

USC Viterbi
School of Engineering

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MESA DAY BRIDGES

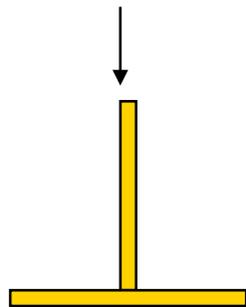




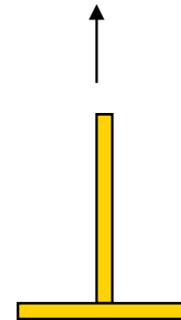
- Forces at Work
- Forces in a Bridge
- Building Better Bridges
- Rules
- Testing Procedures
- Materials Suppliers

Forces are transmitted through materials 4 ways:

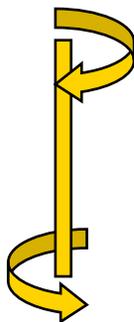
Compression



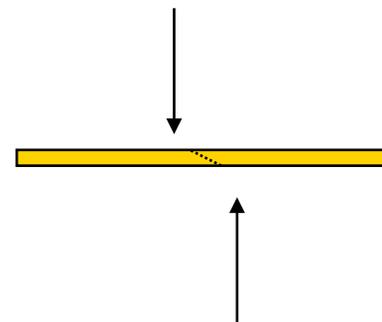
Tension



Torsion



Shear





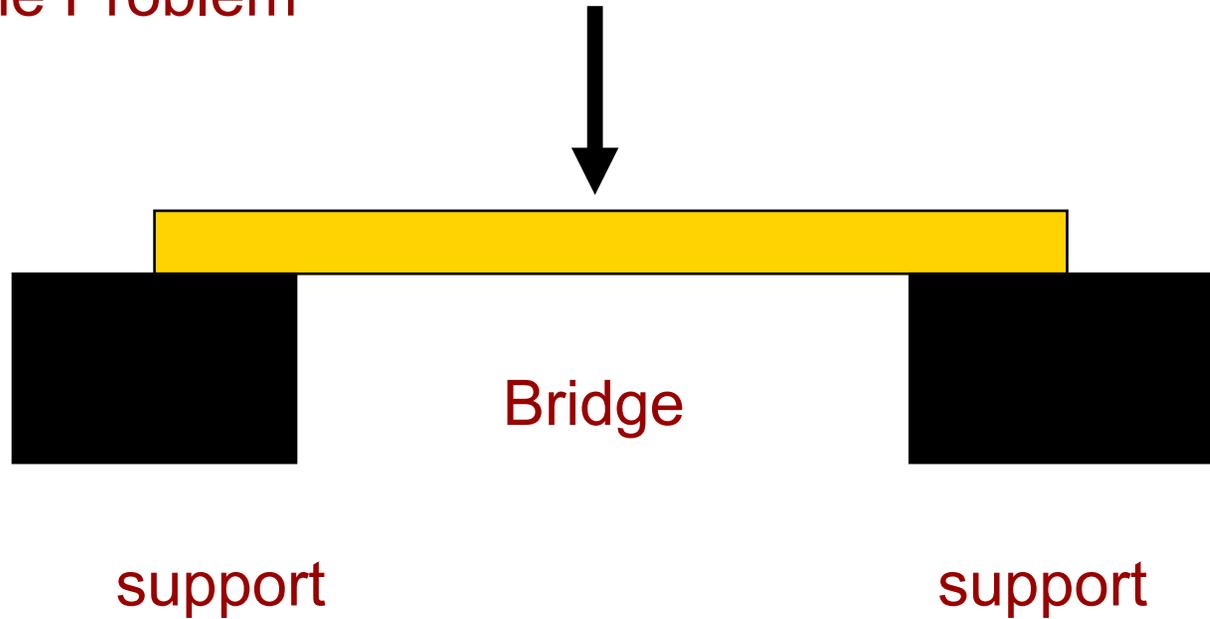
Wood Properties

Wood can transmit:

- Hundreds of times its weight in compression (“pushing”)
- Thousands of times its weight in tension (“pulling”)
- Only a limited amount of torsion (“twisting”) or shear (“tearing”)



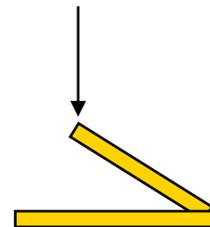
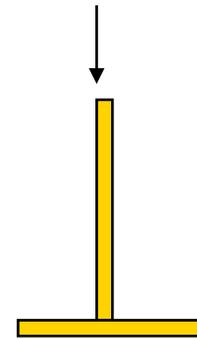
The Problem



The applied force must be transmitted to the two supports in a way that minimizes shear and torsion.

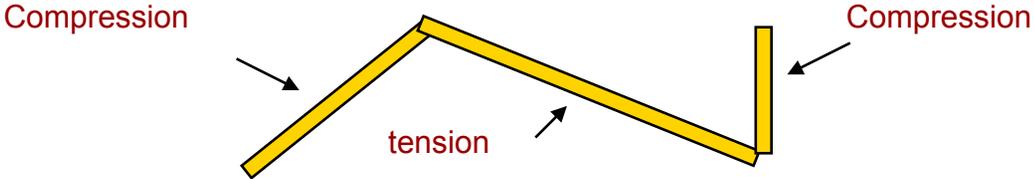
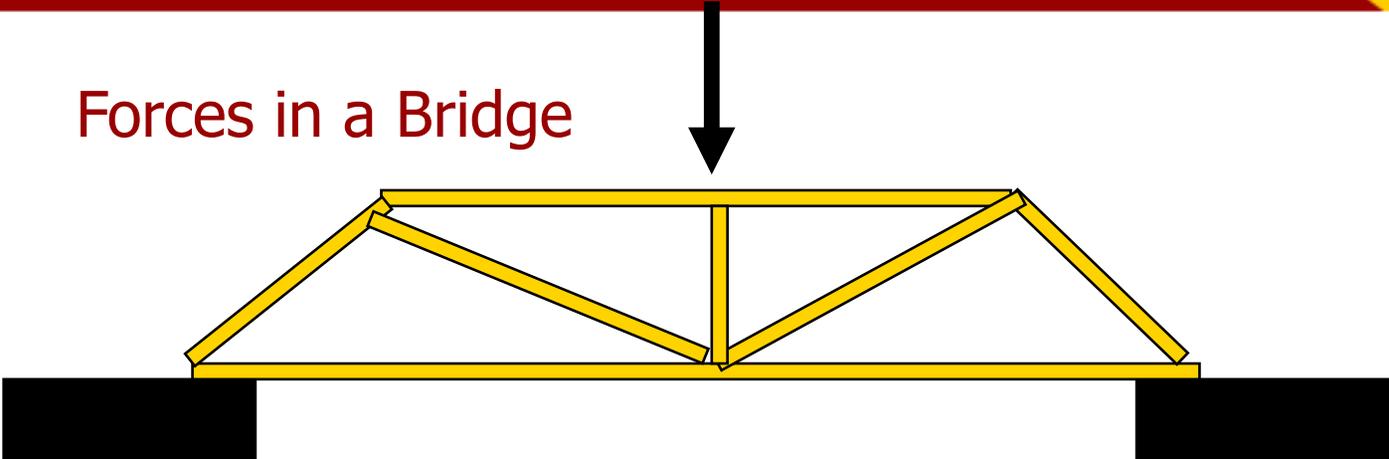
Force Transmission

- Because force is applied vertically, bridge components with a vertical orientation will transmit the force as compression or tension
- The more horizontal the orientation, the greater the amount of force transmitted as torque or shear.





Forces in a Bridge





Using White Glue

For the strongest bonds using white glue:

- Sand the joints carefully so that the members fit well and square.
- Allow to dry in a cool, moist environment.
- Do NOT place in oven or hair dryer to speed drying
- Maximum bond strength occurs after two weeks of drying time.



Building Tips

- Orient components to transmit forces as either tension or compression
- Use the full vertical space allowed
- Use all the wood. Keep your design near the maximum weight.
- Sand all joints prior to gluing
- Make the bridge neat and square
- Build a level base footing. Sand the completed bridge footing so that it is perfectly flat
- Allow about 14 days drying time (i.e. don't wait until the last minute!)



CRAFTSTICK DIMENSION SUMMARY

- Max. length = 17 inches
- Max. width = 5 inches
- Max. height above top of roadway = 7 inches
- Max. below top of roadway = 3.5 inches
- Min. length = 15 inches
- Min. width = 4 inches

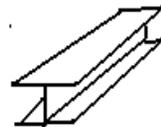


CRAFTSTICK RULES SUMMARY

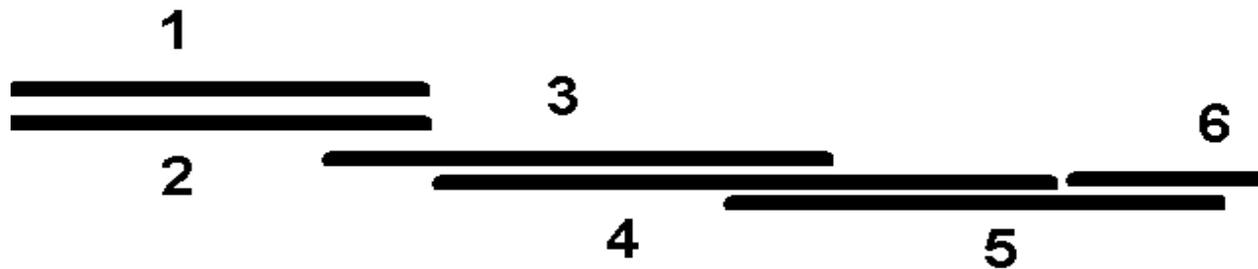
- Max. stick surface glued/overlap = 50%
- Elmer's type white glue only
- No coatings allowed
- Bridge must be open
- Bridge MUST have 3.5 inch roadway
- No I-beams, or T-sections



I-Beam, T-Section



Which Sticks are Legal?



CRAFTSTICKS



Is this Legal?



CRAFTSTICKS

USC



FILE FOLDER DIMENSION SUMMARY

- Max. length = 35 cm (8th), 45 cm (9th, 10th)
- Max. width = 10 cm
- Max height = 15 cm
- Min. length = 32 cm (8th), 42 cm (9th, 10th)
- Min. span = 30 cm (8th), 40 cm (9th, 10th)
- Max. mass = 55 g (8th), 70 g (9th, 10th)



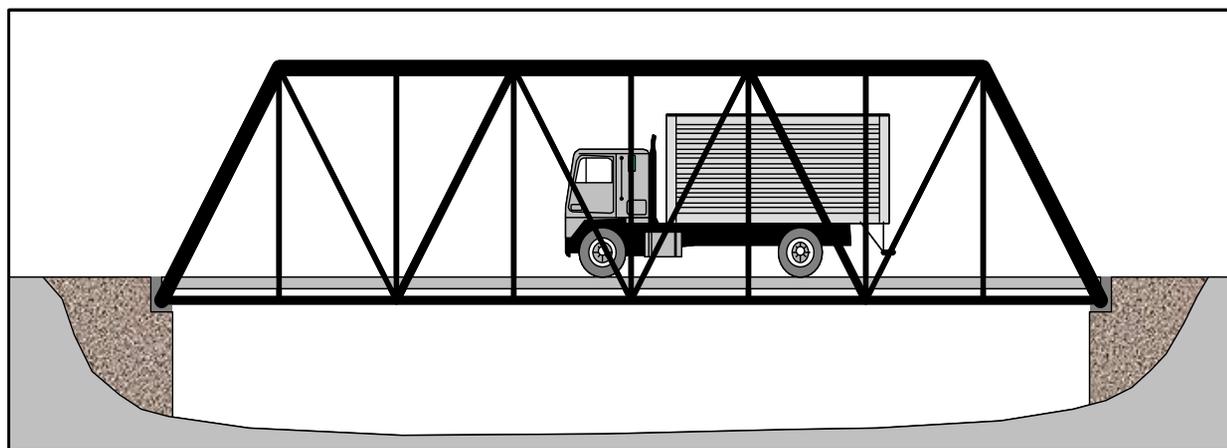
FILE FOLDER RULES SUMMARY

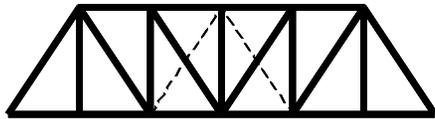
- Only standard, non-plastic, letter-size manila file folders
- No part of bridge below the support surface
- Any glue ok
- No coatings allowed
- Tested by 10cmX10cm plate on top center of bridge
- Roadway NOT required.



What is a Truss?

- A structure composed of members connected together to form a rigid framework.
- Usually composed of interconnected triangles.
- Members carry load in **tension** or **compression**

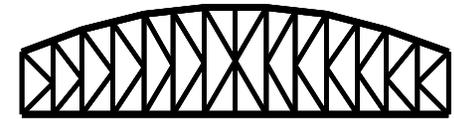




Pratt



Parker



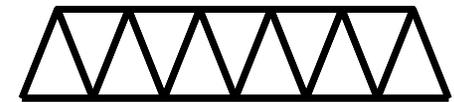
K-Truss



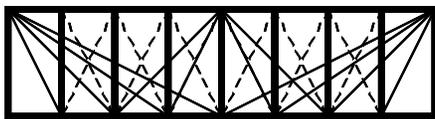
Howe



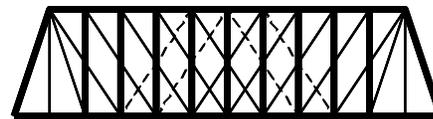
Camelback



Warren



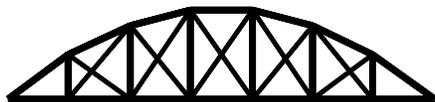
Fink



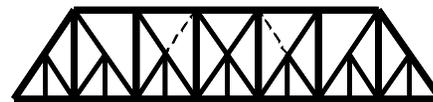
Double Intersection Pratt



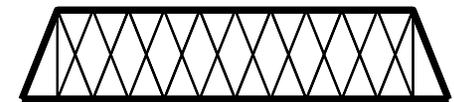
Warren (with Verticals)



Bowstring



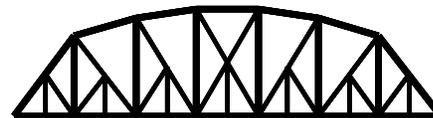
Baltimore



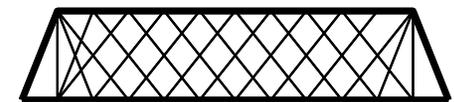
Double Intersection Warren



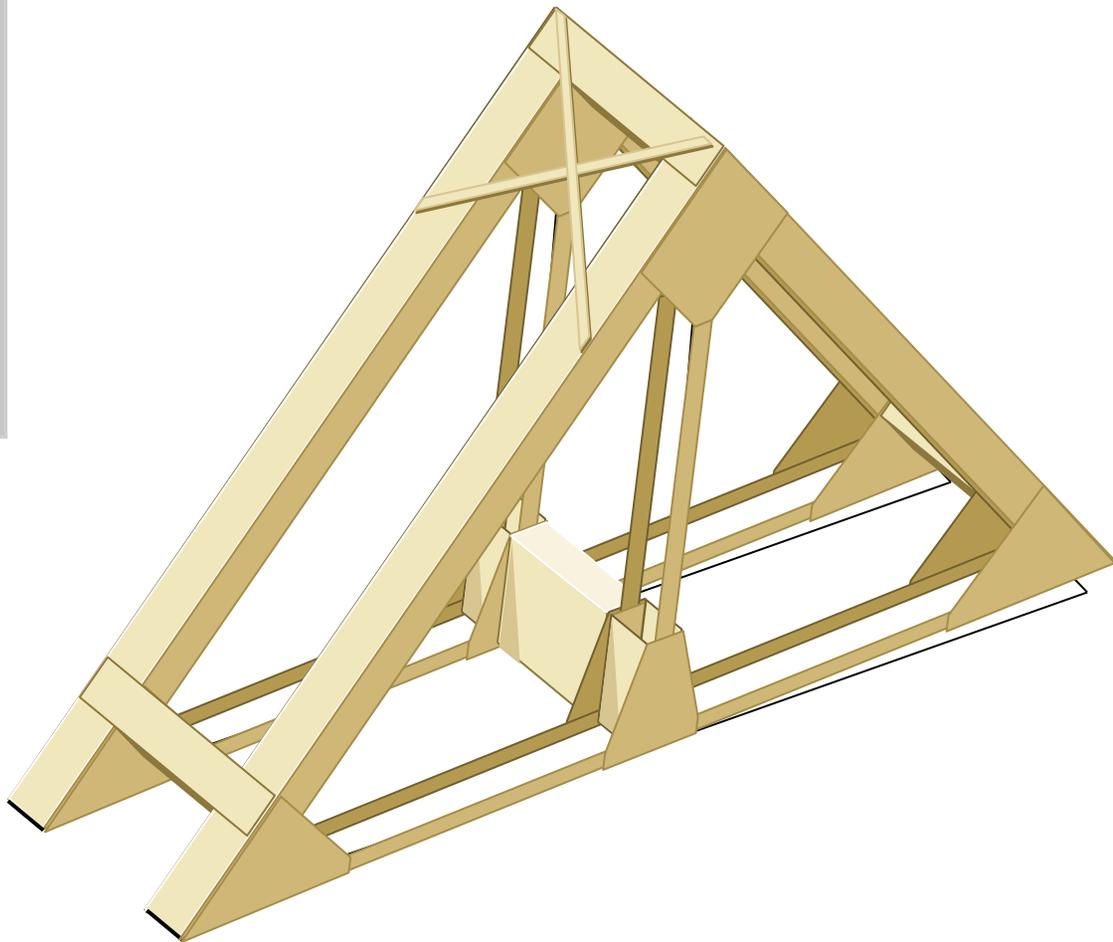
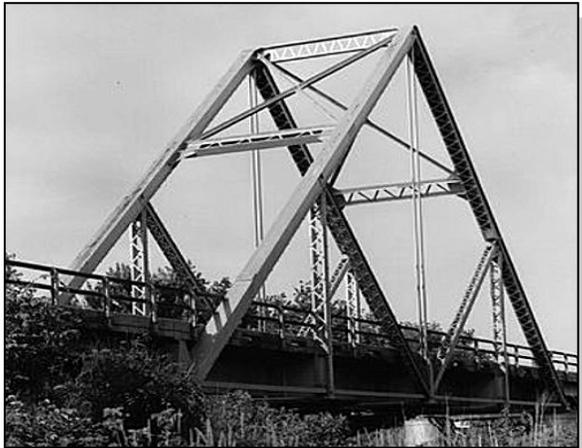
Waddell "A" Truss

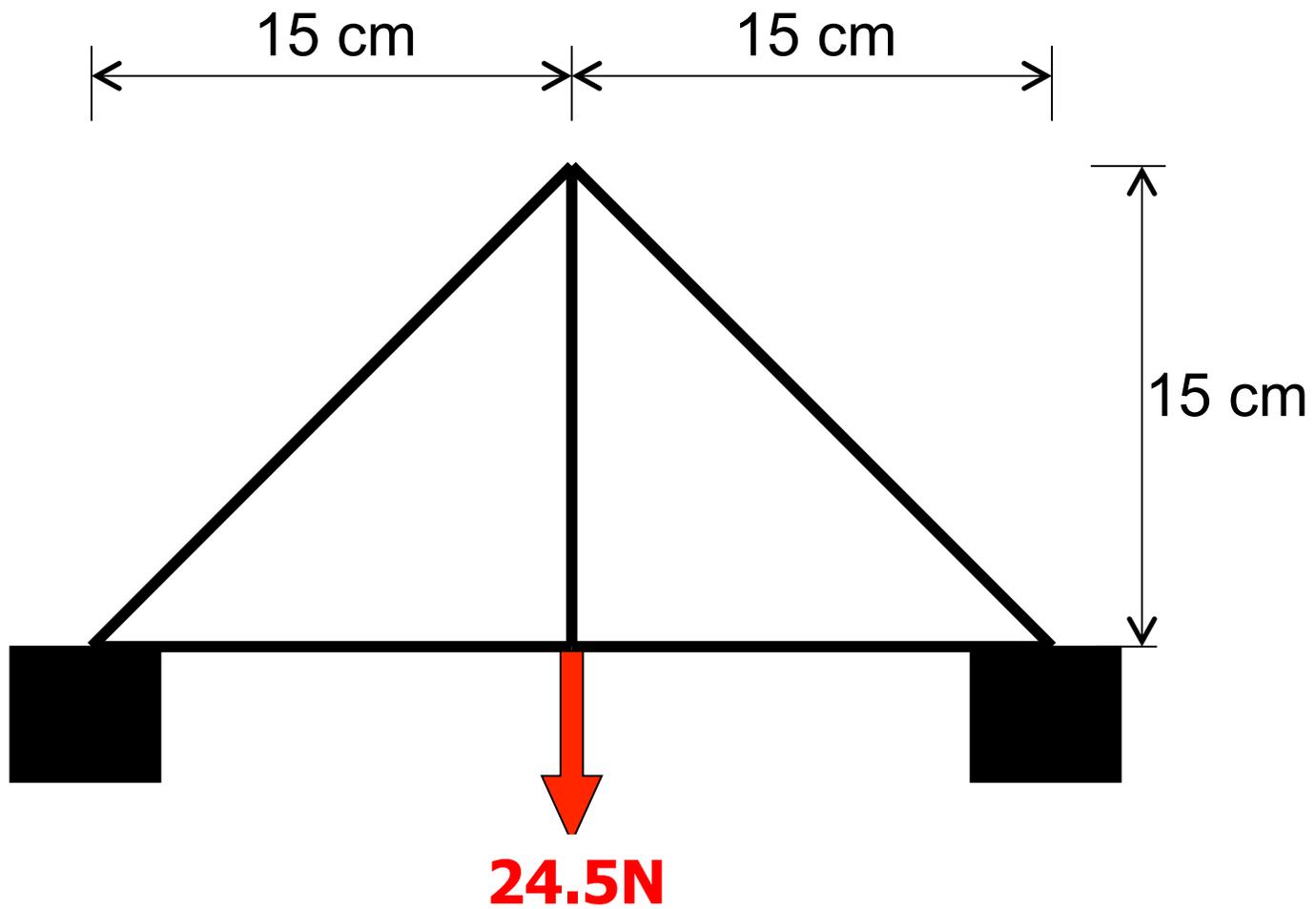


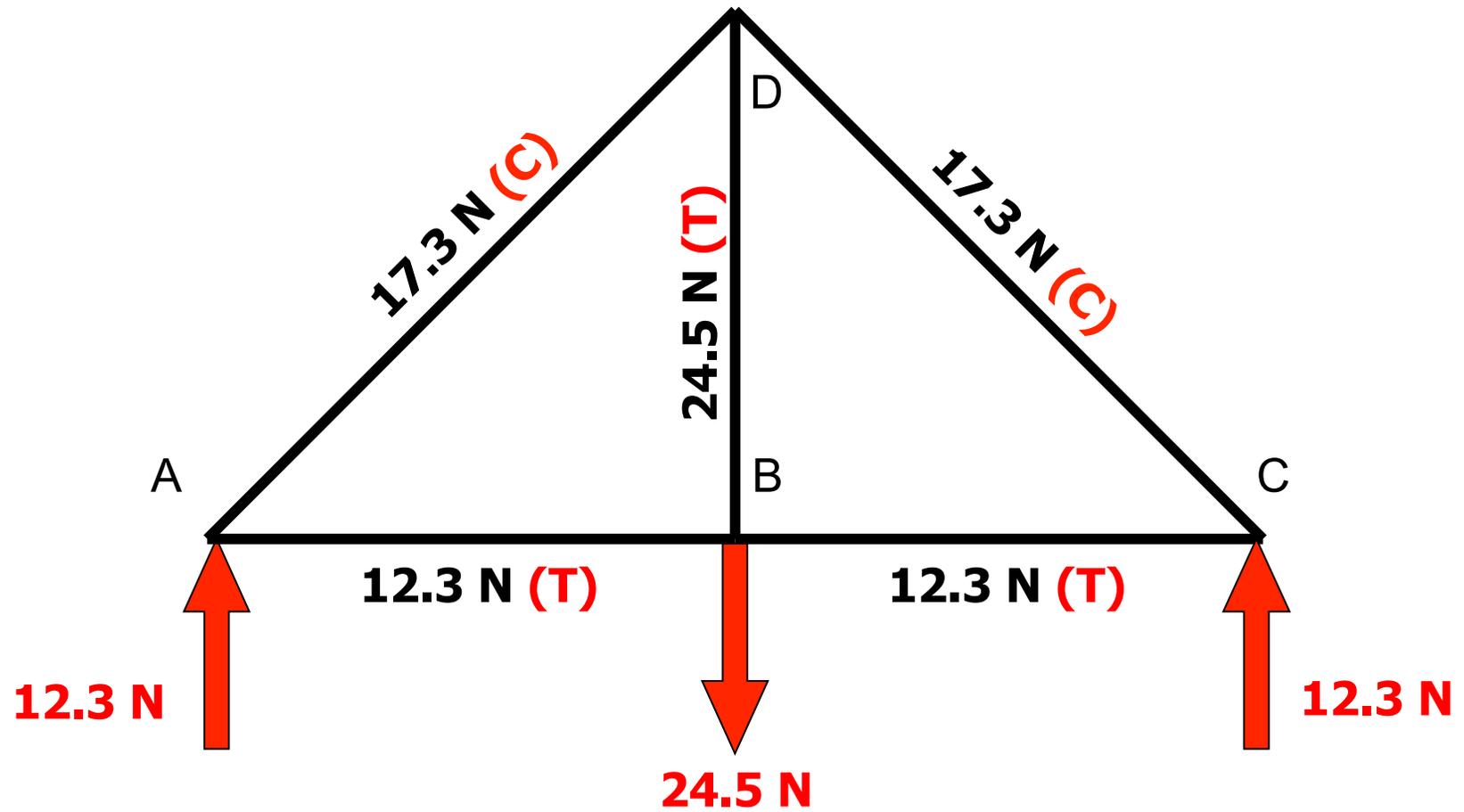
Pennsylvania



Lattice

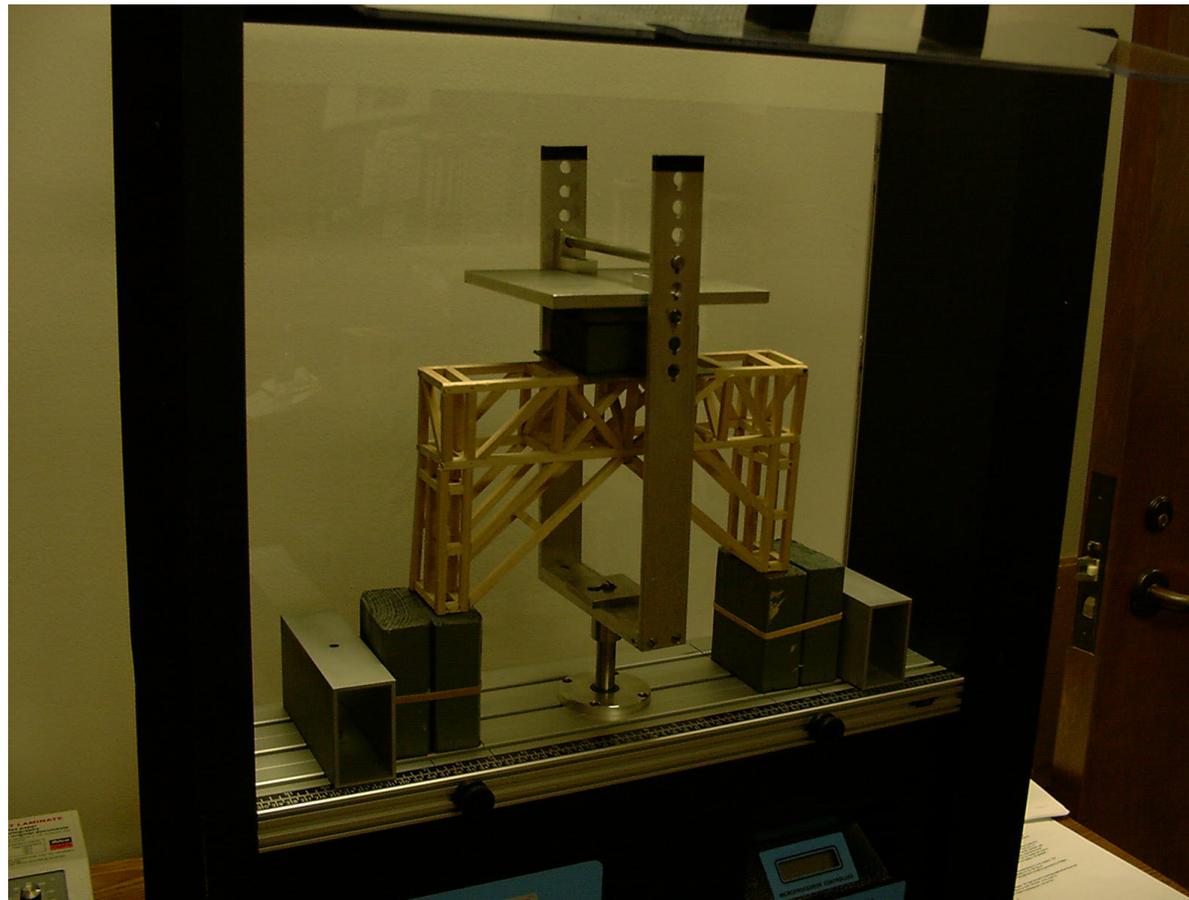








MESA Bridge Tester



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