Modeling Timber Truss Bridges

Michael C. Barrett
President
Black Bear Construction Co., Inc.
www.blackbearcc.com

ABSTRACT
Mike Barrett, President of Black Bear Construction Co., Inc. explains the construction process presented in Midwest Products' HO Scale Fox River Bridge Kit* (a Howe through truss bridge). The basic concepts are expanded to demonstrate a simple, straightforward method of building any timber Howe truss bridge in N, HO, S, and O scales, standard or narrow gauge. Photos of prototypes are presented.

HOWE TRUSS BRIDGE BASICS
Almost all timber bridges are of the Howe design. This design is characterized by inward leaning members that are heavier than the outward leaning members. The inward leaning members are in compression. In a static situation (no movement or shifting of forces), the outward leaning members are not even needed. See Figure 1 for a description of the different parts of a Howe truss bridge.

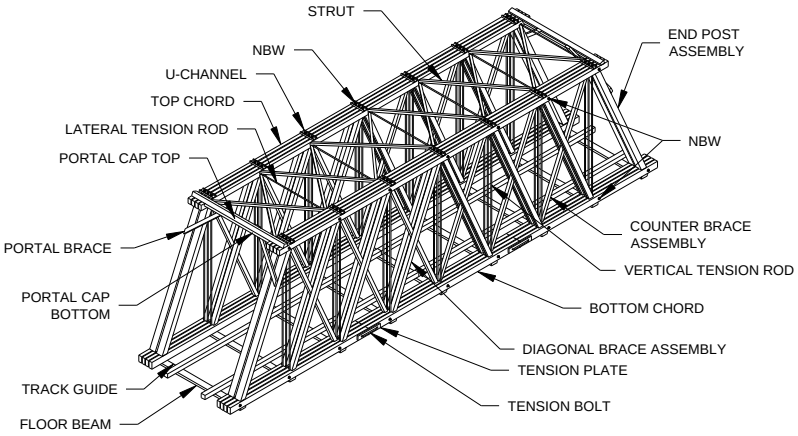

Figure 1 – Components of Midwest Products' Fox River Bridge kit. Notice that the bridge can sit directly on the floor, table, or plywood. (Used by permission of Midwest Products, Inc.)

The top chord is in compression and the bottom cord is in tension. There aren't many trees big enough to supply large timbers long enough to build these chords

* The author designed and wrote the instructions for this product.

without joints. The joints are generally combinations of cleats, plates, and bolts. Lots of drawings and photographs are covered in the clinic.

The stresses in the braces and rods are greatest at the ends of the bridge. It is common for the diagonal braces to be larger in size and the iron rods to be more numerous as they get nearer the ends of the bridge. It is rare to take the size changes into account when modeling. Also, the bottom chord was sometimes reinforced by "scabbing" additional members onto the sides out in the middle of the bridge.

MIDWEST PRODUCTS' FOX RIVER BRIDGE

Fox River's "Success Series" instructions are similar to Midwest Products' offerings in other product lines. The Success Series Kit instructions contain detailed, step-by-step, illustrated instructions that virtually guarantee that a modeler with only moderate skills can build a good-looking, craftsman-quality bridge.

A full size drawing is included in the kit. It is used to build an assembly jig on a piece of plywood. (The plywood is not provided.) This jig ensures the side panels are identical and straight. The artwork on the drawing lets you line up the tension rods so they are all vertical and parallel. Using music wire makes sure they stay straight.

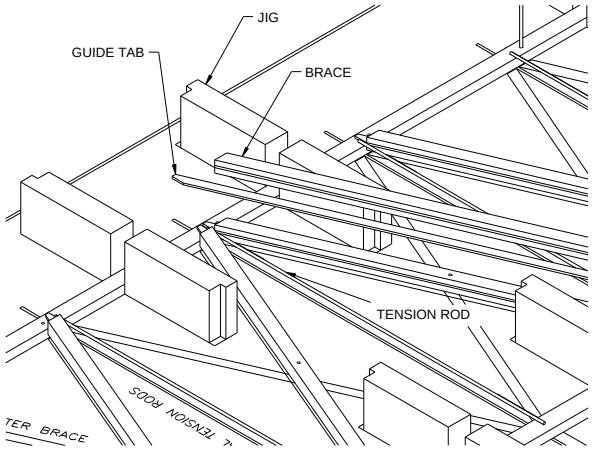

Figure 2 – Brace and guide tab being installed in Fox River jig.

A key feature in the design of the kit is the stacking of the elements (chords, braces, spacers, and iron rods) in the jig. The braces are supplied with a thin "guide tab" spacer that centers the brace where it needs to go. Figure 2 shows how this guide tab lines up the diagonal braces and counter braces with the elements of the chords when the parts are stacked in the jig.

USING THE FOX RIVER IDEA ON OTHER BRIDGES

Building the jig and deciding on the sizes of the pieces is the first task. Figure 3 shows key design parameters for several Howe deck and through-truss bridges. Figure 4 shows typical wood sizes for modeling the Fox River Bridge in other scales.

You do not need a lot of detail on the drawing that is used to build the jig. But you do need an accurate 1:1 schematic of the bridge. First draw two horizontal lines separated by the distance that represents the inside chord height. Draw a series of vertical lines that define the panels. These lines will locate the tension rods and the end support points. See Figure 5.

Install blocks of wood along the horizontal lines. Place them so they do not interfere with any pieces of the bridge. Stack up your chord stock and install blocks of wood on the outer sides of the chords and at the ends of the chords. See Figure 6.

DECK BRIDGES	Span	Panel	Inside Chord	Inside Cl	Top Chord	Bot. Chord
RGS *						
Bridge 45A (original)	108'	10'-3"	23'-3.75"	13'-3"	2-7x12, 2-8x12	2-7x15, 2-8x15
RGS						
DRG Design, 1890	202'	12'-3/8"	23'	12.5'	4-8x14	4-8x16
THROUGH TRUSS BRIDGES						
Fox River - HO Scale						
Midwest Products	97'	12'-6"	26'	15'-6"	4-8x14	4-8x16
DRG/RGS *	128'	10'-2"	21.872	14	2-6x12, 2-7x12	2-6x14, 2-7x14
64A-Burns Canyon						
CMStp&P	147'	10'-11"	25'	14'-6"	4-8x12	4-8x15
1891Natl Trans Mus.						
Northern Pacific	150'	11'-1"	28'-4"	14'-6"	4-7.5 x 14	4-7.5 x 18
Kalmbach, p.40						
NMRA Standards	(Allow .5212" for floor beams, stringers, and track.)					
HOn3			20.77'	12.23'		
HOn3-Large			20.77'	14.95'		
Std Ga, HO			25.53'	14.95'		

* Narrow Gauge

References: Carsten's Bridge and Trestle Handbook, Paul Mallory
Kalmbach's Model Railroad Bridges and Trestles

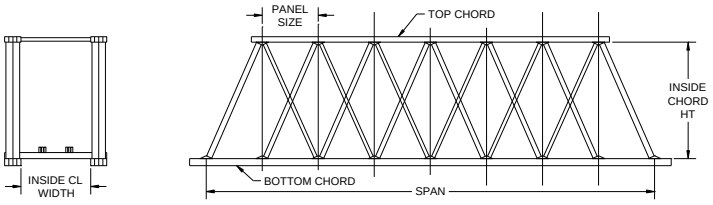

Figure 3 – Typical timber Howe truss bridges.

It is difficult to cut slits in the sides, or ends, of the braces in a non-production environment. Therefore, a different method must be used to line up the braces. The solution lies in using short pieces of the same music wire that is used in the tension rods.

FOX RIVER THRU-TRUSS BRIDGE - BUILDING IT IN OTHER SCALES

	IN THE KIT	O Scale Sizes			
	HO Scale Sizes	**Narrow Ga.**	**Standard Ga.**	**S Scale**	**N Scale**
Top Chord	3/32 X 5/32	5/32 x 1/4	3/16 x 5/16	1/8 x 7/32	1/16 x 3/32
Bot Chord	3/32 X 3/16	5/32 x 5/16	3/16 x 3/8	1/8 x 1/4	1/16 x 1/8
End Post	5/32 X 3/16	1/4 x 5/16	5/16 x 3/8	7/32 x 1/4	3/32 x 1/8
Diagonal Brace	1/8 x 1/8	.2083 x .2083 *	1/4 x 1/4	5/32 x 5/32	1/16 x 1/16
Counter Brace	3/32 X 3/32	5/32 x 5/32	3/16 x 3/16	1/8 x 1/8	1/16 x 1/16
Portal Cap Top	1/8 x 3/16	3/16 x 5/16	3/16 x 5/16	5/32 x 1/4	1/16 x 3/32
Portal Brace	1/16 x 3/32	3/32 x 5/32	3/32 x 5/32	1/16 x 1/8	1/32 x 1/16
Styrene U-Channel	1/8	3/16"	1/4"	5/32"	.080"
Struts	1/16 x 1/16	1/8 x 1/8	1/8 x 1/8	3/32 X 3/32	1/32 x 1/32
Vertical Tension Rods	.025 dia music wire	.047 dia	.047 dia	.032 dia	.015" dia
Tension Plate	.030 x .125 Styrene	N/A	N/A	N/A	N/A
Tension Bolt	1/4" Heavy Duty Staple	N/A	N/A	N/A	N/A
Lg NBW (Grandt Line)	5093	16	16	5123	5066
Sm NBW (Grandt Line)	5066	5093	5093	5066	N/A

* O Scale 10 x 10 or 7/32" x 7/32"

FOX RIVER PROTOTYPE FLOOR MATERIALS - HO

MUSIC WIRE	.025" DIA	.047 dia	.047 dia	.032 dia	.015" dia
SPACER	.0208" x .1041"	.0416" x .125"	.0416" x .125"	1/32 x 1/8	.0208" x .1041
STRINGERS	3/32" x 1/8"	5/32 x 7/32	5/32 x 7/32	1/8 x 5/32	1/16 x 1/16
Lg NBW (Grandt Line)	5093	16	16	5123	5066
Sm NBW (Grandt Line)	5066	5093	5093	5066	N/A
FLOOR BEAMS	1/8" x 1/4"	7/32 x 7/16	7/32 x 7/16	5/32 x 5/16	1/16 x 1/8
STRUTS	1/16" x 1/16"	1/8 x 1/8	1/8 x 1/8	3/32 X 3/32	1/32 x 1/32
Styrene U-Channel	Midwest P/N M-724	3/16"	1/4"	5/32"	.080"

FOX RIVER LAYOUT PARAMETERS

Panel size (inches)	1.724	2.547	3.125	2.344	0.938
Inside chord ht. (inches)	3.586	5.155	6.500	4.875	1.950

Figure 4 – Building Midwest Products' Fox River Bridge in other scales.

It is easy to estimate the lengths of the diagonal braces and counter braces. Cut your material for these pieces. Make them about ¼" too long. Countersink the ends of each brace with a pointed motor tool bit. Drill holes in the ends of the braces for the iron rods. Twirl the brace in one hand while holding the electric drill with the other.

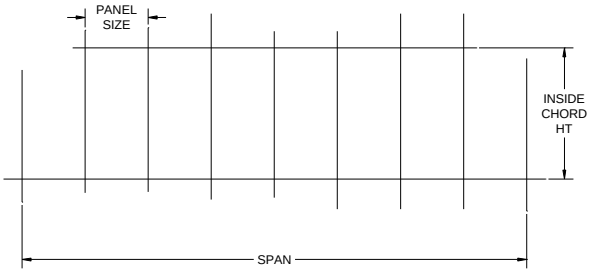

Figure 5 – Drawing the lines for the jig.

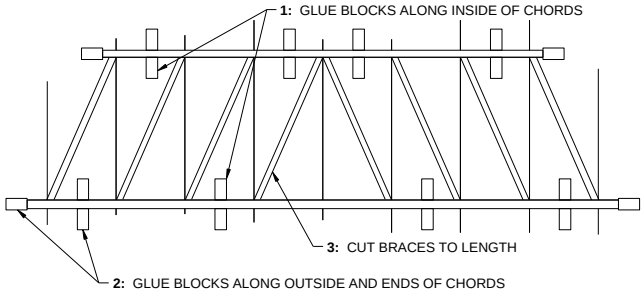

Figure 6 – Build the jig by fitting blocks to the chord stock.

If you have been trying to come up with a reason to buy a battery powered Dremel tool, this is it. See Figure 7.

Follow these steps to construct the bridge:

1. Place one piece of the top and bottom chord stock in the jig.
2. Cut pieces of music wire to length and glue them in place with CA glue.
3. Cut end posts to rough length. Drill holes in the ends. Cut angles to fit. Insert pieces of wire. Glue end posts between chords.
4. Cut pieces of diagonal brace stock to rough length.
5. Drill holes in the ends of the braces. Place short pieces of music wire in the ends of the braces and glue them to the chords using CA glue. See Figure 8.
6. Repeat these steps for all the braces on this layer.
7. Place additional chord material in the jig and continue installing the diagonal braces or counter braces until the side panel is completed.
8. Build two side panels and install the flooring and bracing to join them together.

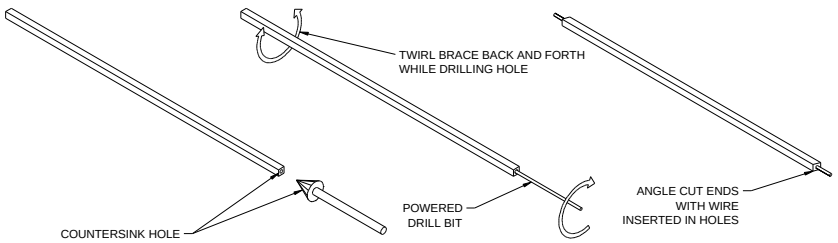

Figure 7 – Procedure for drilling centered hole in the end of the diagonal and counter braces.

CONCLUSION

Many very difficult challenges can be overcome by using the techniques presented here to build a Howe truss bridge of just about any size. The easy-to-build jig and registration wires allow the stacking of the components. This gets around the very difficult task of drilling straight and properly aligned holes. Thus, a great looking timber bridge is within the reach of any moderately skilled modeler.

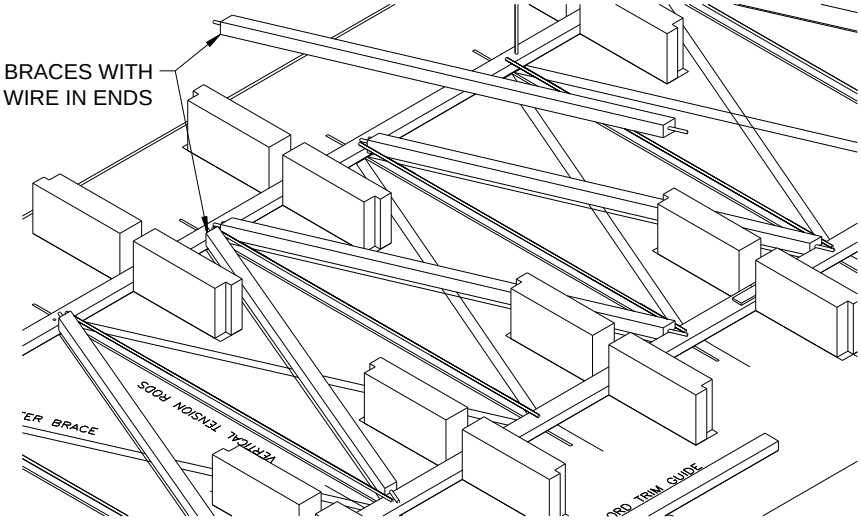

Figure 8 – Building the truss bridge with wire “guide tabs.”

Key points to remember:

1. Build two identical side panels.
2. Drill holes in sides of top and bottom chords. Holes on inside are for lateral tension rods. Holes on outside are for NBW's.
3. Insert tension rods on one side panel.
4. Glue two floor beams to one side panel. Make sure they are square.
5. Glue the first two floor beams to other side panel.
6. Install rest of floor beams.
7. Slide lateral tension rods into other side panel.
8. Install struts, channel iron, and other details.