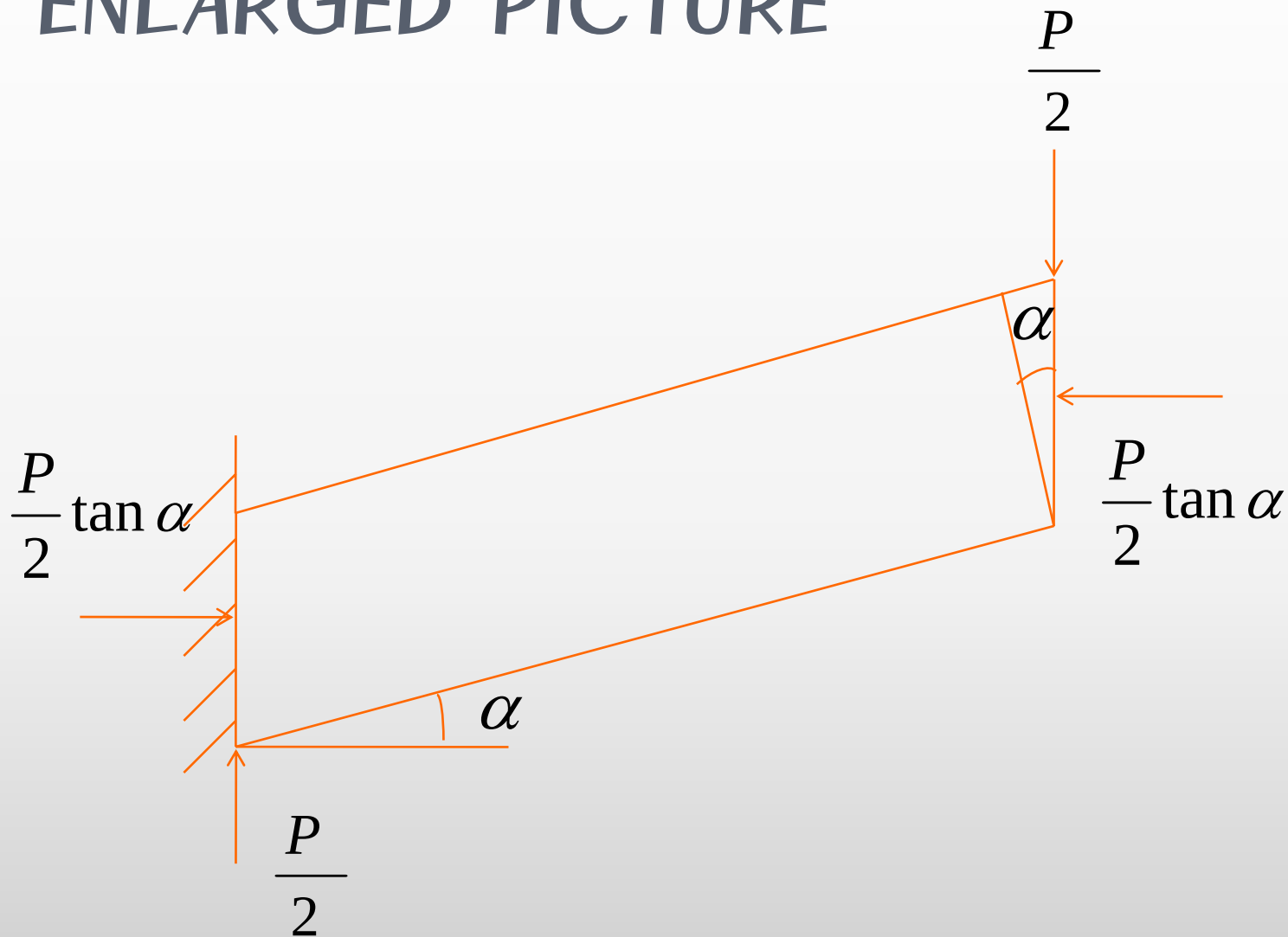
$$-B_f < 0, -T_f < 0, -T_w < 0, -H_w < 0$$

- 3) Angle

$$-\alpha \leq 0, \alpha - 20 \leq 0$$



ENLARGED PICTURE



CONSTRAINTS

○ 4)Stresses

F.S=2

$$2(\sigma_c + \sigma_m) - \sigma_{all} \leq 0$$

$$\sigma_c = \frac{P_c}{A_c}; P = \frac{P}{2} \tan \alpha, A_c = \frac{H_w T_w + 2B_f T_f}{2 \cos \alpha}$$

$$\sigma_m = \frac{M(H_w + 2T_f)}{2I}, M = \frac{PL}{2},$$

$$I = 2\left(\frac{B_f T_f^3}{12} + B_f T_f \left(\frac{H_w}{2} + \frac{T_f}{2}\right)^2\right) + \frac{T_w H_w^3}{12}$$



SOLVE THE PROBLEM BY EXCEL

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Optimum design of triangle mode beam														
2															
3															
4		Constants	value			Constraints									
5		P	1500			g1	-1.5E-13		sig_c	8472023					
6		ρ	7850			g2	-0.30957		sig_m	1.12E+08					
7		L	5			g3	3.91E-14								
8		radian	0.0174533			g4	-0.05825		Pc	3245.138					
9		sig_all	240000000			g5	-0.00324		A	0.000383					
10						g6	-0.00272		M	3750					
11						g7	-0.13591		I	2.39E-06					
12						g8	-0.22713								
13		Minimize weight				g9	-0.12194								
14		W	30.782551	30.06877		g10	2.98E-07								
15															
16		Variables													
17		α	0.296706	0.227127	약 13.01도										
18		Tf	0.003	0.003236											
19		Bf	0.05	0.058246											
20		Tw	0.003	0.002718											
21		Hw	0.15	0.135913											
22															
23															
24															

해 찾기 모델 설정

목표 셀(E):

해의 조건: ☐ 최대값(M) ☒ 최소값(N) ☐ 지정값(V):

값을 바꿀 셀(B):

제한 조건(U):

- $\$G\$10 \leq 0$
- $\$G\$11 \leq 0$
- $\$G\$12 \leq 0$
- $\$G\$13 \leq 0$
- $\$G\$14 \leq 0$
- $\$G\$5 \leq 0$
- $\$G\$6 \leq 0$

실행(S) 닫기 옵션(O)... 초기화(B) 도움말(H)

THE END

Thank you

