

Building a Weldless Lionfish Trap

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The materials and instructions here describe only one way to build a lionfish trap. Alternative materials could be used, and the bending procedures, shapes, and sizes of the frame could be altered. We will continue to test different approaches, particularly those that simplify construction and reduce costs. We encourage all builders and fishers to improve both materials and designs, and to let us know what you find.

Materials:

- One 40' length of #4 (1/2") rebar can produce two frames and an axle (you will need three pieces per trap - two at about 15' for the frames and one at least 86" long for the axle)
- 170" of 7/8" netting (consider #420 knotless netting with 7/8" square openings from Memphis Net)
- ~70' #18 braided nylon seine twine
- ~26' 3/8" poly braided line
- Tenax turf 1.4" x 1.4" mesh
- 1 1/2" or 2" stainless steel ring
- 2' x 3' plastic lattice
- Three pieces of 1" PVC pipe (two x 21" and one x 22")
- Two 1" PVC tee fittings
- Two 1" PVC 90° elbow fittings
- PVC Primer
- PVC Cement
- Cable ties (4" and 8")
- Three hard plastic floats (consider hard plastic floats, 1-3/4" by 5" from Memphis Net)

Recommended Tools:

- Cable Tie Tool
- Cutoff Tool/Grinder (to cut rebar)
- Tin Snips or Jigsaw (to cut lattice)
- Sharp Scissors (to cut net, twine and rope)
- Bending Jig, Pedestal and Bar
- Sliding T-Bevel or protractor head to measure angles
- Tape Measure (12' or greater)
- Sharpie or chalk for marking rebar
- Net Needles (for hanging net on jaws)
- Lighter (to burn ends of netting and rope)
- Electrical tape (to wrap around ends of rope)
- Plastic Splicing Fid for 3/8" line
- 2 pipe wrenches or 2 lb mini-sledge hammer for alignment of loops
- Safety Glasses/Work Gloves
- White Spray Paint (easier to see the marks on the rebar if spray painted)

1. MAKE DEFLECTOR LOOP HINGE

- Starting with a piece of #4 (1/2" diameter) rebar at least 15' long, measure 47" from one end and mark the center point of the loop, this will be the deflector end of the jaw.
- Bend a tight loop (1-1/2" to 2" ID) around the larger post of the bender, rotating the rebar 360 degrees (or 405; see Bend the Deflector below) degrees and keeping it level (Fig. 1 and 2, respectively).

Tip: You can heat the rebar for the loop bends to simplify the bending and prevent small cracks from forming in the cold steel. Optionally, you can coat the bends with marine epoxy, which may prevent saltwater from entering the cracks, extending the life of the frames.

Figure 2. Deflector loop hinge, showing a 360-degree bend, used for a curved deflector (Step 8b). Outside loop is the deflector loop.



Figure 1. Deflector loop hinge, showing a 405-degree bend, used for a straight deflector (Step 8c).



2. MAKE FIRST AND SECOND BENDS

- Measure 6" from the center of the loop to mark the midpoint of the first bend
- Rotate the rebar 90 degrees so the loop is in the **vertical** position before making the first bend, and ensure that the deflector will be positioned on the **outside** of the frame.

Tips:

- The loop is horizontal when it is bent, so the rebar must be rotated 90 degrees to make it perpendicular to the plane of the jaw and allow the axle to be inserted. The loop can be seen in the vertical position in Figure 2 above.*
 - Make sure the entire length of rebar is horizontal and level before making the bends.*
 - The deflector must be on the outside of the loop to prevent binding.*
- Align the mark with the center of the SMALL post and bend the rebar around the small post to create a 152.5-degree angle (you can mark the face of the bender at 152.5-degrees, align with a template, or measure the angle directly; Fig. 3).
 - The two 152.5-degree angles on both sides of the frame should result in the loops being parallel. The frames need to be parallel for the trap to function properly.*
 - Measure 23" from the center of the first bend to mark the midpoint of the second bend
 - Align the mark with the center of the SMALL post and bend the rebar around the small post to create a 135-degree angle (you can mark the face of the bender at 135-degrees, align with a template, or measure the angle directly; Fig. 3).

Tips for Frame Jaw Bends:

- Instead of making the frame measurements as you bend the trap, the frame bending measurements can be made on the ground before the rebar is bent. If you are to do that, please use the following measurements: 47" (trap loop on deflector foot end), 53" (152.5-degrees), 76" (135-degrees), 103.5" (135-degrees), 131" (135-degrees), 154" (152.5-degrees), 160" (final trap loop), 170.5" (total length)*



Figure 3. One of two 152.5-degree bends being bent on bending jig.

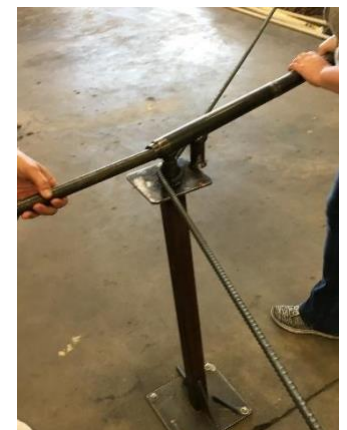


Figure 4. One of three 135-degree bends being bent on bending jig.

3. MAKE THIRD JAW BEND

- a. Measure 27.5" from the center of the second bend and mark the third bend.
- b. Keeping the rebar horizontal and level across the bender, align the mark with the center of the SMALL post and bend the rebar around the small post to create a 135-degree angle (Fig. 3).

4. MAKE FOURTH JAW BEND

- a. Measure 27.5" from the center of the third bend and mark the fourth bend.
- b. Keeping the rebar horizontal and level across the bender, align the mark with the center of the SMALL post and bend the rebar around the small post to create a 135-degree angle (Fig. 3).

5. MAKE FINAL JAW BEND

- a. Measure 6" from the center of the fourth bend to mark the midpoint of the final bend
- b. Align the mark with the center of the SMALL post and bend the rebar around the small post to create a 152.5-degree angle (you can mark the face of the bender at 152.5-degrees, align with a template, or measure the angle directly; Fig. 3).

6. MAKE END LOOP HINGE

- a. Measure 6" from the center of the final bend and mark the center of the end loop.
- b. Rotate the jaw to the vertical position so the second loop is parallel to the first.
- c. Bend a loop tightly around the large post to approximately the 180-degree position. You may not be able to bend the bar farther because the vertical jaw will prevent you from crossing over.
 - A tight loop hinge (1-1/2" to 2" ID) takes about 10.5" of #4 rebar. If the rebar is cut to 170.5" or 171", the trap frame should be the correct length to finish out the last loop.
 - To get the trap to close as tightly as possible, bend the loop the opposite direction of the deflector loop (Fig. 5 and 6).
- d. Cut the excess rebar where it closes the loop and flatten it into alignment with a sledge or vice.
- e. Having the loop face towards the top of the jaw, allowed for less binding of the hinges when closing the trap.



Figure 5 (near right). End loop hinge (left) with axle inserted through it and deflector hinge (right), and loop on the end of axle connecting the two frames.



Figure 6. A different view of the same frames from Figure 5. End loop hinge with axle inserted through it and deflector hinge (closest loop), and loop on the end of axle connecting the two frames. The other end of the frame can also be seen from this view.

7. MAKE SECOND JAW

- a. REPEAT the steps above to create the second jaw.

Tip:

- Lay the pair down on a flat surface to make sure they match. Make adjustments as needed so the jaws are as closely matched as possible.
- Make sure the deflector feet are laid flat on the ground.

- *The loop on the deflector end should be on the outside of the frames. If not, the trap will not open/close correctly.*

8. BEND DEFLECTOR

- There are two options: curved or straight deflectors (Fig. 7).
- Option 1: **Curved** deflector (starting from a 360 degree deflector bend) - The deflector will be curved into a quarter-circle arc about 30" long, with the tip offset by 18" from the plane of the jaw. Create a curve using a series of small bends along the length of the deflector, starting just below the deflector loop, continuing in the same direction. Both jaws should be identical after the bends are completed.
- Option 2: **Straight** deflector (starting from a 405 degree deflector bend; Fig. 1) - The deflector will be straight, bent to a 135 degree angle from the jaw. Mark the extension 27" from the deflector loop (check to be sure the mark is offset by 18" from the plane of the jaw) and bend to a 135 degree angle and trim to form a 6-inch "foot" at the end of the deflector.
- Grind sharp edges on the ends of the deflectors, then cut a 6-12" section of garden hose and secure it to end of deflector with zip ties (Fig. 7). This prevents damage to the boat or user.



Figure 7. Curved (left) and straight (right) deflectors on 1/6 scale model traps. Black covers on tips simulate hose used to cover end of rebar.

9. INSPECT BENDS

- Lay each jaw flat on ground to check for distortion (if you have a template, use that to confirm angles and section lengths).
- Hold two jaws face to face and inspect for symmetry to ensure jaws will close together.
 - *Sometimes the hinge loops will bend inward from the stress of being bent. Using a sledge to flatten out the loops against a hard surface worked well.*

10. INSTALL AXLE

- If using a 40' piece of #4 rebar, after the frames are bent, there should be approximately 11 ½' of rebar left to use for the axle. Begin with a piece of rebar at least 8' long. There will be a loop on both ends of the axle and each individual loop will use approximately 10.5" to create a tight loop (1-1/2" to 2" ID).
- Insert one end of the rebar into the bender and create a loop by bending around the larger mandrel.
 - *Do not close the loop all the way. Make sure the axle loop is over the frame loops before closing the axle loop entirely.*
- Mark the axle at 72" from the loop.
- Flip the jaws so they are facing each other; one should have the deflector on the left and the other on the right, pointing in opposite directions. The deflector loop must be on the outside and the end loop on the inside.
- Slide the straight end of the axle through **one** set of the paired loops.
- Slide two 1" PVC Tee fittings onto the axle and then slide the axle through the paired loops at the other end.
- Hold the jaws together with the axle installed on the bender and bend the loop around the frame loops (Fig. 5 and 6). Bend the loop as tight as possible. The loop direction should be going the same way as the deflector foot.

11. CLOSE JAWS AND TEST

- Bring the jaws together and make sure that they align correctly.
- To test if the jaws are facing the correct way, set the deflectors on the ground while holding the jaws together, then release the unit. If the deflectors push the jaws apart, they are facing the correct way. If the deflectors force the jaws to stay closed, simply rotate one jaw 180 degrees around the axle. Test again and the deflectors should push the jaws apart when released.



Figure 9. Making sure that the jaws close tightly and align correctly.

12. INSTALL PVC MOUNTING BRACKET FOR THE FAD

- Cut two pieces of 1" PVC tubing at 21" and one piece at 22". The 21" pieces will be used for the sides and the 22" piece will be used for the top.
- Use PVC primer and cement to attach a 21" piece of tubing into each PVC Tee on the axle.
- Attach 1" 90 degree elbows to each end of the remaining PVC tubing and attach it to the two upright pieces of PVC on the axle before the cement sets (this forms a three-sided bracket for attaching the FAD).

Tip

- The size of the PVC tubing can be dependent on the size and shape of the FAD being used. If the FAD is more square, then the PVC bracket lengths will need to be changed to fit those measurements.

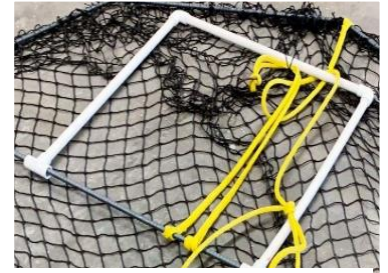


Figure 10. Fully assembled FAD bracket attached to axle.

13. INSTALL FAD

- Cut the FAD from a 4'x8' sheet of lattice or use a prefabricated FAD. The FAD should not extend beyond the jaw when it is attached. Typical sizes for FADs are 24-36" wide by 28-34" tall, with upper corners trimmed so they don't extend beyond the jaws when the jaws close. Trim any sharp points that could snag the net or lines.
- Attach the FAD to the PVC bracket using cable ties, being sure to leave space between the axle and the FAD so it rotates freely and doesn't bind (Figure 11 and 12).

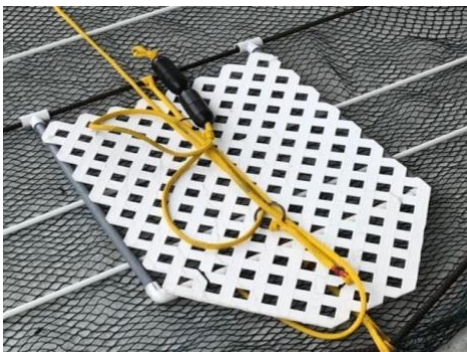


Figure 11. FAD attached to bracket and ring line (harness is also lying across FAD).



Figure 12. FAD attached to bracket with cable ties without the right line or harness attached. The gap between the axle and FAD can be clearly seen. This allows the FAD to rotate freely and not bind.



Figure 13. Completed FAD to show the distance between the top of the FAD and the trap frame.

14. INSTALL HARD PLASTIC LATTICE ON BOTTOM OF TRAP

- a. Lay out completed trap frame on of cardboard/brown paper to trace. Tracing the trap frame allows for ease of making more than one trap and gives you a more exact location of where to make the cuts in the hard plastic lattice.
- b. Once traced, remove the trap frame off the paper. Mark 12" past the traced line to mark where you should start to roll the plastic mesh. Then mark 2" above that mark. The hard plastic lattice is hard to cut, so make sure to use sharp/heavy duty scissors.
- c. Cut the hard plastic lattice to the black dotted line at 14" above the trap frame traced line. Draw on the hard plastic lattice the 12" line. Use the scissors to cut a clean line on the hard plastic lattice to the 12" mark.
- d. Once the hard plastic lattice has been cut to the 12" mark, cut the Vs out. Cutting the Vs out will allow for you to roll the hard plastic lattice to be parallel with the trap frame.
- e. Rolling the hard plastic lattice is easier with two people to make sure that the roll is as tight as possible with no sharp edges that can catch on the mesh. (Fig. 15 and 16) Once the rolls are tight,



Figure 14 (above) The trap frame is traced in the dotted white line. The dotted white line Vs are where to make the cuts in the hard plastic lattice. The solid black line is 12" above the trap frame and the dotted black line is 14" above the trap frame.

secure every 2" to 4" with a zip tie. Using a zip tie cutter or a pair of pliers to keep the zip ties tight is important for the plastic not to unroll.

Tip

- *The rolls should fit into each other so there are no sharp edges to catch on any of the netting.*
- *The easiest way to roll the hard plastic is to have two people work on one roll at once. Roll the hard plastic once not super tight to get the plastic molded. Then go in and roll the plastic as tight as possible. Most of the roll diameters were between 1-2" by the final roll. (Fig. 15)*



Figure 15 (left). Two people rolling the hard plastic lattice parallel to the trap frame. As the hard plastic lattice is secured with zip ties, the other individual makes sure to continue to hold the plastic roll tightly. If needed, the V of the hard plastic lattice can be cut down a bit more to make sure the roll looks good.



Figure 16 (right). Half of the trap is rolled and secured, while the other half is being worked on. On the side completed, all the rolls are secured into each other making the hard plastic lattice parallel to the entire trap frame.

Figure 17. Using fingers to show about a 2" distance between the frame and the rolled plastic lattice.



- f. The goal is to roll the plastic until there is about 2" between the frame the roll. (Fig. 17).
- g. Cut the hard plastic out from around the hinge to make sure no binding occurs between the hard plastic lattice and the hinge.
- h. Once the hard plastic lattice has finished being rolled, flip the entire hard plastic over on itself. This will have the newly made rolls facing downwards. We found that this allowed for less of a chance of the hard plastic catching on the netting and digging the trap a bit down into the sand when deployed allowing for less of a chance of the trap to invert on itself.

15. INSTALL NETTING BETWEEN FRAME AND HARD PLASTIC LATTICE

- a. Lay trap frame on top of hard plastic lattice with the rolls facing downward.
- b. Place a 12" piece of PVC at the top of the frame to separate the hard plastic lattice from the rebar trap frame. From there, take the 7/8" netting and drape it over the trap frame towards the hard plastic lattice.
- c. Cut the hard netting in a crescent shape with the netting tapering out towards the hinges. The netting stretches, so no need to allow for a lot of extra netting.

Tip

- *Make sure the pattern of the netting is going diagonally and not vertically. This is incredibly important when it comes to allowing the netting to stretch (billow) when closing.*
- d. Securing the netting to the frame and the hard plastic lattice before cutting the netting allows you to make sure the shape is correct, and the amount of netting makes sense for the billowing when closing the trap.
 - e. Cut the netting to the crescent shape, making sure the zip ties stay in place. (Fig. 18).
 - f. Load a netting needle with approximately 30' braided nylon seine twine (Fig. 19). This will be used to secure the net to each jaw. Begin about 4" from one hinge by tying a whipping knot with the twine (Fig. 20).

- g. With the net needle, use a blanket stitch (Fig. 19) to attach the net to the frame, gradually bunching so that excess net is secured evenly around the frame. Each stitch should span about 1". This will take a while, so get comfortable and get stitching!
- h. Use a whipping knot (reversed from opposite end) or several half hitches to secure twine on opposite end of jaw, 2-3" from the other hinge.
- i. Repeat on the second jaw.

Tip

- *Make sure the distance between the lacing is only about an inch, to allow for minimal holes in the netting for lionfish escapement.*



Figure 18. The netting of the trap cut and attached with zip ties before being sewn onto the frame and hard plastic lattice.



Figure 19. Loaded netting needle with nylon braided twine.

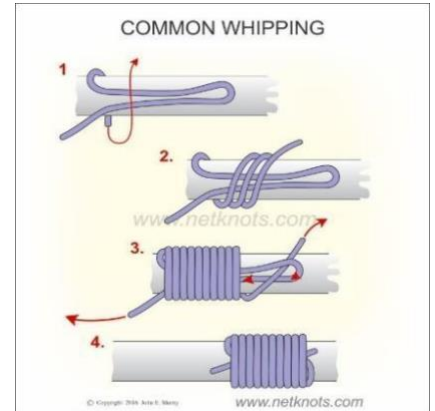


Figure 20. Common whipping stitch.



Figure 21. Finished installed netting between trap frame and hard plastic lattice. There should be minimal gaps between the netting, frame, and hard plastic lattice.

16. INSTALL RING LINE

- a. Starting with a 6' length of 3/8" hollow braided polypropylene line, double wrap the line at the centerpoint of axle, leaving a 10" loose end.

Tip: It is important that this end of the ring line does not slide along the axle as this will keep the FAD centered on the axle.

- b. Using a fid, pass the loose end up through the core of the braided poly at least 10", starting as close as possible to the axle, and out through the side of the line.
- c. Pass fid out of core through the side wall of the line
- d. Remove fid, burn and pinch the exposed end to prevent fraying

- e. Extend line to pull end back into the core, ensuring the double loop remains tight and the line retracts completely into the core.
- f. Splice can be secured with either a short piece of twine or small cable tie passed through the line; lateral movement of the wrap on the axle can be prevented by adding two cable ties adjacent to the wraps.
- g. Repeat steps above to attach 2-1/2" stainless steel ring to other end of line at a point where it will be 1 – 2" above the jaw when the jaws close (about 38" from axle).
Tip: Do not use cable ties to secure splice at ring , as they could snag lines and netting.
- h. Affix line at 3 or 4 points on FAD with cable ties (this will keep FAD centered on axle; Fig. 22).



Figure 22. Steps to attach ring line to axle.

17. ATTACH HARNESS

- a. Starting with at least 16' of 3/8" hollow braided polypropylene line, use an overhand loop knot (Figure 14) to add a small (3-4' diameter) loop at the center point (the loop is for attaching a float line or a trawl line).
- b. Slide three hard floats (1-3/4" by 5") over the two lines of the harness and up to the knot below the loop. Secure loosely with an overhand knot below the floats (the loose attachment will allow for adjustments later).
Tip: Wider floats can be used, but may not pass through the rings, making trap handling and repairs slightly more difficult.
- c. Attach harness line to center point of jaw; line should measure at least 60" from the knot below the float(s). Double wrap the bitter end around the top center of jaw, trimming the loose end to about 10-12".



Figure 23. Overhand loop knot (www.netknots.com).

Tip: If the floats don't fit through the ring, pass the harness lines through the ring before attaching them to the jaws.

- d. Using the fid, pass the loose end through the core of the braided poly at least 10", starting as close to the frame as possible, and out through the side of the line.
- e. Remove fid, and extend line to pull end back into the core. Splice should be smooth to prevent binding on ring.
- f. Repeat steps c, d, and e on the other jaw.

Tips:

- *Ensure harness lines are of equal lengths. If not, adjust the overhand knots below and above the floats.*
- *A short piece of twine passed through the splice and tied off can prevent the internal line from backing out.*



Figure 24. Three 1-3/4"x5" floats below loop at top of bridle, secured with overhand knots above and below the floats.

18. OPTIONAL: WRAP CHAFING GUARD (Nearly any scrap of line can be used as a chafing guard, which protects the twine holding the net to the jaws)

- a. Attach line to jaw with whipping knot (Fig. 25) using twine 2-4" from hinge.
- b. Wrap line around rebar, passing it through the netting every few inches, ending 2-4" from hinge on other end of jaw.
- c. Secure with whipping knot using twine.
- d. Repeat on second jaw.

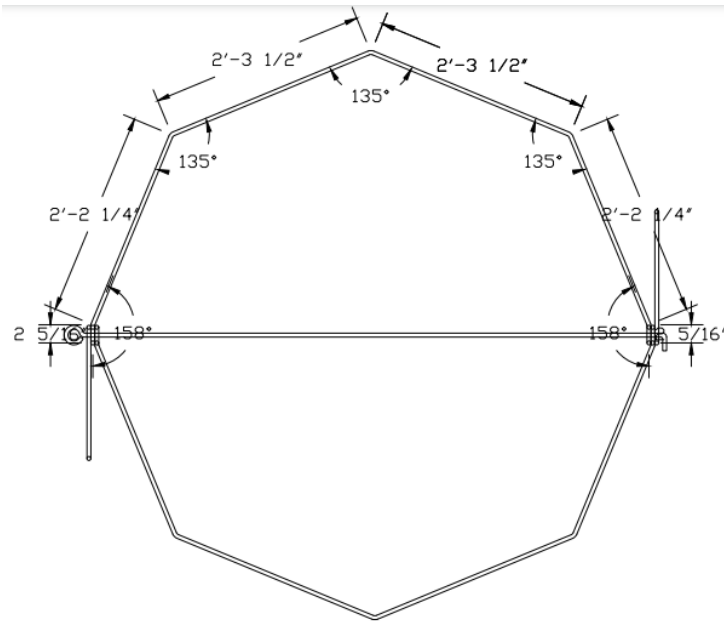
19. DROP TEST COMPLETED TRAP

- a. Toss a line over a tree branch or other structure about 10 feet above the ground.
- b. Attach the line to the loop of the harness
- c. Pull the trap up so it is a foot or so of the ground
- d. Lower it fairly quickly to the ground, or let it free fall.
- e. If the deflectors push the trap open with no binding, the trap should be functional.
 - Check for any binding and make necessary adjustments until the trap opens properly during the drop test.

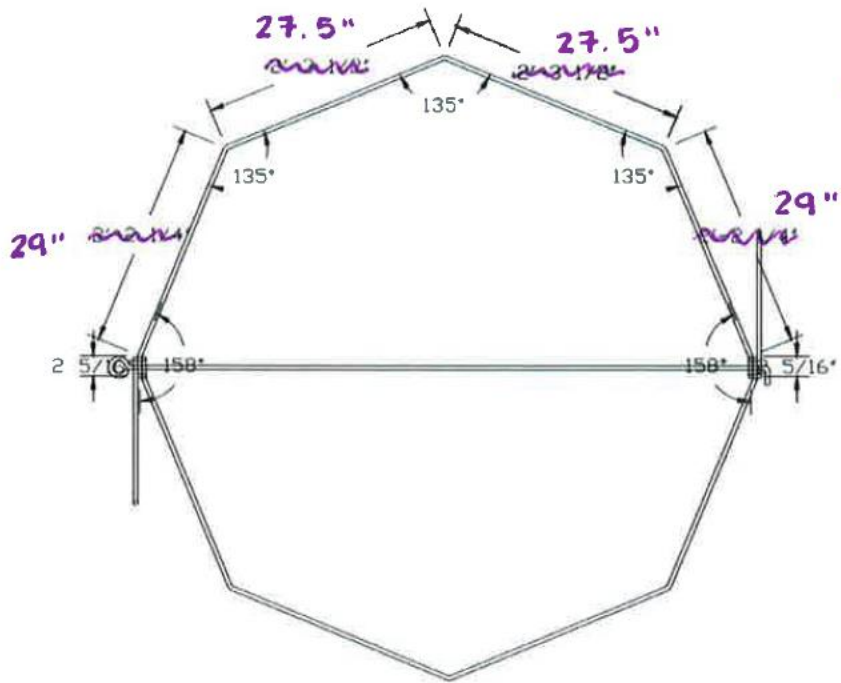


Trap Frame Measurements:

Original



Corrected for SK Grant



Total length
of the frame
= 14' 1/4"

out of a 40'
piece of rebar:
cut 2 x 15'
 ↑
 frame
cut 1 x 10'
 ↑
 axle