Mystery Architecture

That Is Not

Andy H. Milligan P.E. S.E.

Basic Concepts

- Compression
  - Area
  - Material Strength
  - Moment of inertia of the section and Unbraced length
- Tension
  - Area
  - Material Strength
- Bending is Compression and Tension working together

Three types of structures

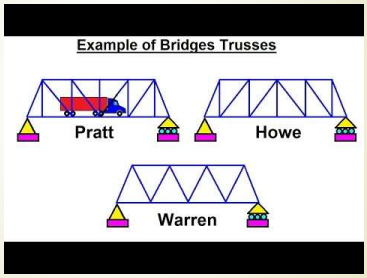
- Tower
- Bridge
- Cantilever (State and Nationals only)

Tower

- Load supported by compression in legs
- Bracing serves to shorten the unbraced length of the legs

Truss Bridge

- A simple span bridge supports load by compression in the top members and tension in the lower members (chords)
- The interior (web) members alternate between compression members and tension members.
- Common types of bridges
- Pratt A practical design.
- Howe How does it stand up?
- Warren Just lots of W's.



Cantilever

- Just like a truss bridge except upside down and backwards.
- Tension members on top.
- Compression members on bottom.

Connections

- The cause of most failures.
- Compression connections
  - Maintain alignment of members
  - Easiest connection to make
- Tension connections
  - Usually connects two or more types of materials
  - Most difficult connection to make.
- Practice as many different types and materials as possible.

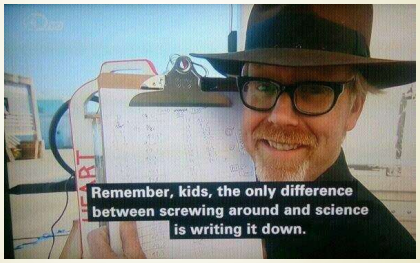
Resources

- Andy H. Milligan P.E. S.E. andyh.milligan@gmail.com 865 207-2773
- www.soinc.org
- https://www.cesdb.com/west-point-bridge-designer.html West Point Bridge Design program (free)

Training

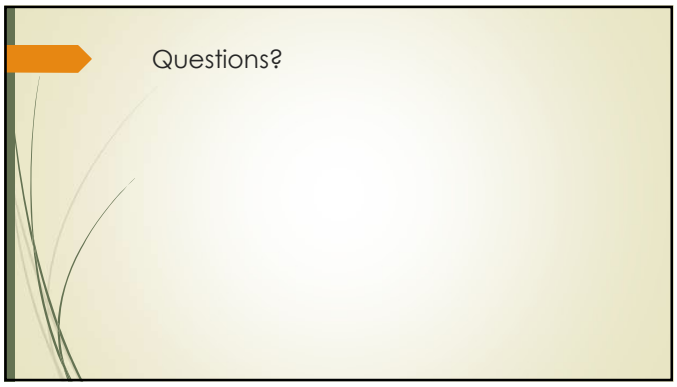
- Team members should build as many towers and bridges as possible using as many different material types as possible. Try different methods to make joints to see which carries the most load.
- Keep a log of trials showing
  - Material list quantity and type of each building material
  - Maximum primary dimension (tower height or bridge span)
  - Secondary dimension (tower base or bridge width) try for minimums
  - Maximum load carried. Keep an assortment of loads and try lightest to heaviest on each design to find out the capacity.
- Learn to complete the build in a given amount of time (30 to 50 minutes).

Keep a log



Differences between competition and real world

- Real towers are designed more for wind resistance than for vertical load, therefore they have much more bracing than needed for competition.
- Real bridges are designed to support a moving load anywhere along their length. Fewer web members are needed if the location of the load is known.


Questions?