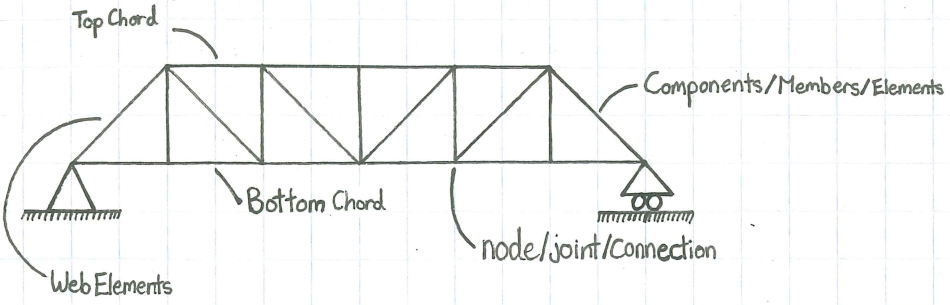
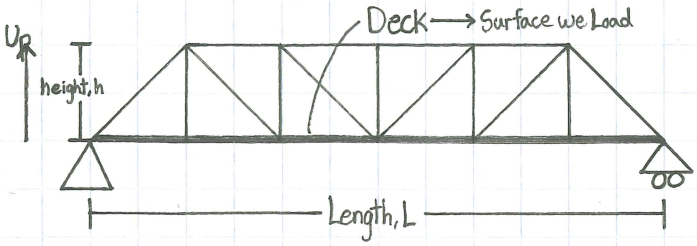
CIV102 - STRUCTURES and MATERIALS

Topic: Trusses

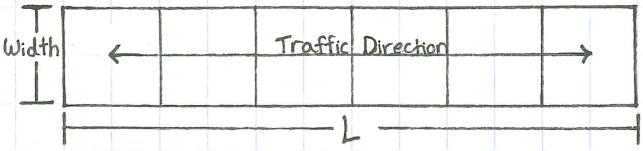
1) Truss

- Stiff, Strong, Light





Elevation View (From Side)



Plan View (From Above)

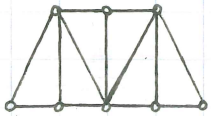
2) Process of Design of a Bridge

i) Select Geometry
ii) Determine Applied Loads
iii) Analyze the Forces Inside the Members
iv) Select Member Sizes
v) Calculate Displacements
vi) Check Dynamic Characteristics
vii) Iterate
viii) Detailed Design

} Preliminary Design

3) Analysis Assumptions for Trusses

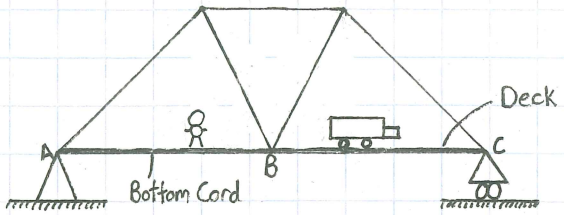
i) Small Displacements
ii) All Connections are Assumed to be Hinges
- Concequence: All members are subjected to tension or compression only (Shear = 0, Moment = 0)



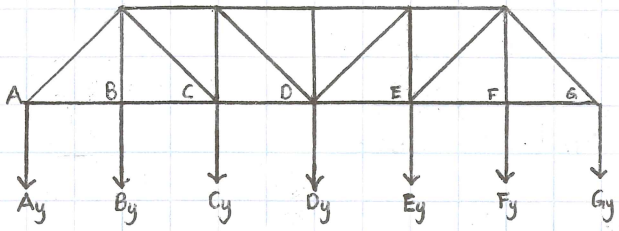
∴ Internal Bending M = Zero at all joints

iii) All Loads are Applied at Nodes

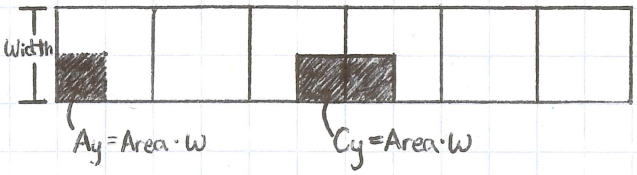
Deck Details



Loads on the Nodes ⟶ How to Calculate
- Tributary Area
- Uniform Load w $\left[\frac{kN}{m^2}\right]$



Elevation



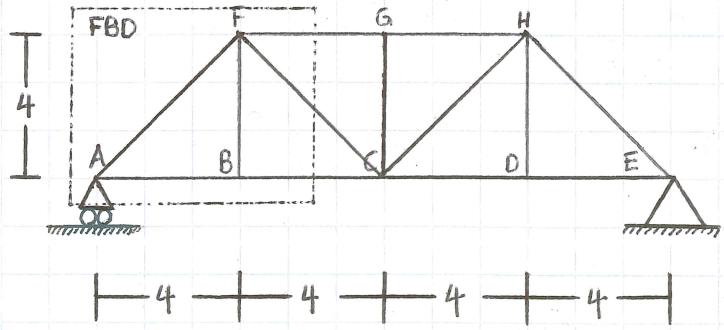
Plan

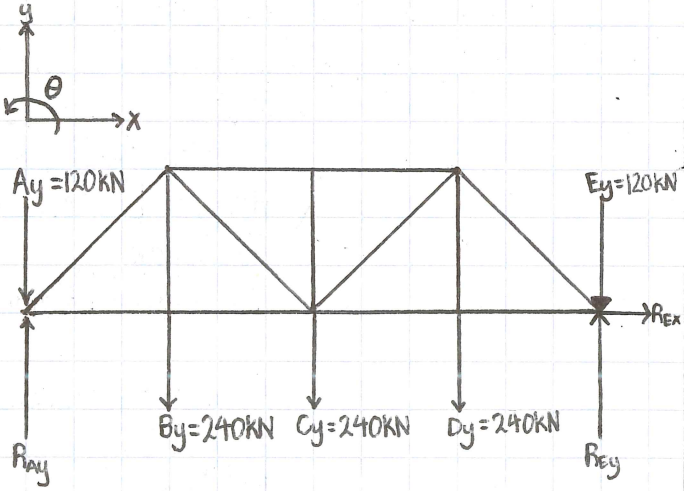
4) Method of Sections

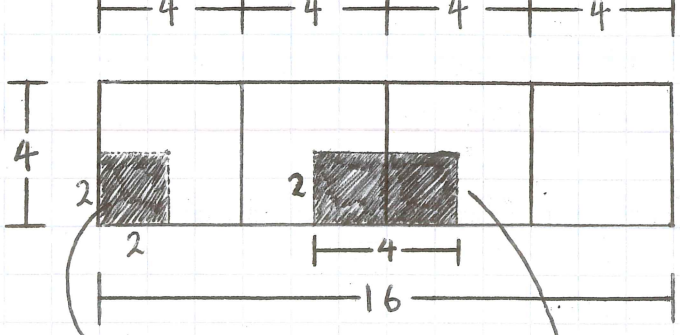
- Draw a FBD of Part of Structure
- I can only allow 3 unknown forces since I have 3 equations:

$\Sigma F_x = 0$
$\Sigma F_y = 0$
$\Sigma M = 0$

5) Example $w = 30\frac{kN}{m^2}$







$\Sigma F_x = 0 \quad R_{Ex} = 0$

$\Sigma M_A = 0$

$0 = -240 \cdot 4 - 240 \cdot 8 - 240 \cdot 12 - 120 \cdot 16 + R_{Ey} \cdot 16$

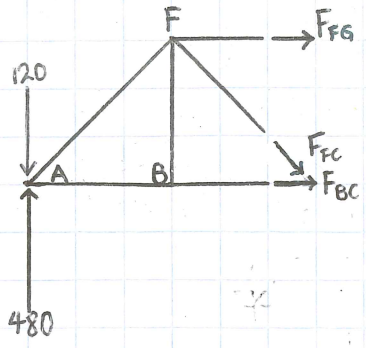
$R_{Ey} = 480kN$

$\text{Area} = 2 \cdot 2 = 4m^2$

$Ay = 4m^2 \cdot 30\frac{kN}{m^2} = 120kN$

$Cy = 4 \cdot 2 \cdot w = 240kN$

What is F_{FG}=? F_{FC}=? F_{BC}=?



$\sum M_F = 0$

$0 = 120 \cdot 4 - 480 \cdot 4 + F_{BC} \cdot 4$

$F_{BC} = 360\,KN$ tension

$\left.\begin{matrix}\sum F_x = 0 \\ \sum F_y = 0\end{matrix}\right\}$ To get others