# K-Botics, Team 2809

www.kbotics.ca                Reversible Bumper Construction

For FIRST Robotics Competitions, each team is required to have red bumpers and blue bumpers for their robot.  To facilitate the change from red to blue bumpers between matches we have designed bumpers that are made from both blue and red material that requires the repositioning of a fabric flap which is fastened by velcro.
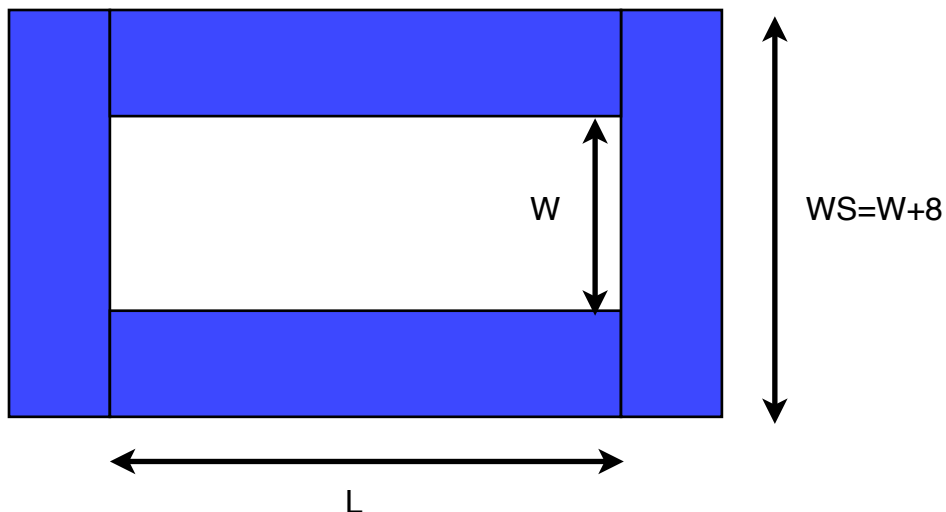
What is required:
- blue and red fabric (durable, no stretch)
- pool noodles
- sew on velcro
- adhesive velcro
- thread
- scissors
- sewing machine
- paper (for pattern making)

- pins
- measuring tape
- plywood to mount bumpers
- iron (optional)
- 8 lengths of aluminum angle (4L, 4W)
- staple gun
- calculator

Step 1: *Know your robot dimensions.*  Consult your CAD drawing, and the bumper rules.  This tutorial assumes a rectangular robot.

robot width (W) = _____                robot length (L) = _____

short bumper width (WS) = W + 4 + 4  (to account for the bumper overlap)

**Step 2:** *Calculate the amout of fabric you will need.* You will be making two short bumpers, and two long bumpers for your robot.

Pool noodles are 2.5 inches in diameter, so the bumpers (including the mounting board) will be approximately 3 inches wide, and approximately 5 inches high.

Remember that fabric needs to fold over to the back of the bumper to be stapled to the wooden backing piece.

Fabric must also cover the ends of the pool noodles which means adding 5 more inches to
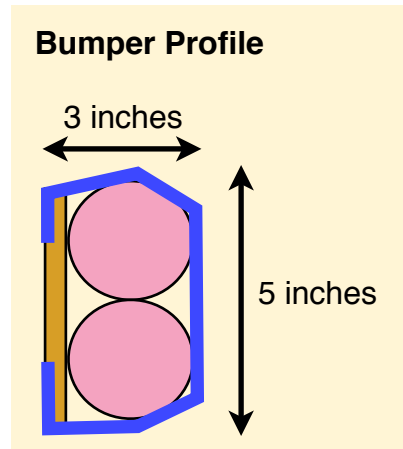
**Short Bumper Fabric Dimensions** (cut 2 blue, 2 red)
15 inches x (WS + 5 + 5) =_____

**Long Bumper Fabric Dimensions** (cut 2 blue, 2 red)
15 inches x (L + 5 + 5) =_____

**Bumper Profile**



3 inches

5 inches

**Step 3:** *Buy your fabric.* Bring your plan with you when you go to the fabric store. Know your dimensions in inches and in centimeters (Canada). Fabric is sold on bolts in standard widths of 45 inches (115 cm) and 60 inches (152 cm). The bolt dimensions are listed on the end of the bolt along with the fabric content.



We chose a twill fabric blend of polyester and cotton. Be sure your material is durable, and not stretchy. Choose a material that will be easy to sew. If the material is very thick you may need a denim needle for your sewing machine.

Buy sewing velcro 2(W+8)+2(L+8) in length of soft and hard velcro. Buy adhesive velcro 2(W+L) in length of soft and hard velcro.

**Step 4:** *Cut your fabric.*  Make pattern pieces out of paper.  Lay out your fabric, pin your pattern to it, and cut the pieces out.

**Step 5:** *Sewing the fabric.*

**Reversible Bumper Plan**

6 inches

sew
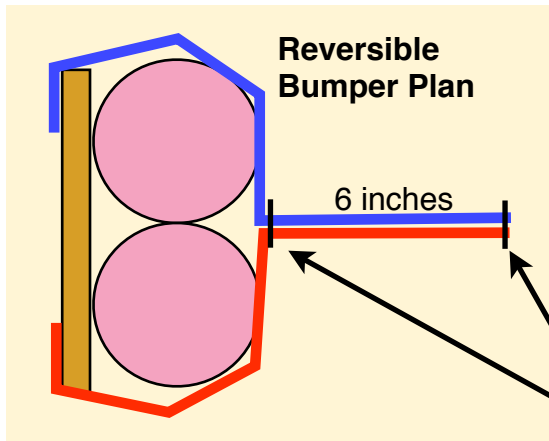
a)  With right sides together, pin and sew a short blue and short red bumper piece together lengthwise.  Repeat for the other short bumper pieces, and the two long bumper pieces.

b)  Turn the work right side out and iron it flat.

c)  Sew another seam 6 inches from the first one to complete the flap.

**Step 6:** *Attaching the velcro.* Sew loop velcro (soft) to the length of the red side of the flap edge.  Sew the hook velcro (hard) to the length of the blue side of the flap edge.

**Reversible Bumper Plan**

hook velcro

loop velcro
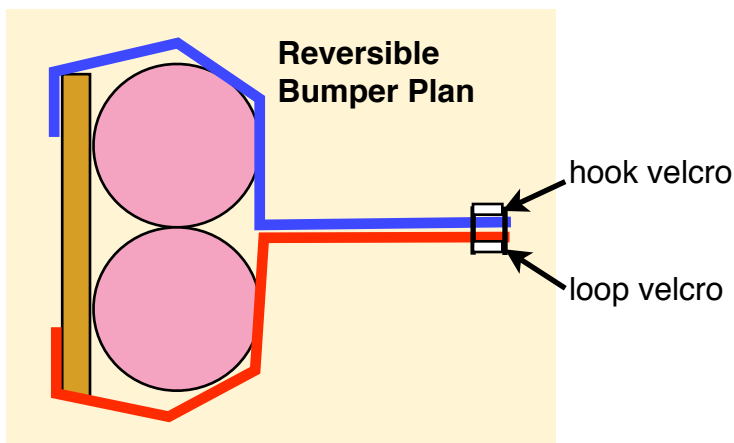
**Step 7:** *Assembling the bumpers.*  Cut the pool noodles to the right length.  <u>Pool noodles cannot be hot glued together</u>, but they can be taped or superglued.

Cut the plywood to the right length.  <u>If there are bolts being used</u> to attach the wood to the robot, be sure that the bolts are in place before the bumpers are assembled.

Center the flap so it is lined up between the two pool noodles.  Be sure that there are 5 inches of fabric free on each end of the bumper.  Use a staple gun to attach the fabric to the plywood.  Ensure that the material is taut.
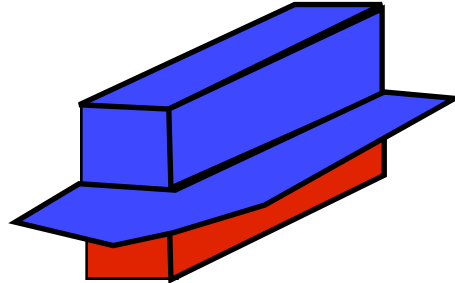
**Step 8:** *Forming the corners.* To make nice neat bumper corners fold the 5 inches of extra fabric around each end of the bumper, as if you were giftwrapping it, and staple the fabric to the wood. Do not staple the flap material!



To make the flap turn the corner nicely, a small triangle of fabric needs to be removed from the outer edge of the flap at each corner. The triangle should be placed as shown in the diagram below. When the sides of the triangle are sewn together the bumper flap should be snug around the corner of the bumper. Be sure that the flap can go over the top and bottom bumper corners. **Before cutting**: pin the sides of the triangle together, and try folding the bumper corner up and down over the pool noodles to make sure there is enough space. Be sure to leave a 1/2 inch of fabric for seam allowances.

The dimensions below are approximate.

*When in doubt cut less fabric. It is much easier to cut more off later than sew more back on.*
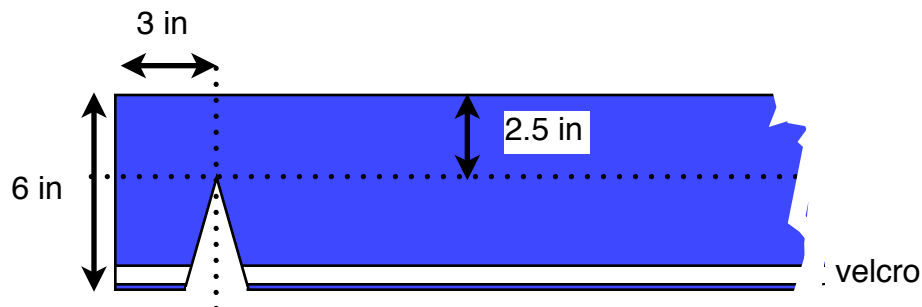


**Step 9:** *Finishing.* Attach the aluminum angle to the top and bottom of each bumper. Attach the adhesive velcro to the aluminum angle. Attach the hook velcro (hard) to the aluminum angle on the red side. Attach the loop velcro (soft) to the aluminum angle on the blue side. The bumpers are now reversible!

Using a stencil and acrylic paint, place the team number on each bumper. Allow ample time for the paint to dry before reversing the colours, and painting numbers once more.