Natural Resources
Research Institute
University of Minnesota Duluth
Driven to Discover℠

NRRI TECHNICAL REPORT

FISHER DEN BOX BUILDING PLANS

Submitted by:
Dr. Michael Joyce, Ph.D., and Dr. Ron Moen, Ph.D.

Date: August 2022

Report Number: NRRI/TR-2022/14

Funding:
Environment and Natural Resources Trust Fund
M.L. 2019, First Special Session, Chp. 4, Art. 2, Sec. 2, Subd. 03i

Website: www.nrri.umn.edu/

NRRI Duluth // Laboratories and Admin // 5013 5013 Miller Trunk Highway, Duluth, MN 55811 // (218) 788-2694

NRRI Coleraine // Laboratories // P.O. Box 188 // One Gayley Avenue, Coleraine, MN 55722 // (218) 667-4201

Recommended Citation:
Joyce, M.J., R.A. Moen. 2022. Fisher Den Box Building Plans. Natural Resources Research Institute, University of Minnesota Duluth, Technical Report NRRI/TR-2022/14. 9 p.

Natural Resources Research Institute
University of Minnesota, Duluth
5013 Miller Trunk Highway
Duluth, MN 55811-1442
Telephone: 218.788.2694
e-mail: nrri-reports@umn.edu

Visit our website for access to NRRI publications.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Introduction

The design for this fisher den box is based on a design that has been used for fishers in British Columbia (Davis 2016). We made minor design modifications as described in this manual, for example we used screws instead of nails in all construction. Almost 100 of these boxes were deployed in northern Minnesota, with several boxes used by fishers (M. Joyce, 2022, Final Report, Environment and Natural Resources Trust Fund project M.L. 2019, First Special Session, Chp. 4, Art. 2, Sec. 2, Subd. 03i).

The thermal characteristics of several prototype den boxes were reported in Velander (2022). Temperatures inside of the den boxes with ¾" extruded polystyrene insulation were more stable and less extreme than temperatures in uninsulated den boxes relative to daily fluctuations in ambient temperature.

Den Box Dimensions and Parts List

The external dimensions of the box are 14 ½" x 14 ½" x 31 ½" and the internal dimensions are 10 ¾" x 10 ¾" x 29 ½", and a completed box weights about 55 pounds. The box can be made with one sheet of plywood, 2 1x2s, a half of a sheet of extruded polystyrene insulation, and screws. Wood and foam are cut to size (Table 1). The sheet of ½" plywood is cut into 13 pieces (Fig. 2). One of the 1x2s is cut into 3 31 ½" pieces, the other is cut into smaller pieces (Table 1). For insulation, ¾" extruded polystyrene should be used, cut as indicated in Table 1. One additional cut is needed in the extruded polystyrene for one of the four sides for part 3C.

Table 1. List of parts needed for the fisher den box.

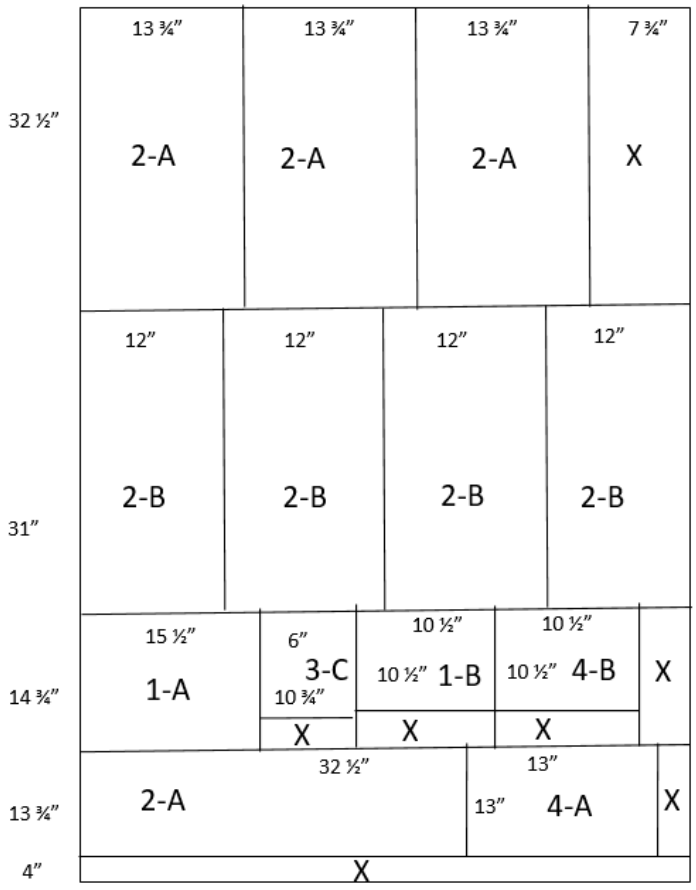
Part	Type	Material	Size	Quantity
1-A	Top (external)	1/2" plywood	14 ¾" x 15 ½"	1
1-B	Top (internal)	1/2" plywood	10 ½" x 10 ½"	1
2-A	Sides (external)	1/2" plywood	13 ¾" x 32 ½"	4
2-B	Sides (internal)	1/2" plywood	12" x 31 ½"	4
2-C	Support	1x2	31 ½"	3
2-D	Support	1x2	20 ¾"	1
2-E	Support	1x2	10 ½"	4
2-F	Sides	3/4" styrofoam	12" x 31 ½"	4
3-C	Opening	3/4" plywood	6" x 10 ¾"	1
4-A	Bottom (external)	1/2" plywood	13" x 13"	1
4-B	Bottom (internal)	1/2" plywood	10 ½" x 10 ½"	1
4-F	Bottom	3/4" styrofoam	10 ½" x 10 ½"	1
5-A	Opening	1x2	6"	2
5-B	Opening	1x2	4"	2

Depending on what is available, alternative materials could be substituted. For example, the design calls for ½" plywood, but ¾" plywood, solid wood, or a plastic material could be substituted for the top of the box (1-A). Metal roofing should not be used because fishers and other species use the top of the box to rest. Similarly, ¾" plywood could be substituted for the wood core near the box opening (3-C). We used

½”, 5/8”, and ¾” plywood in testing den box designs, some of which was treated plywood. Untreated plywood should have a preservative finish such as water-based deck stain applied to the exterior of the den box.

All pieces needed for the den box can be cut from 1 sheet of plywood (Fig. 1). One of the 2-A pieces needs to have an opening cut into it in the upper left as described below. The opening is 3” x 4” (7.6 cm x 10.2 cm).

Figure 1. Cutting pattern for den box if only 1 sheet of plywood is used. Letter-Number combinations (e.g., 2-A) refer to the parts list (Table 1). X indicates the piece is not used.

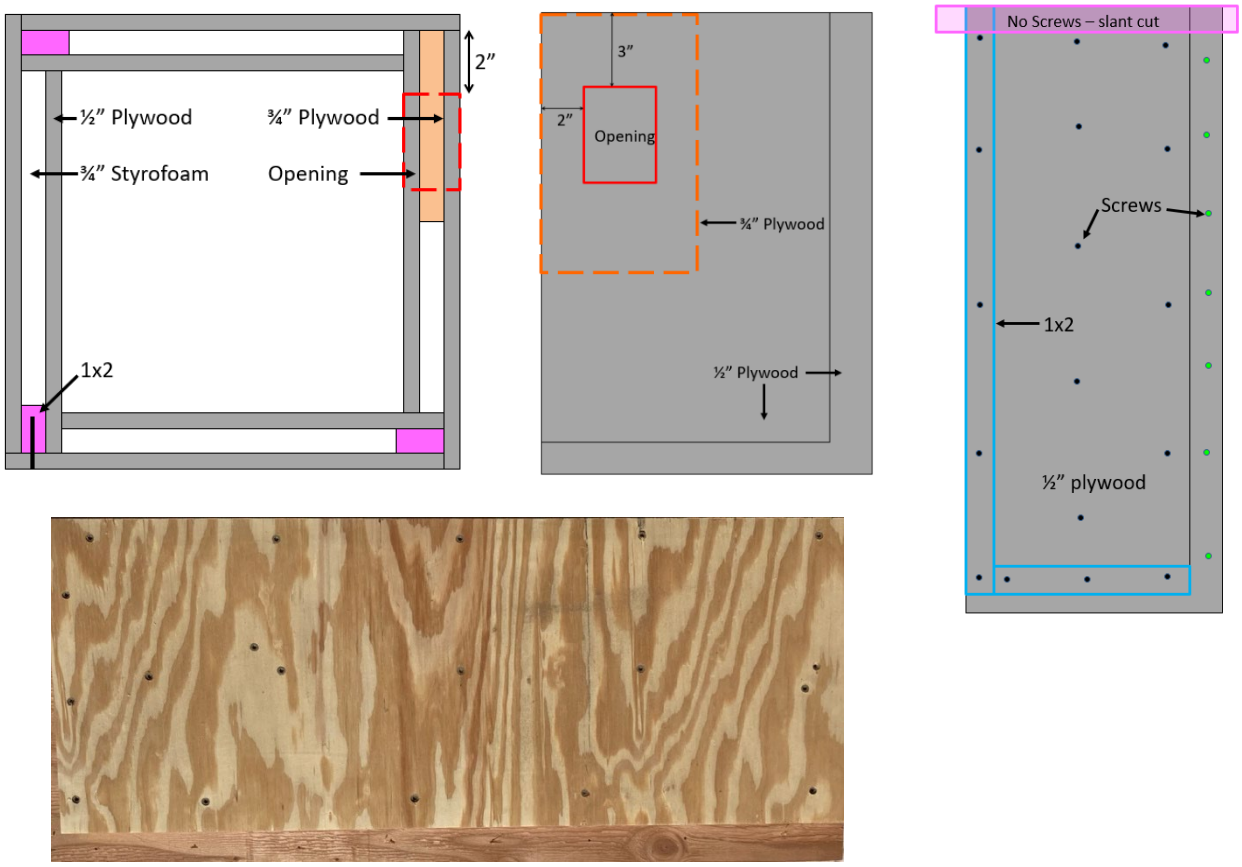


Side Construction and Arrangement

The parts used for constructing the sides are 2-A, 2-B, 2-C (3), 2-D, 2-F, and 3-C. The 1x2s were a design modification to increase strength of the joint, with screws going into the 1x2s in addition to the ½" thick plywood. The diagram on the left in Fig. 4 shows how the sides are attached to each other.

One of the sides (2-A) should have an opening cut into it as shown in the diagram in the middle in Fig. 2. The ¾" plywood (3-C) is needed, or dimensional lumber can be used, to match the thickness of the extruded polystyrene insulation where the opening is cut. The opening must also be cut in part 3-C.

Figure 2. Top view of sides and side view of side of den box with opening. Top view and side view are not to same scale. The picture shows the inside of one of the sides (2-B), with screws going through the foam insulation (2-F) and attaching to the outside side (2-A).

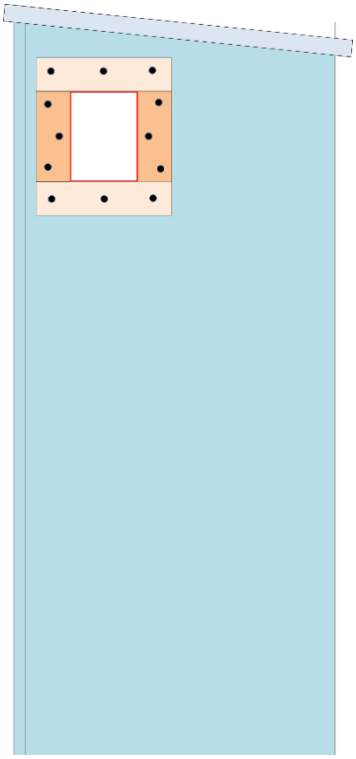


Screws are used to sandwich the Styrofoam between the two pieces of plywood. The first screw should be 1" from the bottom of piece 2-B/2-F, centered on the 1x2 in the side panel. Additional screws should be put every 4 inches until 8 total screws have been placed. No screws should be within 1 3/8" of the top where the slope cut will be made. Approximate screw locations are shown in Fig. 4, schematically and in the photograph are screw locations for one den box side. A template can be made for drilling holes to attach side panels to each other.

It should take 17 screws per side panel and an additional 8 screws for the 1x2s, or a total of about 100 1 5/8” screws for assembling the sides. Screw length might need to be changed if different wood thicknesses are used.

The roof is cut at a 5-degree slant, and there is a slight roof overhang on the lowest part of the slant. The door opening should be next to the highest part of the roof. The roof angle can be cut after the den box is assembled, or it can be cut on individual pieces. The additional 1x2s at the opening are installed as an additional thicker barrier, because different species will chew on openings in some of the den boxes that are deployed.

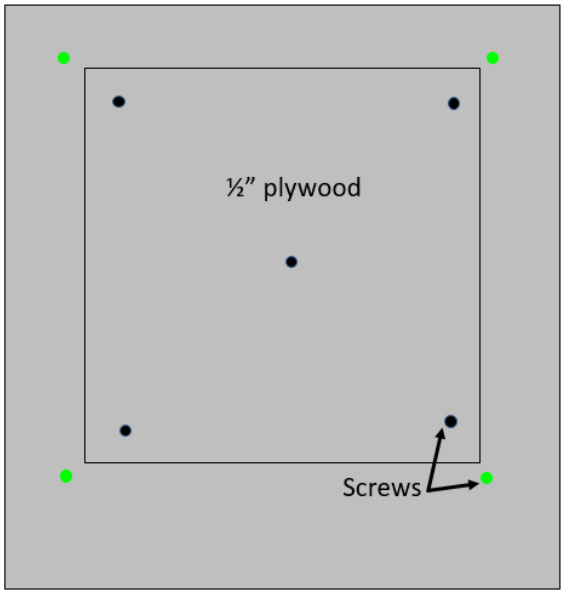
Figure 3. Side view of den box with opening, showing the additional 1x2 pieces that are screwed into the opening. An unfinished opening is shown in the middle picture, and fishers at a den box are shown in the right picture.



Top and Bottom Construction and Arrangement

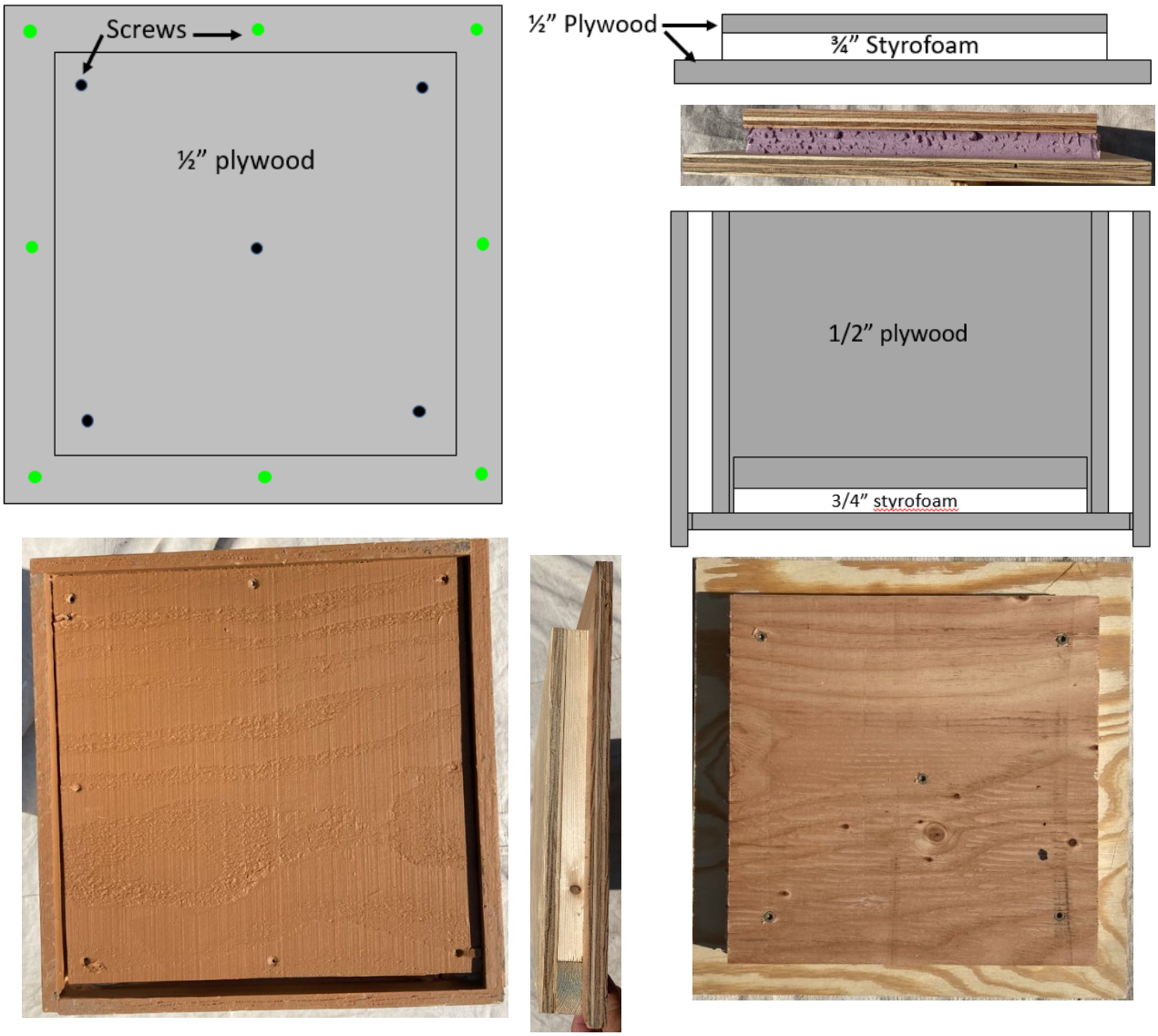
The top panel is relatively simple because there is no extruded polystyrene insulation. Parts 1-A and 1-B are used for the top (Fig. 4). We used 5 screws to attach the 2 plywood pieces together, and 4 screws to attach the top to the sides of the box, with approximate locations as shown in Fig. 4.

Figure 4. Diagram of bottom view of top of den box. The inside piece is slightly offset to create a small lip on the top of the den box, the offset should be as thick as the box (2 * ½" plywood + ¾" Styrofoam insulation = 2.5").



Parts 4-A, 4-B, and 4-F are used for the bottom of the den box. The extruded polystyrene insulation is sandwiched in between the plywood using 1 5/8” screws from both sides of the bottom plywood pieces. Screws should be spaced about 6” apart and at least 1” from the edge of the plywood. About 13 1 5/8” screws are needed, 5 to attach the plywood pieces together, and 8 to attach the bottom to the sides of the den box. There is about 1/8” of space between Part 4-A and Part 2-A, and also between parts 4-B and 4-F and part 2-B. One modification we made is that pieces 2-B and 2-F were resized so that the bottom would be recessed ½” as recommended by Steve Mortenson (Leech Lake Band of Ojibwe). This modification helped reduce bottoms from rotting out of wood duck boxes. The bottom right diagram in Fig. 5 shows how the bottom was recessed, and the bottom left pictures show how the bottom was attached to the sides of the den box.

Figure 5. Top view and side view of bottom of den box. Diagrams are not to the same scale.



Installation of Den Boxes on Trees

Once we were in a forest stand we would search for a tree with a strong enough branch to hold the den box, alternatively we could use trees without branches because there were two cables attaching the den box to the tree (Fig. 6). We generally deployed den boxes from 5 to 12 feet above ground level.

Figure 6. Examples of some deployments of fisher den boxes. For research purposes, we wrote the name of the den box by the opening.

We attached den boxes to trees using galvanized vinyl-coated wire rope (7x7, 3/16” cable). First, we would attach 2x2s to the back of the den box (Fig. 7). We drilled two holes in each 2x2 and fed the wire rope through the holes. Next, we would loop a rope around the branch, attach the rope to the den box, and lift the den box up to the height where it was to be attached to the tree. Alternatively, we would push the den box up from the bottom, reaching as high as possible. Once the lifting rope was tied off on an adjacent tree or being held securely, we would use a ratcheting tie-down to secure the den box to the tree. Next, we would loop the vinyl covered wire cable around the tree and use a wire rope clip (inset on Fig. 7) to hold the wire rope in place.

Figure 7. Steps in attaching a den box to a tree. First, 2x2s are placed on the back of den box to fit the tree bole. The den box is lifted up and a ratchet strap is tightened, after which the wire rope is attached.

After removing the racheting tie-down, we would screw a branch onto the den box just below the opening, as is seen in several of the examples in Fig. 6 and Fig. 7. Fishers and other animals would use this branch to enter and exit the den box.

Acknowledgements

Funding for this project was provided by the Environment and Natural Resources Trust Fund for the project "Artificial Den Boxes for Fishers," M.L. 2019, First Special Session, Chp. 4, Art. 2, Sec. 2, Subd. 03i.

Literature Cited

Davis, L.R. 2016. Fisher (*Pekania pennanti*) artificial reproductive den box study. 16.W.BRG.04 / CAT-16-3-345. Davis Environmental Ltd., 108 Mile Ranch, British Columbia, Canada.

Velander, T.B. 2022. Mechanisms underlying American marten (Martes americana) winter rest site selection across the Western Great Lakes Region. M.S. Thesis, University of Minnesota Duluth.