

# Northern Virginia NTRAK "How-To" Article

## SIMPLE NTRAK MODULE FRAME WITH FOAM

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BY

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The module frame discussed in this article provides a simple approach to building a module. The deck of the module will be used as the "sub-roadbed" for the track, a much simpler construction than one that adds a layer of foam to the top. The trade off is that scenery can only be built up above the track level but not below it.

Building the module frame discussed in this article will require basic woodworking skills and access to a Table Saw. Use of a router will speed several steps. If you do not have a woodworking shop, and are a member of a NTRAK Model Railroading club, get help from a club member with the basic tools needed.

**Module Design Considerations:** There is no perfect module; only compromises to achieve the best design. The picture shows one of the modules built to the design to be discussed in this series of articles. It is a standard four-foot long by two-foot wide module, often referred to as a "Plain old Four Footer" (POFF).

**Module weight** This is a challenge that must be considered. A module made of three-quarter inch plywood will be very sturdy but will also be very heavy. If the sides and top are too thin, then the module will be flimsy. The deck, which is 8 square feet, has the greatest influence on weight. For example, using a one-half inch plywood deck adds 12 pounds to the module, while using one-quarter inch plywood adds only 5 pounds.

**Leg Support:** Module legs are 39 inches long, with only 3.5 inches of the module for leg support. The design problem for both wood and metal legs is leverage. A force of 10 pounds at the bottom of a leg will result in at least 100 pounds of force in the support structure. The frame needs to be able to take this stress.

**Durability:** How will the module stand up over time? For example, our experience indicates that "open frame construction", where insulating foam is installed directly to the frame without underlying support, is not durable. The foam insulation will sag over time and is easily damaged.

**Materials:** The design needs to be consistent with the materials you choose. When dimensional pine is used for the frame, the pine you buy will be relatively green and subject to warping as it dries. The design must compensate for this warping tendency.

**Scenery below track grade:** To have scenery below the track grade, one or two inches of insulating foam needs to be added to elevate the tracks sub-roadbed. The addition of foam to the top of the module will increase the difficulty in construction and is not recommended for a first module. One inch of foam provides 13 scale feet of elevation; enough for a creek under the tracks as shown. For a bigger structure, such as the underpass, two inches of foam is needed, providing 27 scale feet of elevation.

**Dos and Don'ts:** Here are some things to consider:

**Do Not** use dry wall screws in module construction. Wood screws, which require a pilot hole, are designed to pull the pieces tightly together, improving alignment and strength of glued joints.

**Do** use the best quality lumber available if you are using 1 x 4 pine for the sides. Every knot represents a discontinuity that invites the wood to warp. Top quality pine does not split as easily as lower grades.

**Do not** cut the 4 by 8-foot sheet of plywood for the deck into four equal pieces. The saw cut results in pieces that are 23 7/8 inches by 47 7/8 inches. There is more discussion of this later.

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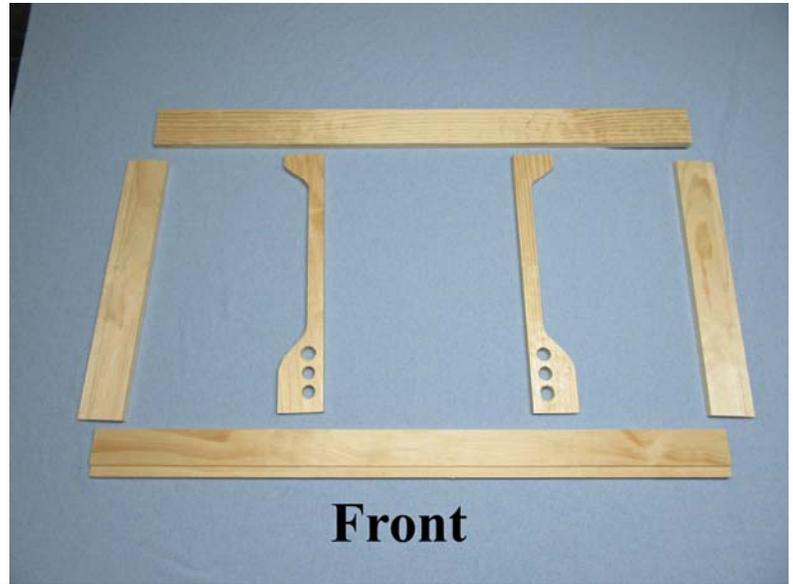
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**Frame preparation:** The table provides a list of materials. Construction starts with two 8-foot lengths of 1 by 4 premium grade pine (3 ½ by ¾ actual). A number of boards must be examined at the hardware store to find ones with a straight edge and minimum bow. A little bow can be handled, but the edge must be straight so the top of the module will be flat.

List of materials for Module Frame	
No.	Description
2	1 in x 4 in x 8 ft Select Pine Boards (No Knots).
1	4 ft x 8 ft x 1/4 in maple, poplar or birch Plywood.
1	Wood glue of your choice.
16	#8 by 1 1/2 in Wood Screws
48	#6 by 3/4 in Wood Screws
4	#10 x 1 1/2 round head bolts.
8	#10 Washers.
1	Quart Flat white Latex Paint
1	Quart Flat black Latex Paint

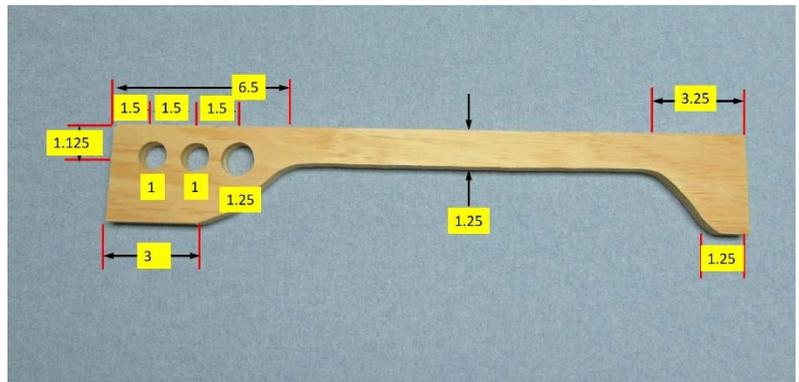
List of materials.

1. A 48-inch side, a 22 ½ inch end and a 22 ½ inch cross brace are cut from each board. The mill end is rough so make the first cut at 48 ½ inches and trim the other end to the desired 48-inch length. It is important that all cuts be square and that the two side pieces are the same length. The four short pieces also need to be the same length.



Front  
Frame pieces ready for assembly

2. Prepare the cross-braces as shown. The cross-brace keeps the sides square to the deck and provides support to the deck. The holes will house the electrical wiring and broom clips will be used towards the back for leg storage.



Cross Brace.

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**Frame Assembly:** With all the parts ready, as shown, assembly goes rather quickly. The location of each end and cross brace is marked on the sides before assembly, allowing easy alignment and helping to get screws in the right place. The cross-braces are located 16 inches from the module ends. Note that the holes in the cross brace should be at the front of the module. The leg storage will be at the back of the module.

1. While assembling the frame, it is important to keep the sides and ends square. As seen a carpenter's square is clamped on one side, while drilling and screwing the parts together. Two 24-inch clamps are used to keep the joint tight so they will not slip while being worked.

2. As seen, the sides are glued to the ends and screwed together using two #8 by 1 1/2 inch wood screws for each joint. A pilot hole is essential to keep the wood from splitting. Before screwing, an end is checked to make sure it is vertical, and the screw heads need to be fully countersunk.

3. The two cross braces are installed next, also using two #8 by 1 1/2-inch wood screws on each side. The cross braces need to be square, and the top edge level with the top of the side.

The frame base is now ready for installation of the deck. At this point the frame is not very rigid and can easily twist out of alignment.



Clamping the frame



Screwing frame together.



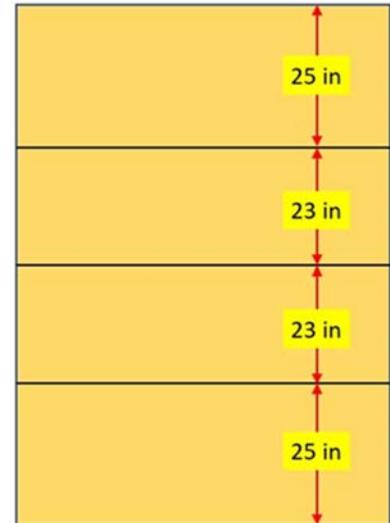
Base for frame is complete, ready for the deck

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**Installing Deck:** The deck, or top, is made using 1/4-inch plywood. The deck needs to have two straight sides at a 90-degree angle so it can be used to square the frame and remove any bowing.

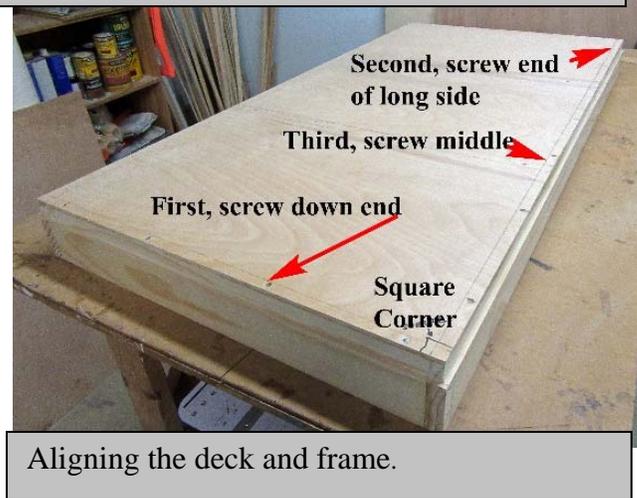
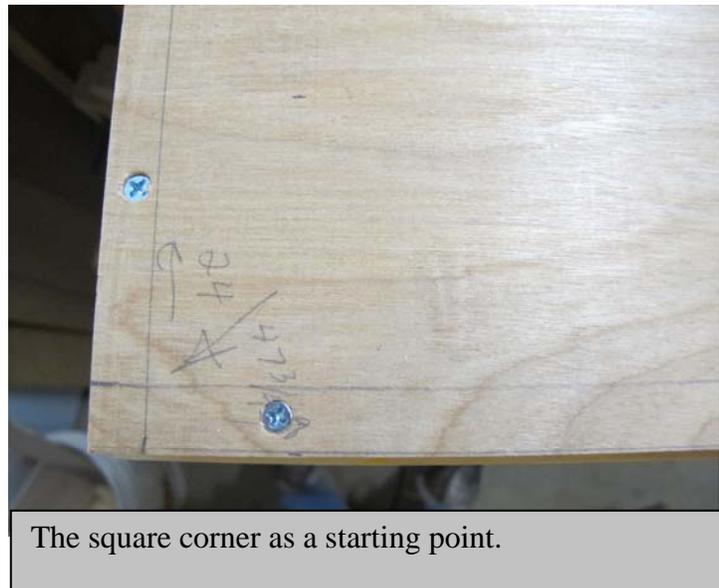
One issue is how to best cut the 4-foot by 8-foot sheet of plywood. If the sheet is cut into four equal pieces the dimensions will be 23 7/8 by 47 7/8 because of the saw cut. This would leave an annoying gap at the ends when installed on the frame. If the cuts are made by the hardware store the cut edge will also be rough. It is recommended that the cuts be made as shown above.



The deck surface is marked to show the frame layout to facilitate screwing the top down. The corner that has the two straight edges and an exact 90-degree angle, in this case the front left corner, is used as a starting point to help ensure that the module will be fully square.

**Note:** It may seem that too much attention has been put on how to install the top. The frame is relatively weak until the top is installed. It then becomes a very strong and stable unit. The top is used to ensure that the frame is square and to remove any bow in the sides, since most pine boards will have some bow.

1. Wood glue was spread on top of the frame and the deck placed on the frame with the square corner in the correct position
2. The edge at the left end, in this case, is carefully aligned with the frame and screwed down with #6 by 3/4 inch wood screws.
3. Next, the front right corner of the deck is aligned with the front of the frame and one screw installed. This ensures the frame is square.
4. In the middle of the front, check for bowing and make any adjustments needed to get the deck edge and frame edge square. Insert one screw in the middle of the front.
5. Finally, screw down the rest of the deck to the frame, placing screws at about a 6-inch interval.
6. These steps need to be completed relatively quickly so adjustments can be made before the glue sets.



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7. After the glue dries any screws that were not fully countersunk need to be removed, the hole countersunk and the screw reinstalled.

8. Any overhang on the sides and back of the deck needs to be trimmed off, using a router or hand saw.

The next picture shows the module with the deck installed.



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**Skyboard:** After scenery work has been completed a skyboard will be needed for the back of the module. While we have the woodworking tools out it is a good time to build the skyboard. NTRAK standards call for a skyboard 8 to 14 inches above the track.

1. For the module under construction a 10-inch skyboard will be used, to fit with other modules in the set. Since the skyboard will be attached to the back of the module, we need to add the 5 1/8-inch height from the bottom of the module to the top of the roadbed. It is also recommended that a 1/4-inch gap be left at each end of the skyboard, so it does not interfere with neighboring modules in a setup.

2. Cut a 15 1/8-inch wide by 23 1/2- inch long piece of 1/4-inch plywood.

3. Cut a top edge 3/4-inch wide by 3/4-inch high from a pine board. Using a table saw cut a groove in one side so it just fits on the top of the skyboard as shown. Round the top corners as shown.

4. Glue the top edge on the skyboard.

5. Clamp the skyboard to the back of the module with the bottom edge aligned with the bottom of the module. Drill five 13/64-inch holes evenly spaced 2-inches from the bottom of the frame. Attach the skyboard with #10 by 1 1/2-round headed bolts with #10 washers under the head and nut.

6. Remove the skyboard while other work on the module is in progress.



Skyboard detail.