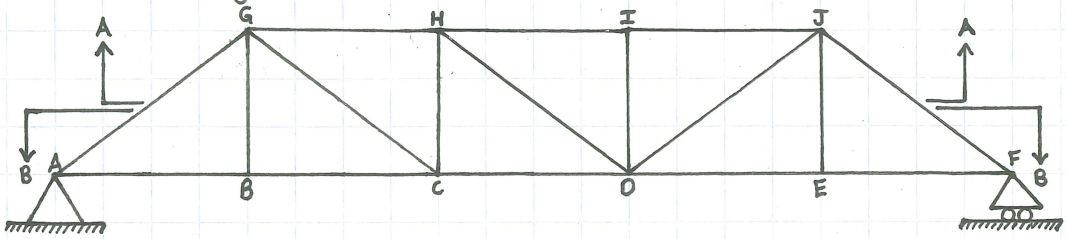
CIV102 - STRUCTURES and MATERIALS

Topic: Design for Wind

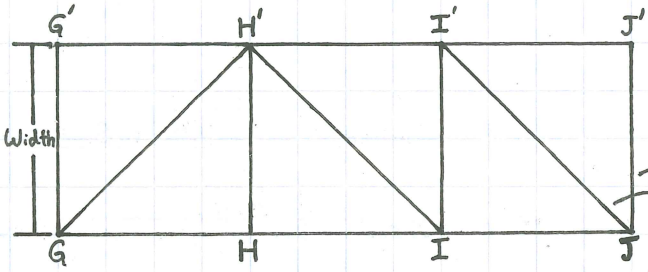
1) National Building Code of Canada (NBCC)

- Specifies load
- Floor loading for lecture hall
  - With fixed seats $= 2.4 \frac{kN}{m^2} = 50 \frac{lbs}{ft^2}$
  - Without fixed seats $= 4.8 \frac{kN}{m^2} = 100 \frac{lbs}{ft^2} = 100 psf$

2) Wind Design for Trusses

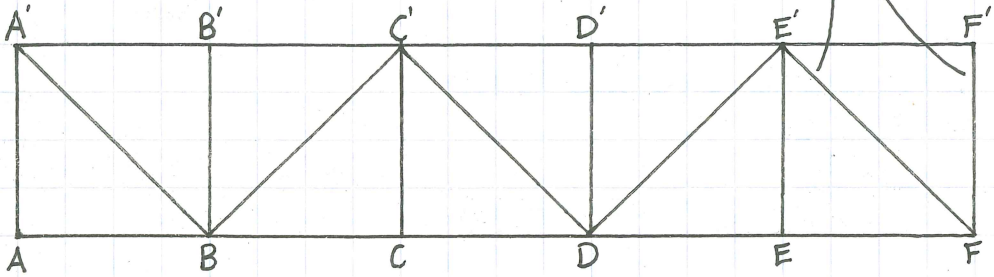


Elevation

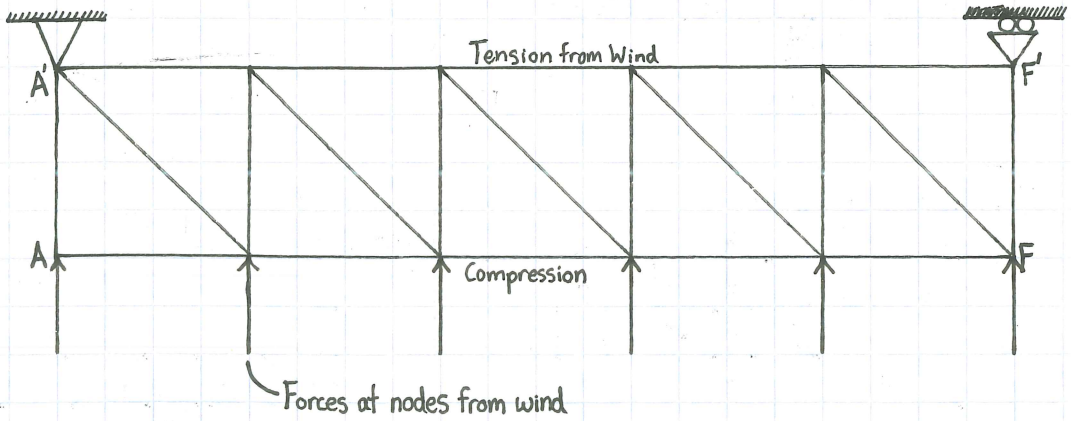


Plan A-A

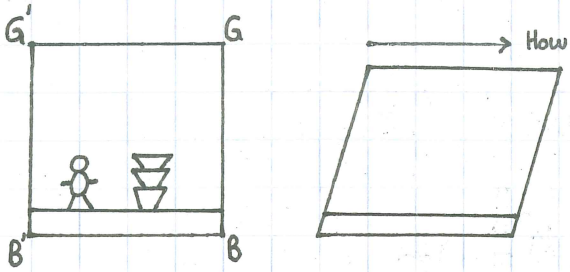
Wind Bracing

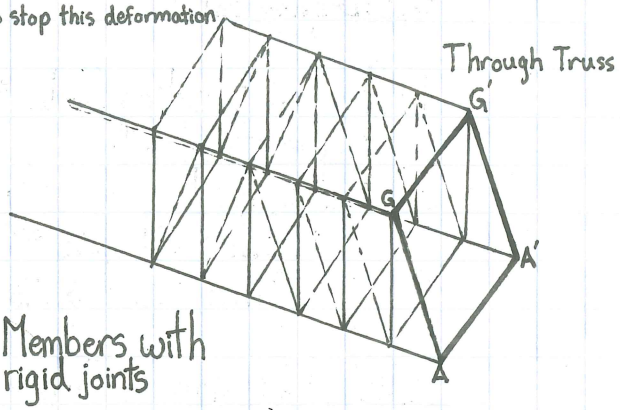


Plan B-B

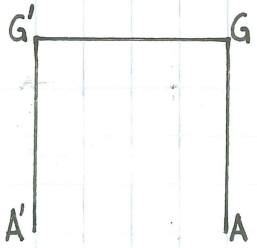


Usually only design diagonals and cross-bridge members for wind.
Neglect forces in bottom/top chord.

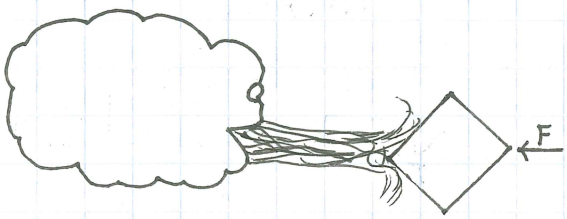




We will add a frame at each end = Members with rigid joints



3) Wind Forces



$W_{wind} \rightarrow$ Wind Pressure [kPa] or $[\frac{kN}{m^2}]$

$W_{wind} = \frac{1}{2} \rho \cdot V^2 \cdot C_D$

- ρ: Air Density
- V: Air Velocity
- C_D: Coefficient of Drag
  - Racing Car $C_D = 0.2$
  - Hindenburg $C_D = 0.08$
  - Sphere/Cylinder $C_D = 0.75$
  - Block $C_D = 1.5$

We will assume worst case senario

$\rho = 1.2 \frac{kg}{m^3}$

$C_D = 1.5$

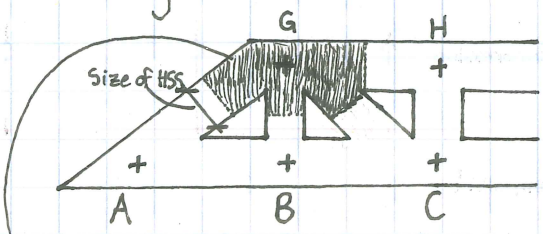
$V = \sim 100 mph, 170 \frac{km}{h} = 47.2 \frac{m}{s}$

$W_{wind} = \frac{1}{2}(1.2)(1.5)^2(47.2)$

$= 2 \frac{kN}{m^2}$

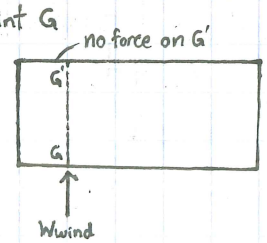
$= \underline{2 kPa}$

4) Tributary Area

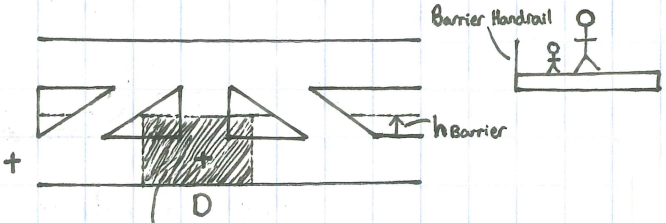


Tributary Area of Joint G

Force = Area · W_{wind}



Bottom Cord



Tributary Area for D