Building a Bumbo Wheelchair
October 6, 2014

Introduction & Background
My younger brother and his wife recently had their first baby. He was born with Spina Bifida. Both of them and their young son have been an inspiration to our family with their faith and courage. He is absolutely adorable and it has been a joy to see our family come closer together and prayers answered as we are pulling for little Calvin.

My brother recently forwarded a video and other information showing Bumbo Wheelchairs that allow young babies to be very mobile. We were inspired by the video and one of the documents showing different pictures of how it came together. I want to offer our heartfelt thanks and give complete credit to those who posted the original documents and videos if Bumbo wheelchairs. Thank you!

- Video: https://www.youtube.com/watch?v=iPwPc2AiCyg

From these videos, we decided to dive in and build a Bumbo Wheelchair for Calvin. We had a great time, learned a lot, and ended up with a fun little ‘race car’ as my brother and sister-in-law refer to it. I also need to give full credit to my neighbor, Joe Fix-it, who is a true craftsman, a magician with all things metal and an amazing neighbor and friend.

That said, after having so much fun and learning, we wanted to post this document to provide pictures, design thoughts and a parts list for others who may want to build their own set of wheels. There are plenty of ways to improve on or simplify our attempt. My goal isn’t to provide all the answers, but hopefully spark ideas and help you find some of the parts a bit easier. I look forward to seeing your ideas and improvements.
**Table of Contents**

Building a Bumbo Wheelchair................................................................................................................................................. 1

Introduction & Background................................................................................................................................................. 1

The finished product ........................................................................................................................................................... 3

Building the base ................................................................................................................................................................. 4

Brackets and wheels ........................................................................................................................................................... 5
  Caster wheels .................................................................................................................................................................. 5
  Main wheel brackets ....................................................................................................................................................... 5
  Main wheels and tires ..................................................................................................................................................... 6

Chair and mounting brackets .............................................................................................................................................. 7
  Bumbo Chair .................................................................................................................................................................... 7
  Bumbo mounting brackets .............................................................................................................................................. 8
  Attaching the seat ........................................................................................................................................................... 8

Additional Pictures .............................................................................................................................................................. 9

Additional Design thoughts ............................................................................................................................................... 10
  Push handle ................................................................................................................................................................... 10
  Chair base ...................................................................................................................................................................... 10
  Oxygen bottle holder .................................................................................................................................................... 10

Blueprint pictures .............................................................................................................................................................. 11

Final pictures ..................................................................................................................................................................... 13

Cost ................................................................................................................................................................................... 14

Parts List ............................................................................................................................................................................ 14

Credits and Thank you! ..................................................................................................................................................... 15

Contact Information .......................................................................................................................................................... 15
The finished product
Let’s start with a few pictures of the finished product to provide context for the following sections:

Figure 1 - Front Angle View

Figure 2 - Front & Rear Views
Building the base
The base is 20” x 12”. The cutting board is 5/16” thick and a hard polypropylene surface. The actual cutting board we used doesn’t appear to be for sale anymore. If doing this again, I would probably look for a slightly larger cutting board and trim it down to meet the dimensions. The length felt about right, maybe add 1” on the backend. For the width, I would hold at 12” or maybe drop by ½”. The wider the base, the wider the wheel base and I believe it will give the child less leverage when pushing the wheels.

As you can see from the pictures of our base, we have 3 types of holes that we put into the base. The four corner holes are 3/8” and are for the caster wheel posts. The 3 sets of ¼” holes are used to attach the main wheel brackets. We put three sets in to allow them to adjust the wheelchair center of gravity as the baby grows. As their legs grow longer, their weight distribution will shift and this allows the chair to still be stable and have the front tilt (see caster wheel section for more on front tilt). The two large holes are for access to the nuts securing the main wheel brackets. The nuts can be easily placed and tightened through these holes. These two large holes were cut with a 1 7/8” Forstner bit and then filed out to create the long smooth shape.

I might also note that we chose to flip the cutting board upside down. We felt the gutter around the outside of the cutting board might carry water, juice, milk or other fluids under the seat and make it more difficult to clean.

Figure 3 = Bare base pictures w/12” ruler

We did build a prototype using a cheap board to play with different wheel placements and center of gravity. It turned out that different size children, depending on leg length and weight, had very different centers of gravity on the chair. That was the reason for the adjustable position. The three sets are ¾” apart. The caster wheel post holes were positioned so the spinning wheel stays (mostly) under the cutting board. We probably could have pushed these out more, but they provided plenty of stability and were conveniently located to also serve as mount for the seat brackets.
Brackets and wheels
The brackets and wheels were where we spent most of our time. We tried out various different caster wheels, spent a lot of time finding the right tire and ultimately were fairly happy with the result.

Caster wheels
The caster wheels are two different sizes so the baby can lean forward and pick-up toys or other items off the floor. When sitting up normal, the chair rests on the 3” rear casters and main wheels. The front 2” caster wheels are floating off the ground when the chair is resting or the baby is sitting up normal in the chair. When the baby leans forward with his/her head, shifting their center of gravity, the chair tilts so they can easily reach different items. We used 3” and 2” caster wheels with the 3/8” bolt post. These were lighter than the full mounting bracket versions and had higher quality bearings than other options we were able to find. Harbor Freight had a clear poly wheel that was pretty cool and was used on another Bumbo Wheelchair that we referenced. They would have worked well also and were about the same price.

We did add an extra washer below the cutting board. We were planning to put one above as well, but we used the same post to secure the chair brackets which meant we didn’t need to drill additional holes or add a washer to the top. The top and bottom washers are probably overkill, but it does put less wear on the cutting board. You’ll notice from the picture, we also cut off the top of the post (using a hacksaw and file) so the post bolt didn’t stick too far through the cutting board. They are just long enough to securely attach the cap nuts with the washers and brackets in place.

Main wheel brackets
This was the fun part. From a design perspective, we wanted the brackets to be solid, tight to the cutting board and adjustable height to accommodate slightly different wheel sizes and to tweak how stable the chair is before it tilts forward. The original design was a simple L with a rounded top and gussets at the bottom to strengthen the ‘L’ joint. We later add a fender tail (the part that goes parallel with the board) to hold in the seat. The fender had nothing to do with the wheels. I’ll discuss this more when in the Chair and mounting brackets section. These brackets where made out of stainless steel flat bar, left over from a very cool BSA Eagle Project. Joe Fix-it did all of the welding, grinding and polishing to trick out these brackets. Amazing what someone with skill can do! In reality, we probably could have used a standard bracket from Lowe’s and drilled holes for the wheel and to secure the bracket to the cutting board. If you have a friend that can weld, great! If not, a 6”x6” L bracket which could be drilled and filed to serve the same purpose.
As per the pictures, the bottom of the bracket has 5 sets of holes with 3/8” spacing (see blue print for details). This allows you to adjust out the wheels as the baby grows. The closer to the chair, the more leverage. However, it was easy enough that we wanted it to be adjustable so the seat could grow with the baby. We’ll have to wait and see if this feature is ever used.

Next, on the upper leg of each L, we placed 3/8” holes at a ¼” spacing. This was extremely difficult w/o having the drill walk. We did drill both brackets at the same time so they would be perfect mirror images of each other. This allows you to move the main wheel up and down in ¼” increments and allows you to adjust the stability of the chair or accommodate different tire sizes. To start with we lowered the wheel ¼” below the point where the chair would set perfectly level resting on the main wheels and back caster wheels. We felt the extra stability would help the little guy feel more comfortable. As he gets the hang of it, it is very simple to drop them both down a notch.

To secure the bracket to the cutting board, we used ¼” by ¾” bolts w/a self-locking nut. The self-locking nuts w/the flange are shown in the pictures below

Figure 5 - Main wheel brackets, bolt and self-locking nuts

The back fender that sticks back was welded on after we designed the original bracket. The fender squeezes the chair in to fit w/in the 12” width. We could have also done this with a second smaller bracket.

Main wheels and tires

The main wheels and tires were pretty straight forward. We like the mag wheels – fewer places to get fingers caught. Tubes were easy to find and inexpensive. We did do research to find latex-free tires and absolutely love the Schwalbe
tires that we found. Apparently, young babies exposed often to latex are much more likely to form a latex allergy and so we went ahead and tried to eliminate that concern. The tires were just $2 more per side than the other option and the smooth tread feels nice on the hands. They are the 12.5” Schwalbe City Jet, 54-203, Black, Wired – SKU: 11103257.

In terms of modifications, we did three things to the wheels. First, once we assembled the wheel on the brackets, we cut off the hub bolt so it would be flush with the nut. It was longer to fit a bike fork and needed to be trimmed. The second was to adjust the tension on the inner hub bracket bolt to help the wheel spin easier. The manufacturer had over-tightened the bolt and there was too much pressure on the bearings. Third, and completely a Joe touch, was to add the chrome stem caps to match the cap nuts on the chair.

Figure 6 - Wheels and tires

Chair and mounting brackets

Bumbo Chair
One of our goals early on was to avoid cutting the outside chair surface. The external coating on the Bumbo seat is easy to clean and very durable. The inside, exposed when cut, is porous and difficult to clean. To accomplish this, we cut out the buttresses on the inside of the seat. This can be seen in the pictures below. We removed just enough to allow us to squeeze the side without pinching the seat or leg openings on the top. The fenders attached to the main wheel brackets squeeze the chair slightly and the chair is held down by the mounting brackets. As you can see from the pictures, there are no cuts on the external surface of the Bumbo chair.

Figure 7 - Chair cuts and fenders
Bumbo mounting brackets
The mounting brackets were also built custom using mild steel. The mild steel is softer for drilling as we go through chair and rigidity isn’t as critical with the mounting brackets. These could easily be replaced with 2” aluminum L brackets from the local hardware store and self-tapping metal screws. Once again, Joe Fix-it worked his magic w/metal.

Attaching the seat
To protect the seat, we used both a metal fender washer and a silicon fender washer that we built by cutting it out of a cheap silicon cutting board. We used a 2” hole saw, but could have used a pair of scissors. The same cutting board was also used to provide a ‘fender’ to cover the bracket so it wouldn’t rub through the inside of the seat over time. This time we just used scissors. These silicon fenders were held in place by the nutserts. The nutsert requires a special tool to ‘rivet’ it into place. If Joe Fix-it wasn’t on the job, I would have glued the silicon fenders in place and attached the seat brackets with a self-tapping metal screw as I mentioned earlier.

Figure 8 - Mounting brackets and fender washers for chair

Just for reference, I have shown the brackets on the board below. The brackets connected to the 3/8” stem bolt from the caster wheels, but this isn’t necessary. We did bend angle the back brackets in and the front brackets out slightly to better match the inside angle of the Bumbo seat.
Additional Pictures
Not too much to explain here. Just a few additional pictures showing different and views while assembling the chair. I did realize that I didn’t take any pictures of the bottom with the caster wheels attached before I shipped the chair off to my brother.
Additional Design thoughts

Push handle
We discussed attaching a push handle for walks. While they didn’t want this feature, it could easily be added by attaching a flag holding bracket to the back of the cutting board. It would stick up at an angle and a pole / handle could easily be inserted and attached via an anchor screw.

Chair base
If starting from scratch, I would probably look for a slightly larger cutting board and cut it down. I would use 11 ½” by 21” as the dimensions to provide a little more length in back and allow for a narrower base. The chair base can be squeezed by another ½” without impacting the seat or leg openings where the child sits. I believe ¼” is the right thickness, but potentially drop some weight using a lighter weight cutting board and adding one additional access hole to the front to connect seat (especially if didn’t have nutserts). The board would still have plenty of strength and it would reduce weight.

Oxygen bottle holder
We also discussed adding a cup holder on the back center (same location as the push handle) to hold a small oxygen bottle. We would also add a strap that would connect to the back of the chair to secure it.
Blueprint pictures
The following drawings were traced after building the Bumbo wheelchair
**Final pictures**
The wonderful family that published pictures and details on their Bumbo wheelchair set the tone for what a real ride needs... so we added some swag of our own to the race car! Rise and Shout, Calvin is out... on the trail to fame and Glory! Go Cougars and Go Calvin!
### Cost

<table>
<thead>
<tr>
<th>Part</th>
<th>Qty</th>
<th>Unit Cost</th>
<th>Cost</th>
<th>Tax &amp; Shipping</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bumbo seat</td>
<td>1</td>
<td>34.99</td>
<td>34.99</td>
<td>2.94</td>
<td>37.93</td>
</tr>
<tr>
<td>Cutting board</td>
<td>1</td>
<td>7.95</td>
<td>7.95</td>
<td>10.37</td>
<td>18.32</td>
</tr>
<tr>
<td>Wheel rims</td>
<td>2</td>
<td>21.07</td>
<td>42.14</td>
<td></td>
<td>42.14</td>
</tr>
<tr>
<td>Tubes</td>
<td>2</td>
<td>5.68</td>
<td>11.36</td>
<td>0.96</td>
<td>12.32</td>
</tr>
<tr>
<td>Tires</td>
<td>2</td>
<td>18.85</td>
<td>37.30</td>
<td>9.93</td>
<td>47.23</td>
</tr>
<tr>
<td>3” Caster wheels</td>
<td>2</td>
<td>6.47</td>
<td>12.94</td>
<td>1.10</td>
<td>14.04</td>
</tr>
<tr>
<td>2” Caster wheels</td>
<td>2</td>
<td>4.47</td>
<td>8.94</td>
<td>0.76</td>
<td>9.70</td>
</tr>
<tr>
<td>Thin cutting board</td>
<td>1</td>
<td>4.99</td>
<td>4.99</td>
<td>0.42</td>
<td>5.41</td>
</tr>
<tr>
<td>Misc HW (Nuts, bolts)</td>
<td>48</td>
<td>10.00</td>
<td>10.00</td>
<td></td>
<td>10.00</td>
</tr>
<tr>
<td>Donated custom pieces</td>
<td>6</td>
<td>-</td>
<td>-</td>
<td></td>
<td>Priceless</td>
</tr>
</tbody>
</table>

Total Cost: $170.61 + $26.48 = $197.09

### Parts List

<table>
<thead>
<tr>
<th>Part name</th>
<th>Description</th>
<th>Link (if Available)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting board</td>
<td>12” x 20”, Dexas GrippBoard Cutting Board</td>
<td>No longer for sale where we bought it... See “Building the base” section for details.</td>
</tr>
<tr>
<td>Wheel rims</td>
<td>12” Mag wheels</td>
<td><a href="http://www.amazon.com/dp/B004E3V314/ref=pe_385040_30332190_TE_3p_dp_1">http://www.amazon.com/dp/B004E3V314/ref=pe_385040_30332190_TE_3p_dp_1</a></td>
</tr>
<tr>
<td>Tires</td>
<td>12.5” x 1.95” Latex free, city tread. Schwalbe Tires, Part # 11103257</td>
<td><a href="http://www.schwalbetires.com/bike_tires/road_tires/city.jet">http://www.schwalbetires.com/bike_tires/road_tires/city.jet</a></td>
</tr>
<tr>
<td>Tubes</td>
<td>12.5” x 1.95” Schrader valve</td>
<td><a href="http://www.amazon.com/dp/B0038VDSTI/ref=pe_385040_121528360_TE_dp_1">http://www.amazon.com/dp/B0038VDSTI/ref=pe_385040_121528360_TE_dp_1</a></td>
</tr>
<tr>
<td>Wheel brackets</td>
<td>Custom, See pictures in document</td>
<td>Potentially replace by 6” x 6” L bracket</td>
</tr>
<tr>
<td>Seat brackets</td>
<td>Custom, see document description</td>
<td>Potentially replace with light gauge 2” x 2” L bracket</td>
</tr>
<tr>
<td>1 ½” Fender washer</td>
<td>3/8” hole in center. Fits between caster wheels &amp; cutting board</td>
<td>Local hardware store</td>
</tr>
<tr>
<td>3/8” Nut</td>
<td>Size to caster wheel post, Attaches caster wheel to cutting board. Cap nut nice, but not necessary</td>
<td>Local hardware store</td>
</tr>
<tr>
<td>¼” by ¾” Bolt</td>
<td>Correct length to secure main wheel bracket</td>
<td>Local hardware store</td>
</tr>
<tr>
<td>Part name</td>
<td>Description</td>
<td>Link (if Available)</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Locking ¼&quot; Nut</td>
<td>See picture w/bracket side profile. Shows locking top/bottom picture of locking nut</td>
<td>Local hardware store</td>
</tr>
<tr>
<td>⅛&quot; Washer</td>
<td>⅛” hole, standard diameter</td>
<td>Local hardware store</td>
</tr>
<tr>
<td>1 ¼” by ⅛&quot; Bolt</td>
<td>Phillips head, 1 ¼” long. See picture of fender washers</td>
<td>Local hardware store</td>
</tr>
<tr>
<td>⅛” Nutsert</td>
<td>Inserted into chair brackets. Requires special tool. Would likely replace with self-tapping metal screw</td>
<td>Replace with self-tapping metal screws into aluminum L brackets.</td>
</tr>
<tr>
<td>¼” Fender washer</td>
<td>¼” hole, 1 ¾” outside diameter.</td>
<td>Local hardware store</td>
</tr>
<tr>
<td>¼” Silicon fender washer</td>
<td>Custom, Thin silicon cutting board, using 1 ¾” hole saw.</td>
<td>Cutting boards were the cheap cutting boards that are very thin and flexible.</td>
</tr>
</tbody>
</table>

### Credits and Thank you!

A huge THANK YOU ...

- To my brother, sister-in-law and their super son, Calvin, for letting us put this together.
- To the families who posted videos and documents showing their Bumbo Wheelchairs
- To my parents and other brother who offered to cover the cost of all of the materials.
- To my wife and children that put up with me hanging out in the garage and over at Joe Fix-it’s
- To Joe Fix-it for his craftsmanship and friendship... and his wife for putting up with us in their garage
- To all those who are pulling and praying for Calvin... or other children around the world

### Contact Information

Please don’t hesitate to reach out if you have questions or to share your ideas.

Alva Barney, alva.barney@gmail.com