Lecture 16, Oct 19, 2021

Resisting Wind Loads

- Wind forces can be calculated with $F = \frac{1}{2}\rho v^2 c_D A$, where ρ is air density, v air velocity, A is the frontal area on which the wind acts, and c_D is the drag coefficient
  - For boxy objects like walls and most structural members we can take a conservative value of 1.5, and assuming a wind speed of 170km/h the wind load is approximately 2.0kPa of horizontal load
- Cross bracing is added to connect the top chords to each other and the bottom chords to each other, just like how vertical trusses transfer gravitational load
- Wind can blow or pull away on either side, creating 4 possible loading combinations
  - Members must be designed for both tension and compression

Solving For Forces

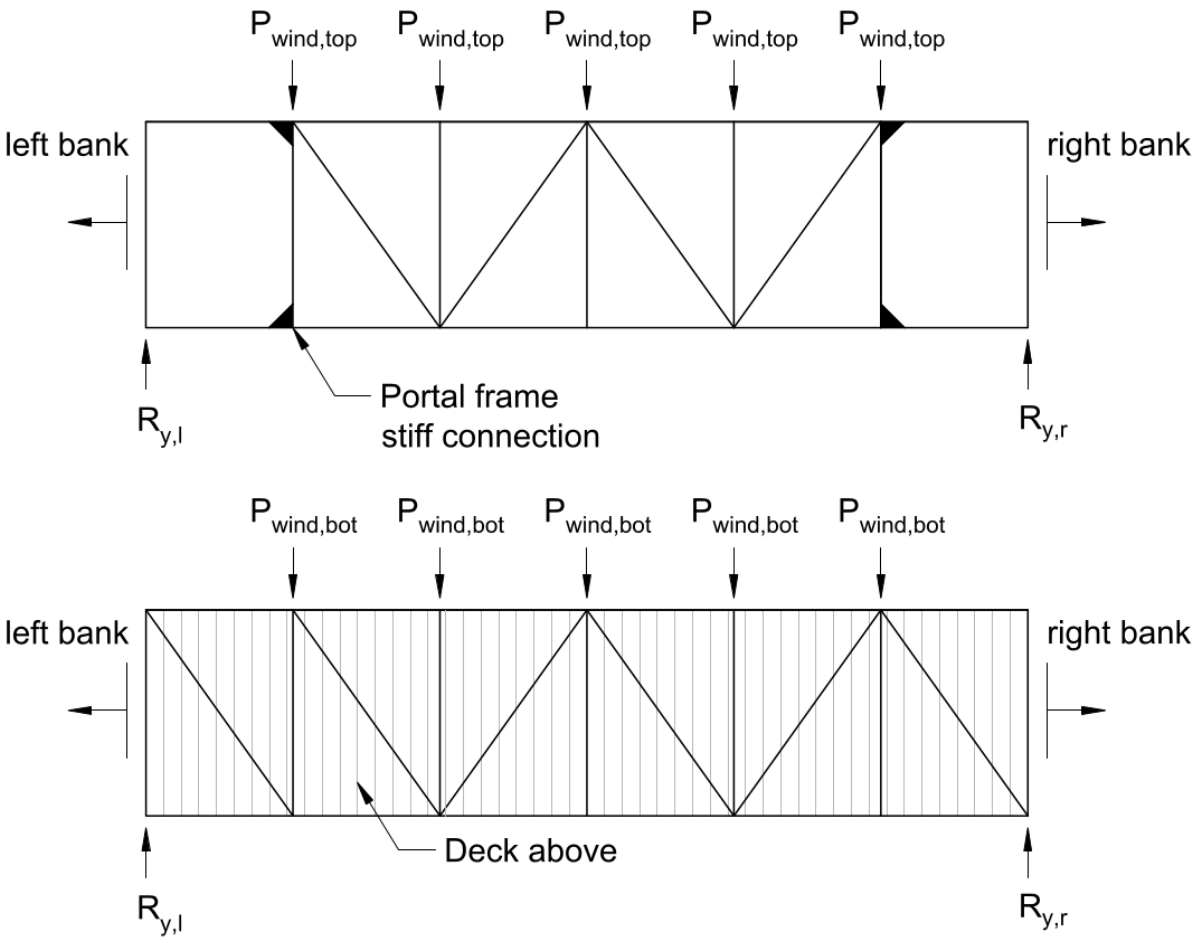

Figure 1: Arrangement of members in the top and bottom cross bracings

- In the bottom bracing, method of joints/sections can be used as usual, after first determining the reaction forces $R_{y,l}$ and $R_{y,r}$
- There are no diagonal members in the left and rightmost sections of the top cross bracing so the bridge could be entered; instead the connections are typically stiffened
- We can still analyze it using method of joints/sections by assuming that the reaction forces provided by the supports can be transferred to the stiff connections and ignoring the end sections

- Actually moving this support force to the top requires a good frame design, which is not covered in this course

Calculating Joint Loads

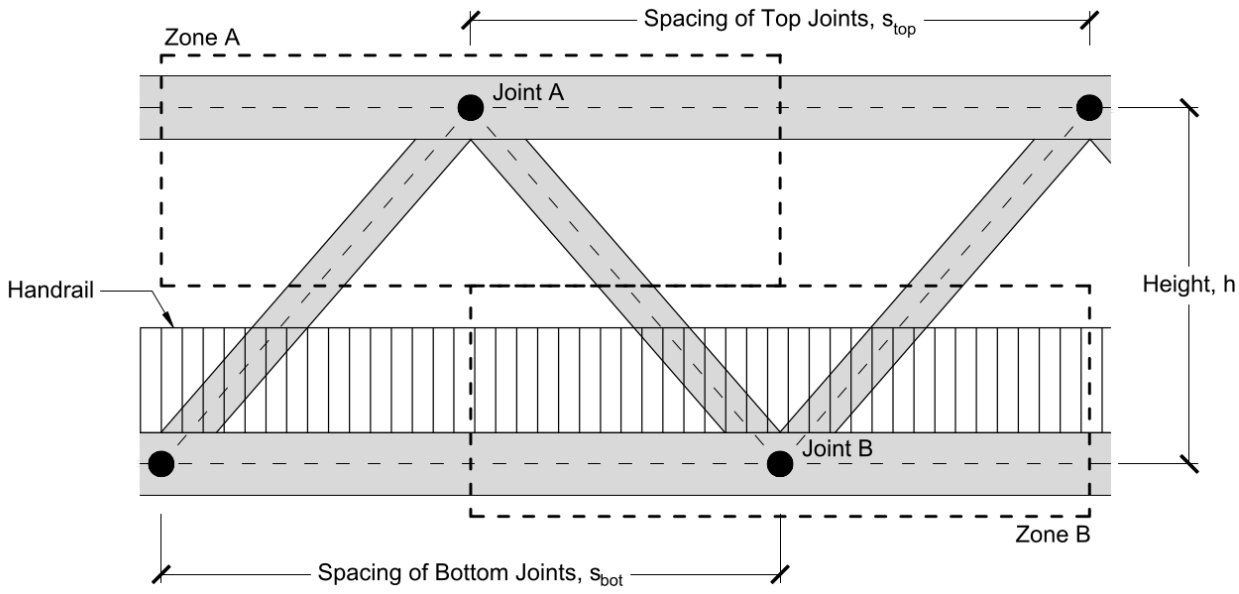

Figure 2: Tributary area of the joints

- To calculate the joint loads, we need to know the frontal area of each joint; this is determined by the tributary area method, but is more complicated
- In the figure above joint B will have a greater load because of the handrail
- In joint A, we can approximate the frontal area by summing the area of each piece, which is approximated by its length times its width
- Handrails consisting of vertical members close together can be approximated by a solid surface, because the resulting turbulence from air passing through increases the drag force
- In joint B, the frontal area of the handrail is much larger than the frontal area of the HSS, so the HSS can be ignored for simplicity