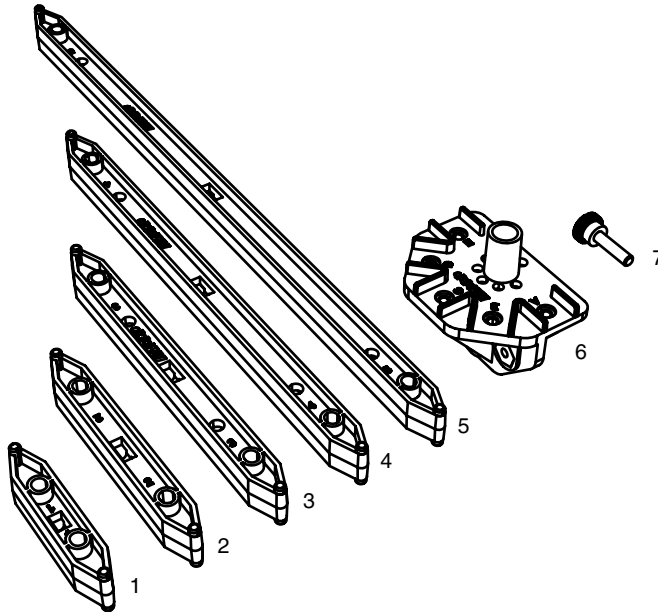


**PASCO Structures System**

**Truss Set**

**ME-6990**



| <b>Included Equipment</b> | <b>Quantity</b> |
|---------------------------|-----------------|
| 1. #1 Beams               | 8               |
| 2. #2 Beams               | 8               |
| 3. #3 Beams               | 18              |
| 4. #4 Beams               | 18              |
| 5. #5 Beams               | 8               |
| 6. Brackets               | 14              |
| 7. Screws                 | 75              |

**Related Equipment**

- Load Cell & Amplifier Set (PS-2199)
- Bridge Set (ME-6991)

See [www.pasco.com](http://www.pasco.com) for other PASCO Structures System parts and sets.

**Introduction**

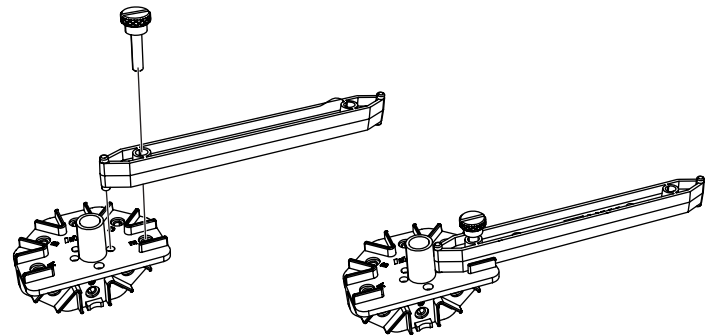
The Truss Set includes beams, brackets, and screws for building various trusses and bridges.

The Truss Set can be combined with other parts of the PASCO Structures System. The Load Cell & Amplifier Set (PASCO part

PS-2199) can be added to measure compression and tension forces in the components of any PASCO Structure.

**About the Components**

Attach beams to brackets as illustrated.



**Figure 1: Attaching a beam to a bracket**

Each bracket has eight slots, labeled A through H, for accepting beams.

There are five sizes of beam, labeled #1 through #5.

**Simple Triangles**

Most structures are made of isosceles right triangles as shown in Figure 2 and Figure 3.



**Figure 2: A triangle made from a #5 beam and two #4 beams**

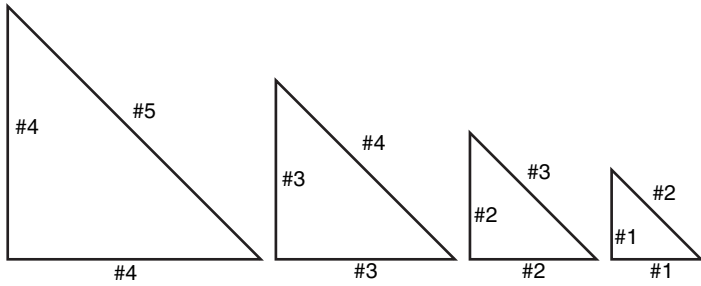


Figure 3: Combinations of beams to make triangles

## Structures

### Kingpost Truss

Figure 4 shows a simple kingpost truss made from #5 and #4 beams. Use a hanging mass to apply load.

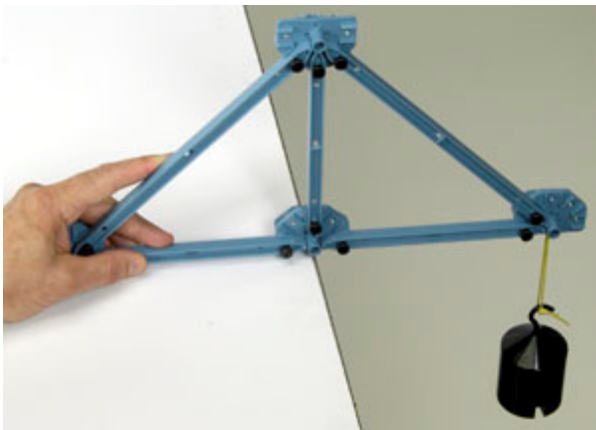
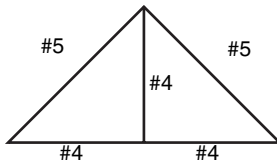


Figure 4: A simple kingpost truss

Lay the kingpost truss flat on the table to compare its horizontal and vertical stiffness.

To build a three-dimensional structure, connect two trusses with #4 beams (Figure 5).

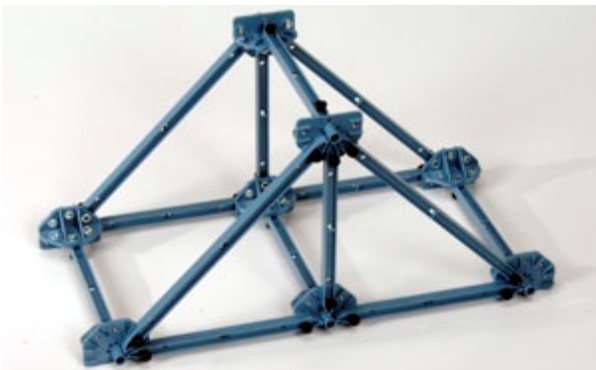


Figure 5: A three-dimensional kingpost truss structure

Add cross bracing to increase stiffness.

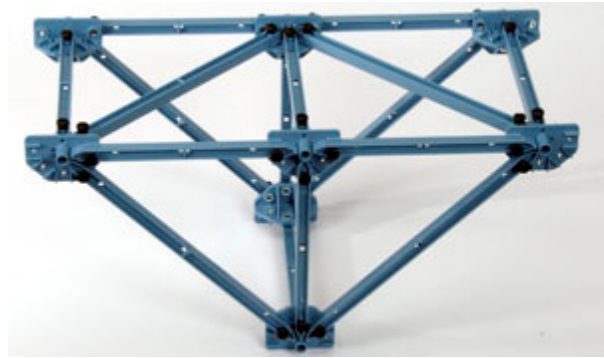


Figure 6: Kingpost truss with cross bracing

### Queenpost Truss

To make a queenpost truss, separate the kingpost truss in the middle and add a square section.

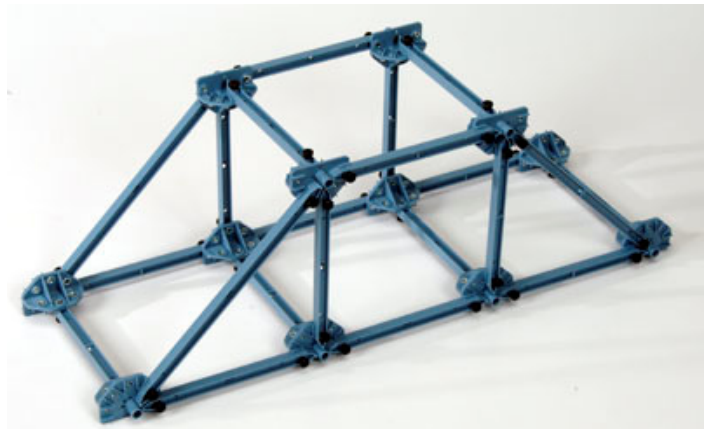
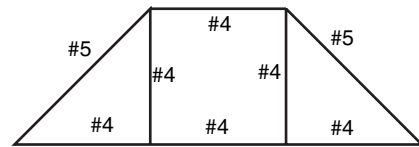


Figure 7: Queenpost truss

Legs can be added to any truss or bridge.

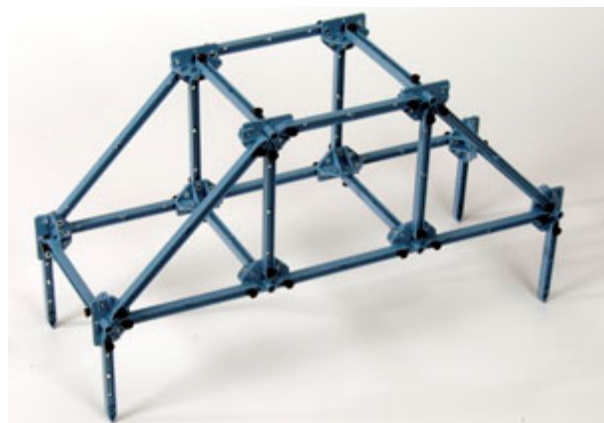


Figure 8: Queenpost truss with legs

### Roof Truss

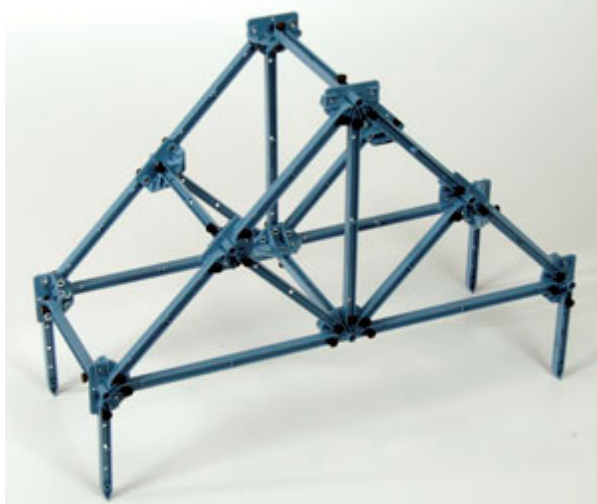
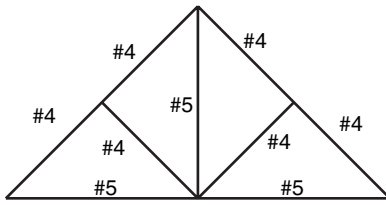


Figure 9: Roof truss

### Two-span Bridge

Remove the center section of a roof truss and replace it with a #5 beam.

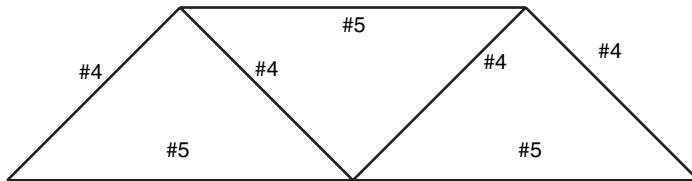


Figure 10: Two-span Bridge

### Bridge with Verticals

The bridge with verticals has additional deck support.

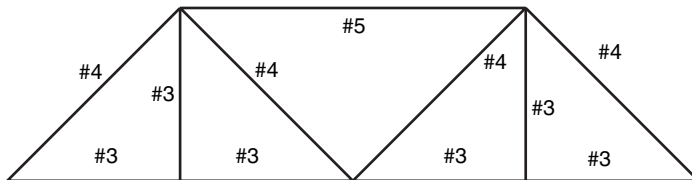


Figure 11: Subdivided bridge

### Deck Truss

Make a deck truss by turning the bridge with verticals over. Use #5 beams for legs.

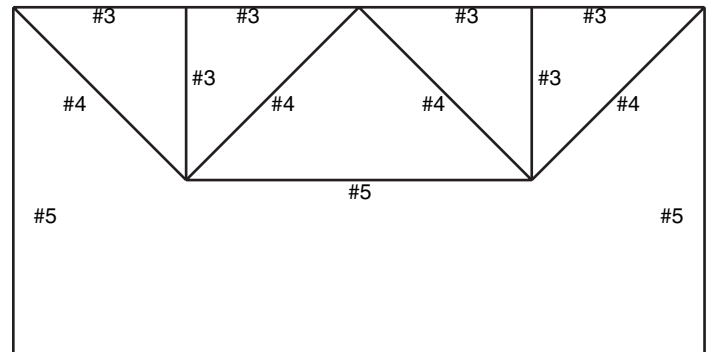


Figure 12: Deck truss

### Properties of I-beams

This demonstration shows the difference between the X and Y bending moments of an I-beam.

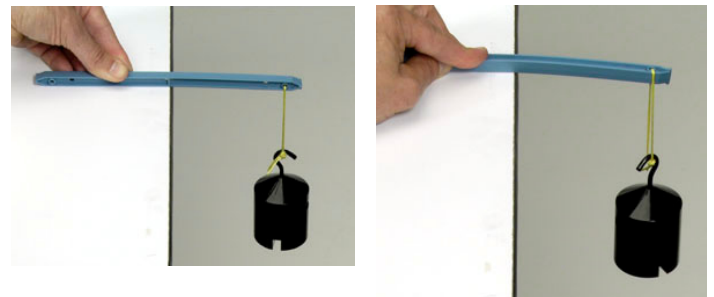


Figure 13: Bending an I-beam

### Adding Load Cells

To measure the compression and tension forces in individual members, add load cells (PASCO part PS-2199) to any PASCO Structure. Replace a beam with two shorter beams and a load cell.

#5 beam = load cell + two #3 beams

#4 beam = load cell + two #2 beams

#3 beam = load cell + two #1 beams

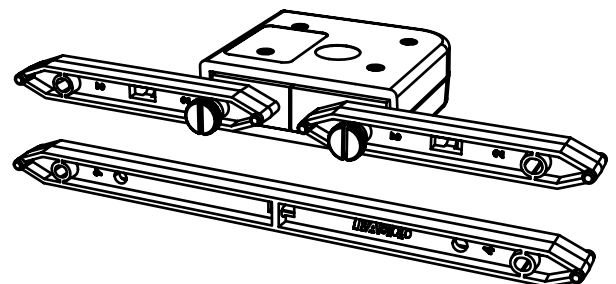


Figure 14: A load cell combined with two #2 beams is the same length as a #4 beam

Use thumbscrews to attach two beams to a load cell as shown in Figure 14.

When using load cells, assemble your structure with the screws loose. This will simplify the analysis by ensuring that the members experience only tension and compression without moments.

See the instructions that came with the load cells for details about how to connect the load cells to an interface or datalogger and collect data.

### Example: Bridge with Load Cells

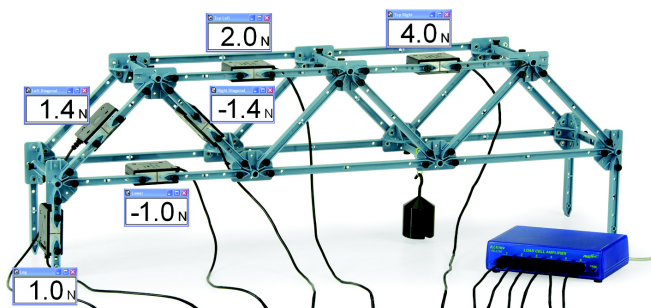


Figure 15: Bridge with load cells

The bridge shown in Figure 15 incorporates six load cells to measure the tension or compression in various members. A hanging mass is used to apply load. The mass is adjusted so that the compression in one of the legs is 1.0 N. Compression is registered as a positive value and tension as a negative value.

If the screws are loose, the theoretical analysis of the bridge can be carried out by assuming that the net force at each node is zero. Thus, the vertical component of compression in the left-most diagonal member must be 1 N (to oppose the force applied by the leg). The horizontal component must also be 1 N since the member is at a 45° angle. The predicted resultant force is:

$$\sqrt{(1.0 \text{ N})^2 + (1.0 \text{ N})^2} = 1.4 \text{ N}$$

The actual measured force confirms the theory.

### Calibration of Load Cells

Load cells are factory calibrated; however, you can recalibrate them in software or on the datalogger. See the documentation for your software or datalogger for instructions.

When calibrating a load cell, it is necessary to apply a known load. Assemble the fixture shown in Figure 16 to support the load cell. Hold or clamp the fixture at the edge of a table and hang a mass from it as shown.

Note that the hanging mass applies tension to the load cell; therefore the known force that you enter into the software or datalogger should be a negative value. For example, if the mass is 1.0 kg, the applied force is -9.8 N.

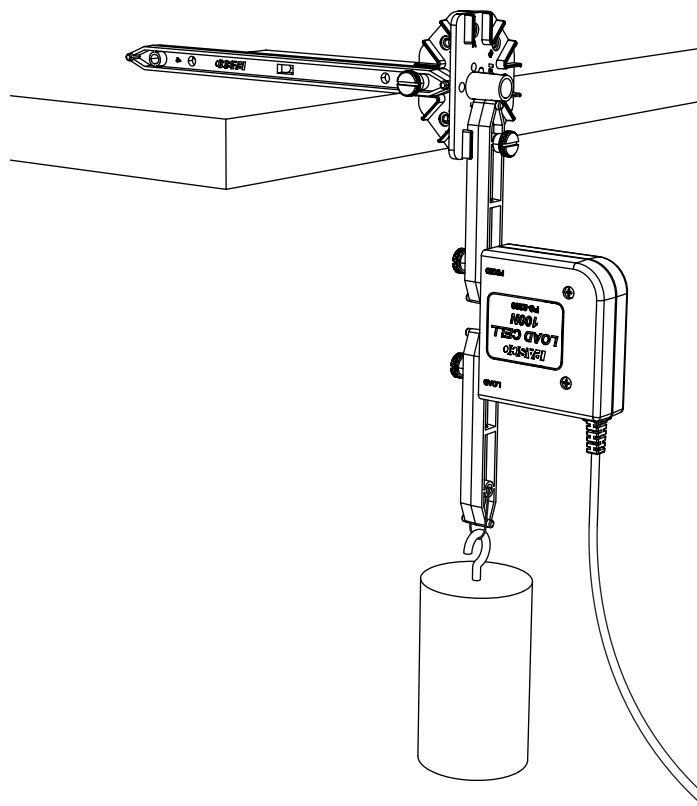


Figure 16: Calibration fixture

## Technical Support

For assistance with any PASCO product, contact PASCO at:

Address: PASCO scientific  
10101 Foothills Blvd.  
Roseville, CA 95747-7100

Phone: 916-786-3800 (worldwide)  
800-772-8700 (U.S.)

Fax: (916) 786-7565

Web: [www.pasco.com](http://www.pasco.com)

Email: [support@pasco.com](mailto:support@pasco.com)

For more information about the Truss Set and the latest revision of this Instruction Sheet, visit:

[www.pasco.com/go?ME-6990](http://www.pasco.com/go?ME-6990)

**Limited Warranty** For a description of the product warranty, see the PASCO catalog. **Copyright** The PASCO scientific 012-10586B *Truss Set Instruction Sheet* is copyrighted with all rights reserved. Permission is granted to non-profit educational institutions for reproduction of any part of this manual, providing the reproductions are used only in their laboratories and classrooms, and are not sold for profit. Reproduction under any other circumstances, without the written consent of PASCO scientific, is prohibited. **Trademarks** PASCO and PASCO scientific are trademarks or registered trademarks of PASCO scientific, in the United States and/or in other countries. All other brands, products, or service names are or may be trademarks or service marks of, and are used to identify, products or services of, their respective owners. For more information visit [www.pasco.com/legal](http://www.pasco.com/legal). **Patents Pending** The PASCO ME-6990 Truss Set has patents pending.