

Steps to Building a Model Bridge

The following guidelines were adapted from Garrett Boon's [5 Steps to Building a Model Bridge PDF](#). I have modified it to reflect the rules and testing procedure of our competition as needed. You can download the complete ebook which provides an expanded version of the outline.

1: Know the rules!

Be able to define in your own words what the bridge must accomplish. You need to know the rules by heart specifically if you are doing it for the first time. In the past many bridges were disqualified for not following the rules.

2: Design the bridge

- “Center” the design around the loading point (at the mid-span this year)
 - Plan for extra bracing around loading point
 - Make sure you have clear opening at the loading point so that the loading bolt can pass through and the 2”x 4”wood piece holding the bolt can rest on the main beams.
- Choose a truss to use
 - Warren
 - Pratt
 - Howe
 - Arch (ex. Sydney Harbor bridge)
 - Bridge similar to railroad track (main beams should be very strong, build I beams using multiple balsa sticks)
 - Design your own
- Draw the bridge to scale on graph paper
 - Measure every member very carefully
 - Label everything
 - Name the design and add a date

3: Preparation for building

- Get the wood
 - Hobby stores
 - [Specialized Balsa.com](#)
 - Pick out the “good” wood
- Tools
 - Glue
 - Saw/Exacto knife
 - Gram scale

- Clamps/clothespins
- Foam Board
- Workspace
 - Good lighting
 - Good ventilation

4: Build the bridge

- **Step 1**
 - Cut the balsa wood to the right size
 - Weigh the cut pieces including the extra pieces to be used as lateral braces needed to join both sides of the truss
 - Weigh all the pieces and include 10% for glue. Check against the weight limit – 10z. or 28.3 g
- **Step 2**
 - Secure the bridge design on the graph paper on your work space (foam board if you are using one)
 - Tape down the top and bottom chords board by pins on both sides
 - Glue on remaining pieces (Use sparingly. If you can see the glue, you have used too much). For extra strength you can use notched joint or use gusset plate made from balsa sheet.
 - Make sure everything is held firmly in place either by pins or tape.
 - Let dry for at least 24 hours.
 - Follow the same procedure to build the other side of the truss from the same bridge design. The two sides should be identical.
- **Step 3**
 - Make two piles of books, spaced correctly apart (minimum 2”).
 - Tape trusses to piles
 - Glue bracing on top
 - Glue bracing on bottom
- **Step 4**
 - Double check if your bridge is laterally stable (not leaning on either side)
 - Glue on lateral bracing
 - Weigh the bridge
 - Record the final weight and all specifications of the bridge that you made.

5: Test the bridge

- Test before competition if:
 - You have time to build another bridge
 - You are only testing your bridge to a certain point
- Testing equipment
 - Bathroom scale (top loaded only)
 - Bucket and sand (top or bottom)
- Testing Procedure
 - Pour sand slowly but steadily
 - Watch for deflection (2" is considered failure)

6: Evaluation of the bridge / Analyze the failure

- Efficiency = mass that bridge held divided by mass of bridge
 - What is a good efficiency score? (Look at previous year's winning score. Even to win a third place prize, typically you need to score significantly better than 250)
- What failed? A member or a joint?
 - Video tape the test and replay to find answer
 - Carefully examine the broken pieces
- Improving
 - Design (add a piece around the point of failure)
 - Construction (use notched joint or add a gusset plate made from a thin balsa sheet)