



## **Contest Field Border Construction Manual**

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## Section 1 Field Construction

The field used in the Code 3 competition is a fairly simple frame designed to keep robots from leaving the field of play, providing a physical alignment “barrier” that can be used by the robot, providing game-specific facilities, and ensuring a consistent field surface under the competition mat. The field is a required element in this year’s game.

The field is composed of standard components that can be purchased at any Lowe’s or Home Depot home improvement stores. These components DO NOT REQUIRE ANY CUTTING, so if a table saw or similar tool is used to build the field then it is most likely not going to be correct. Please read the ENTIRE instructions before starting.

## Section 2 Bill of Materials

Here is a list of items you will need to purchase:

Quantity	Part	Dimensions	Length	Notes
1	3/4" birch plywood sheet	4'x8'	--	Birch is required as it provides a smooth, straight surface and the plywood has exact dimensions.
6	lumber	1"x6"	4'	Actual size: 0.75" x 5.5", 4 feet long
2	lumber	1"x6"	8'	Actual size: 0.75" x 5.5", 8 feet long
1	lumber	1"x4"	4'	Actual size: 0.75" x 3.5", 4 feet long
8	corner braces	2"	--	Usually come in a pack of 4 with 3/4" long screws (so 2 packs needed total)
50	wood screws	#10	1 1/4"	Get screws and countersink bits to match.
1	countersink w/ bit tool	--	--	Countersink tools with drill bits can countersink AND drill pilot holes. Necessary for this project.

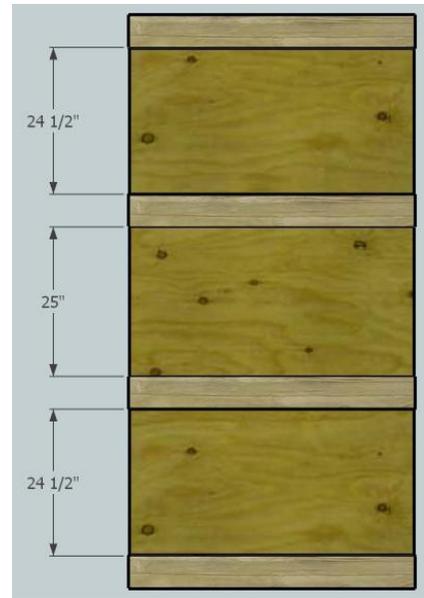
It is important to purchase a countersink tool for this project; we will be drilling into the bottom and sides of wood, and we do not want to scratch furniture with protruding screws. You can buy countersink bits with drill bits also attached to them, which makes the process of drilling a countersink and a pilot hole one easy step. The countersink drill bit is about \$5, and comes in multiple bit sizes – if you purchase #10 wood screws, you need a #10 countersink bit. #10 wood screws are the recommended size screws, but any size you can get between #6 and #12 will do.

Corner braces are another important item. It will be assumed that the corner braces will come with their own screws, no more than 3/4" in length. I purchased Home-Depot brand corner braces, (EverBilt 2" corner braces, 4 pieces per pack). It really doesn't matter what corner braces you purchase, so long as they're strong – we use the corner braces for additional support for the walls – and that the screws used do not protrude from the wood on the other side.

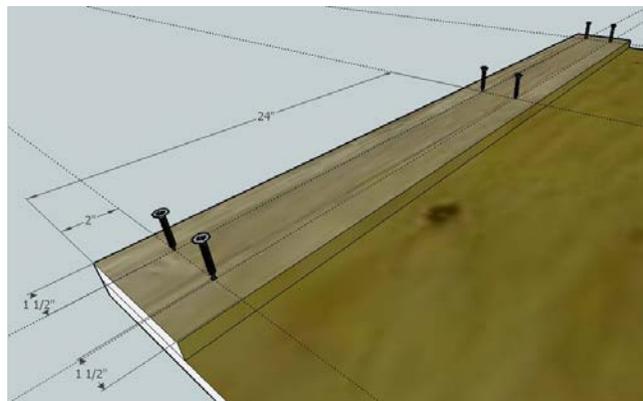
## Section 3 Construction

Building the field structure can be performed in a couple easy steps:

**Step 1** - Lay out the 3/4" birch plywood with a smooth side facing down. On the top of the plywood, place four 1"x6"x4' lumber boards lengthwise so that the 4' length of the lumber spans the 4' length of the plywood. Two of these boards should be placed on the ends of the 8' span of the plywood, and the remaining two should be placed 24.5" apart from those. This will create a 25" gap in the center of the board. These boards will be used later to mount the walls of the frame to the boards. It is important to place the end lumber boards flush with the 3 sides of the plywood that they share, and it is also important that the boards be placed as straight as possible. It would be advisable to use simple clamps to hold the wood in place, as the next step may get messy if they aren't secured in place.

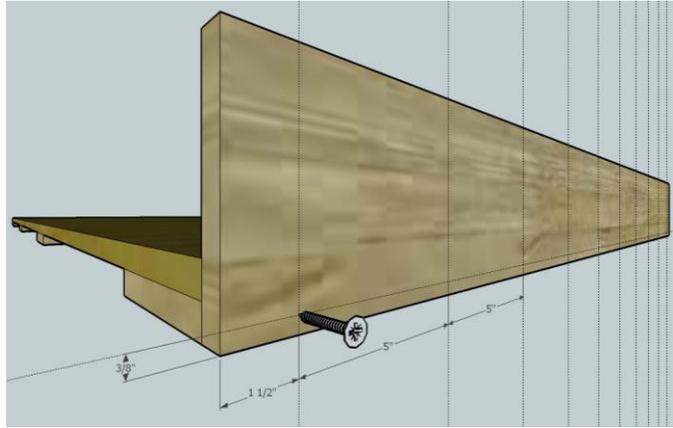


**Step 2** -Drill countersink/pilot holes in the wood BEFORE drilling the screws into the wood. If you do not drill pilot holes FIRST, the wood may crack and/or split. Two screws should be placed 2" into each lumber board, 1.5" from the side of the board. This should be duplicated on both sides of the board. 2 additional screws should be put 24" into the board, 1.5" from the sides. Additional screws may be placed as desired, so long as the screws are placed in one-inch multiples (no half-inch measurements). Perform the same actions on all 4 boards. These will serve as the "feet" for the board, and will also act as



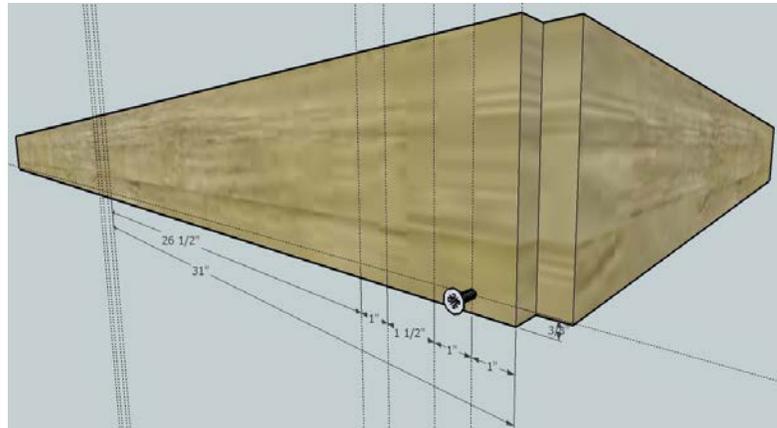
the mounting surface for the walls (you NEVER want to screw into the side of plywood, as the ply will separate and damage the plywood). This is where the board clamps will come in handy; as you're drilling countersink/pilot holes it's easy to bump the lumber boards and throw the pilot hole alignment out of whack.

**Step 3** - Flip the plywood board over, and mount the first 4' side wall. You want to mount a 4' 1"x6" board to the side of the 'feet' you created in the previous two steps. Remember, it is NOT WISE to drill into the side of plywood, so only drill into the side of the lumber boards we mounted to the underside of the plywood. You want to drill pilot holes 3/8" from the bottom of the board,



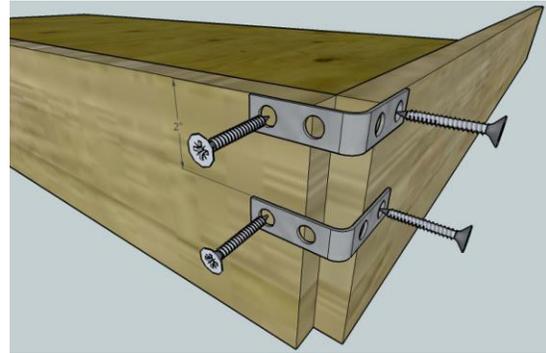
and in intervals starting at 1.5" into the board then continuing in 5 inch increments. In the image, only the first screw is shown, and screws should be placed at each guide line increment (10 total in this step). Note that the side-wall board will be completely flush up against the 4' side of the plywood, and flush to the bottom of the lumber "foot" of the board.

**Step 4** – Now mount an adjacent 8' 1"x6" side wall board to the structure. Again, you will be mounting screws 3/8" from the bottom of the board, in the pattern shown. On this 8' side of the board, you are mounting the wall to the 5.5" side of the 1"x6" lumber board 'feet'. For optimal



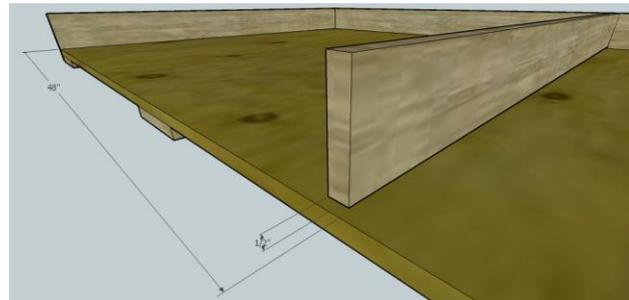
mounting, screw two screws 1" and 2" from the edge of the board, and then 1" and 2" from the opposite edge, leaving a 1.5" gap between the two center screws. Do this 4 times (16 total screws in this step) on this side of the 8' board. Once completed, this will leave a 3/4" square gap between the 8' and 4' side of the boards. This is expected, and will be strengthened in the next step.

**Step 5** – Time to strengthen the walls. At the top of the boards, and then again 2" from the top, place corner braces on the outside of the walls. This will provide the walls with extra strength, while at the same time not affecting the performance of a robot (and we didn't have to cut boards down to provide excess wood for mounting). Use the provided screws (if 3/4" in length or less) to mount the corner brace to the wood. If desired, additional (or longer) braces may be used.

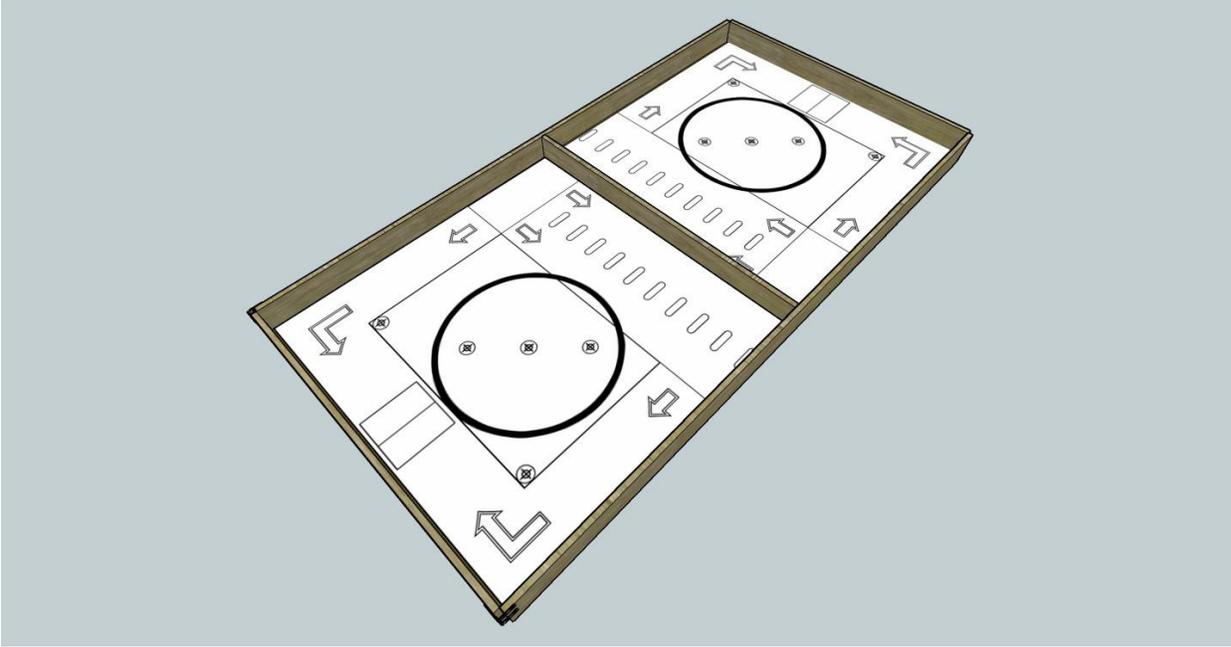


**Step 6** – This is merely a “wash, rinse, and repeat” step. Perform steps 3, 4, and 5 as necessary to mount the two remaining side walls using the 4' and 8' 1"x6" boards and the rest of the corner braces. This will create roughly 4" tall walls surrounding the playing field. The actual height of the wall may vary depending on how close the thickness of the plywood is to 3/4"; it is quite common for the plywood thickness to be slightly less than 3/4", which will make the inner height of the walls slightly larger than 4".

**Step 7** – Now to mount the center wall between the two 4'x4' fields. As you've probably realized the mats used in Code 3 are EXACTLY 4'x4', and the plywood we're using is EXACTLY 8'x4' long. This doesn't really provide any room to place a center wall between the two robot playing areas. To compensate for this, we will use the 4' long 1"x4" board. The actual size of the board is 0.75"x3.5", and what we'll do is mount the board flush to the TOP of the outer walls. This means there will be approximately 1/2" of open space under the board; the board will not rest on the surface of the playing field. Attempt to center the board over the center of the playing field; a tolerance of 1" is allowed – robots wanting to use walls as alignment barriers can use any of the other side walls to do so. By mounting the center wall above the playing surface, it allows the mats to snugly sit on the playing surface. Drive screws through the 8' outer walls uniformly to mount the center board in place. 3 screws on each side should be sufficient.



**Step 8** – Place the mats on the board. You may use a thin double-sided tape to adhere the outer edges of the mats to the plywood surface. It is recommended that you clean the plywood surface first, however, as there will most likely be sawdust on the wood from drilling the pilot holes. Align the mats with the outer field corners (and not to center).



## Larger Pictures

