Construction of a soapbox derby car.

YOU CAN DO THIS - DON’T GET DISCOURAGED!!!

This is how I built my soapbox derby car. This particular car was built using tools that most anyone would have in a typical garage. There are a few parts that require some more complex tools but there will be some notes about that later.

A car could be built differently, stronger, faster, lighter, heavier, easier, cleaner, better than this car, again….. I tried to build a car using relatively common tools.

I think it’s important to note that if you read all the pages here first, each of the steps I took would make more sense.

It’s very important to note that I am not suggesting you build your car like this, instead this are strictly notes about how I built my car. In no way am I suggesting you build your car like this or that you or anyone you know or anyone in your family actually try to drive this or any soapbox derby car, especially one that is built like this one. Clearly these types of vehicles are very dangerous, again I would not suggest actually building this car or driving one like it.
Time to Build – Probably about 8-14 hours

Tools needed:
Skill saw
Saber saw
Electric Drill
Drill bits
Tape Measure
Hand Tools (screw drivers/some wrenches)
<table>
<thead>
<tr>
<th>Quantity</th>
<th>Part</th>
<th>Where I bought it</th>
<th>Cost</th>
<th>For what</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>2</td>
<td>2x4x8'</td>
<td>Home Depot</td>
<td>$8</td>
<td>Chassis</td>
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<td>Front &amp; Back Axle</td>
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<tr>
<td>2</td>
<td>Eye bolts with long threads</td>
<td>Home Depot</td>
<td>$4</td>
<td>Steering</td>
<td>See pics (5&quot;)</td>
</tr>
<tr>
<td>2</td>
<td>Eye bolts with short threads</td>
<td>Home Depot</td>
<td>$3</td>
<td>Towing</td>
<td>2&quot; or 3&quot;</td>
</tr>
<tr>
<td>2</td>
<td>Boxes of 3&quot; Deck Screws</td>
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<td>$10</td>
<td>All</td>
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<tr>
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<tr>
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<td>see pic</td>
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<tr>
<td>3</td>
<td>3/8&quot;x3&quot; Lag Screws</td>
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<td>$3</td>
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<td>Get washers also</td>
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<td>$4</td>
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<tr>
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<tr>
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<tr>
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<td>Steering Shaft</td>
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<td>Industrial Hardware</td>
<td>Wheel Nuts</td>
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<td>5/8&quot; Nuts</td>
<td>Industrial Hardware</td>
<td>Steering Shaft</td>
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<tr>
<td>6</td>
<td>5/8&quot; Washers</td>
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<td>Industrial Hardware</td>
<td>Front Axle</td>
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<tr>
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<td>Industrial Hardware</td>
<td>$10</td>
<td>Front Axle</td>
<td>$10 max for all</td>
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| 4 | Wheels (20" Utility Wheel) | Amazon | $140 | I used the 5/8" Bearings (comes with 3/4" Also) |

You can get smaller wheels from Amazon or "House of Wheels" in Boise - save money using smaller wheels

| 1 | Bicycle Brakes | Amazon | $20 | Brakes |
| 4 | 4" pulleys (gym equipment) | Amazon | $16 |

| 1 | (4) axle mounts | John Ahrens | $25 | Per the pictures | I would be glad to weld these parts for anyone!!! |

**Total** | $297
The first part I built was the “CHASSIS”.

1. Cut: (2) 2x4x38” (I would have done it a little shorter if I had built this for a smaller driver)
   (2) 2x4x20” (I did 22”, 20 will be better)
   (1) 4x4x26”

2. Marked a line 1 ½” from the edge of each of the (2) 20” long 2x4’s.
3. Predrill 5/32” holes as shown.
4. Using the (8) 3” long deck screws, I screwed together the (4) 2x4’s that make up the front, back and the sides of the “chassis”. Predrilling the holes in the short pieces prevents those boards from splitting when they are tightened the deck screws. This will be a common practice when using the screws throughout this entire project.

5. I predrilled (10) holes evenly spaced in one of the short pieces, this will be the back of the car.

6. I screwed the 4x4 to this “back” 2x4. The 4x4 was exactly centered with 2” extending past the 2x4.
7. I cut (2) 2x6x8½”. However, if I were going to build another car, I would cut these 10” long. As you will see in future pages, the 8½” pieces were just a little too short, 10” would have been better.

8. I marked center marks 1¾” down from the top and exactly centered side to side.

9. I drilled ¾” holes in both of these boards being careful to drill straight through the board.

10. After I drilled perfectly straight all the way through, I slightly “wiggled” the drill in each of these holes to make the holes just a little tiny bit bigger than ¾” so that the ¾” bolt, used in future steps, would fit easier.
11. Another 4x4x26” board was cut.
12. The metal plates with the axles welded on, with holes drilled are available by emailing john25@ctcweb.net or by calling (208) 602-4589. (4) of these and the steering wheel shaft (seen in future pages) can be purchased for $25.
13. These axle plates were screwed down, making sure to line them up to one edge of the board and they were screwed down so the 5/8” threaded axles stayed parallel and straight in relation to the board, this is important so the wheels will be straight and aligned to the rest of the car. The washer on the end of the axle plate was pushed up tight to the end of the 4x4.
14. I marked a center line exactly centered from side to side and exactly centered from top to bottom, then I drilled a ¾” hole using that center mark.

14. This next part is a bit more complicated and really requires the use of a router, if I didn’t have access to this tool, I would alter the construction a little, I will explain this later. Both methods would work. I would router these out for anyone in need.

15. I marked a section on the top and the bottom of the board that was exactly centered and was 7” wide. Then I routered a ¼” deep groove into both the top and the bottom of this board.
16. This picture shows the 7” long, ¼” deep groves on both the top and the bottom of the board. Again, if I didn’t have a router, this step could be avoided with a slight change to a few of the future steps. These grooves are routered to make room for (2) 1/8” thick washers that will be installed both above and below this front axle board, 2 on top and 2 on the bottom.
17. This picture shows the 8 1/2” long 2x6’s that were cut in a previous step. I marked a 1½” wide strip and marked for 3 holes to be predrilled with a 5/32” drill. Again, if I did it again, I would cut them 10” long.

18. I cut (2) 2x4x6 ½” long boards and marked similar 1 ½” wide strips and predrilled 5/32” holes on both sides of these boards in the center of those strips.

****Note: if I wasn’t going to router the ¼” groove, I would have cut these 2x4’s .....7” long instead of 6 ½”****
19. On the front of the chassis, I made a center line mark and then marked 2 lines 2 ¾” away from this center line. This made an outline 5 ½” wide (exactly the width of a 2x6)
20. I clamped the 2x6 so that it was exactly centered and perfectly straight. Then I screwed it down using the 3” deck screws.

21. I turned the whole chassis upside down and put the other 2x6 on aligning it with the previously marked lines and then put the steering pivot bolt in the ¾” hole to help align the bottom 2x6. I clamped this board in place and screwed it down using the 3” deck screws.

If I choose not to router those ¼” grooves, I would not screw down the bottom 2x6 in step 21. This would happen later in the construction.
22. Remember when I said earlier that if I did it again, I would have cut the 2x6’s, 10” long instead of 8 ½” long, the reason for that is that it would have pushed the axle out further forward. This would have made more room for the 2x4 shown here. I used the 8 ½” long 2x6’s so I had to make the 2x4’s about an inch narrower. Those 2x4s were screwed to the 2x6’s with 3” deck screws.

***Note: if I didn’t router the ¼” groove, I would have cut those 2x4’s 7” long which would have allowed for the bottom 2x6 to be installed after the ½” thick plywood “floor pan” that will be installed later. That ½” plywood floor pan basically makes room for the (4) 1/8” thick washers that get installed on the top and the bottom of this front axle board. These washers allow the front axle to rotate and turn side to side so the car will turn.****
23. I predrilled (4) holes (just through the chasis 2x4 and then used 3” screws as shown. This makes this whole assembly stronger and better attached to the front of the chassis.
24. These pictures show the metal rear axles pads installed on the wood rear axle using (6) 3” screws on each pad. Again, I took my time to make sure the threaded axles were square and straight to the chassis. Also, I made sure that the washer was tight up against the edge of the 4x4.
25. These pictures show the front axle installed using 2 washers above and below and then the axle bolt installed. Not shown is a washer on the bottom of the 2x6 and a Nylock nut.
26. I marked (1) 4” diameter circle on the plywood using a compass. Also marked (2) 5” circles. I made sure to mark the center of the circles so I could drill holes in the center later. It was very important to cut the 4” piece very round.
I cut out all three plywood circles and drilled a hole through each one using the center mark I made earlier.
I drilled a ¾” hole using the previously drilled hole as a predrilled center hole to help the bit go through straight.

I drilled half way through from one side and then the rest of the way from the other side to help keep the hole straight. I did wobble the drill bit a little to help the steering shaft go through easier.

I put a 2x6 in the chassis with 2 3” screws on each side. The location of this board would depend on the size of the driver (I am 6’ tall).
I used a straight edge to mark a pencil line on the front axle as shown. I then drilled a small hole in the center, as shown. This is for the steering eyebolt.

The pictures here show the eyebolt tightened all the way down, you will see in future pictures that I ended up reduces that depth to let the eye bolt stick up further to help the steering cable clear the floor pan better. You will also see that I used a turnbuckle to help tighten the steering cable. You can get one from Home Depot, it’s not in the material list.
I cut out a piece of plywood to cover the entire bottom of the car. This isn’t a good picture of that step, see future pic’s. Don’t completely screw the plywood down just yet, put only a few screws to hold it to the chassis.

I marked out an 8 ½”x2” rectangle make room for the steering pulleys. Drilled a hole to make room for the saw blade, then I took the plywood off and cut out the hole.
The following pic’s show the installation of the pulleys. Pretty hard to put into words how to install these parts but the pictures are very telling.
I used a straight edge to align the pulley on the bottom with the center of the pulley mounted in the previous step.

I did the same for the other side taking care to position the pulley so that the steering cable would clear the other pulley.

You will notice that the pulleys installed in the previous step were staggered to help with this alignment.

I used the 3/8” bolts and nuts (nylock) to attach these pulleys. Washers were used to raise the pulley off the floor pan for better clearance.
I marked 3 holes and drilled them through the 2x6. These are to mount the 4x4 steering shaft. I used the 3” long lag bolts to attach the steering shaft. I cut my 4x4 steering shaft 15 ½” long. I drilled a 5/8” hole in this board for the steering shaft. This can be seen in future pictures.

These next set of pictures show how I installed the complete steering assembly.

You can also see the eye bolt that was screwed into the front axle, this is so the car can be towed back up the hill on race day.
Notice the Nylock nut on the end of each side of the steering shaft (5/8” threaded rod – I would provide this to anyone with the axle assemblies so you don’t have to buy a full length – tell me how long you want it) Mine was 11”.

It’s important to tighten (hard) the nuts that surround the steering wheel and round steering cable reel. These nuts “sandwich these parts and keep them from spinning on the steering shaft.
To make the steering wheel, I screwed together two pieces of plywood using 1” long drywall screws and then cut out this shape and sanded the edges smooth. The steering wheel could be made out of anything that I could have drilled a 5/8” hole in.
The following pics show how I installed the brakes that I bought from Amazon.

The Boise Bicycle Project, Downtown, also has used brakes for sale.

I just used some scrap wood that I had. Could have used the plywood. Again, all of these holes were predrilled so as not to split the wood.
I cut out a fun shape from the plywood. I also made some support pieces.

The seat back could have been any shape.
These are the axle assemblies that I welded up. I would build these for anyone. Including the 11” long 5/8” steering shaft, the cost is $25. Give me a few days notice so I can have time to get the parts and build them. I would glad to build them a different size or configuration, just let me know.

Good luck….have fun. Call us if you need any help!!!