

# *CubMobile*

## How To Build a Cubmobile

### Introduction:

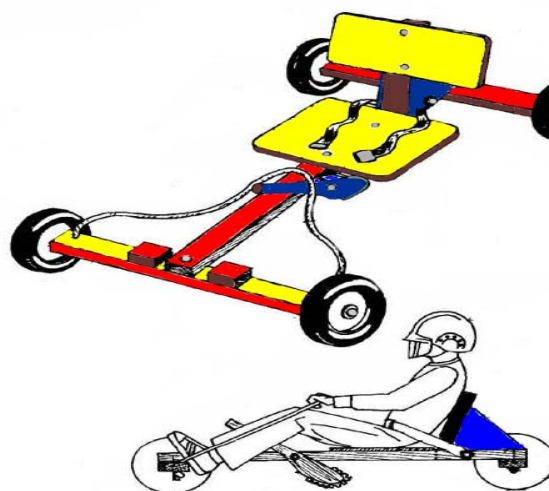
**Welcome and Thank You for purchasing this “How to Build a CubMobile”.**

**It contains many tips and hints on the construction and setup.**

I hope you are not disappointed after reading this and learn how to build a safe and fast Cubmobile.

At right is a picture of a standard Cubmobile. A larger illustration is on Page 2.

I have colored the different parts of the Cubmobile to make it easier for you to see what a Basic Cubmobile looks like when finished.



**1st** - Before you begin building your Cubmobile, check with your local Cub Scout Pack to see if they will be holding a Cubmobile Race.

**2nd** - If they will, obtain the Local Packs Cubmobile Rules —before you purchase anything or start to build. For items that their **rules** may require or not allow on the car. For example, seat belt, seat sides, foot guard, roll bar.

**3rd** - If your pack does not hold an annual Cubmobile race, other area packs will ! Most of them are open to other area scout packs who are eligible to participate in one.

**4th** - If neither is an option for you, then a hill comes in handy for hours of enjoyment for your child with a Cubmobile.

# CubMobile

## How To Build a Cubmobile

### Three Cubmobiles We Built:

At right is a photo of my son's **2004** Cubmobile that we built.

1/4" plywood was used for the seat and back support.

2x4's were used for the front and rear cross members and also a 2x4 was used for the frame.

2x4 was also used for the steering blocks and for mounting the brake lever.



The end of a old broom came in handy for making the brake lever providing a nice soft grip for the rider.

12 inch wheels were used. Bought from Blains Farm N Fleet.

**Circled**— A 2x2 piece of wood was used to connect the brake lever and a piece of hard rubber was used for the brake. The rubber piece is what will touch the ground and grab the surface to slow and stop the Car.

### 2005 Cubmobile

The Cubmobile at right is more developed. We took a lot of time creating a more aerodynamic front and rear cross member.

I also added more arc to the seat and back support board.

Notice the front and rear cross members were made using 2x6's, not 2x4's.

The brake lever was made out of 1" dia. dowel rod and a hockey puck was used for the brake pad.



# *CubMobile*

## How To Build a Cubmobile

### Three Cubmobiles We Built:

#### 2006 Cubmobile

##### TOP RIGHT PICTURE-

Here is our 3rd Cubmobile, That we built.

We used 2x6 for the frame, 2x6 for the rear & the front.

Doll rod and Hockey Puck for the brake again. It works well, so we have continued with the use of those items.

This Cubmobile, was the heaviest one we have built to date.

The main goal, was to have a heavier car, due to a lighter driver.

The seat back and seat support was positioned with the driver sitting on the seat.

The balance of the car, was at the front edge of the seat.

A hand rail was glued onto the front cross member.

##### LOWER RIGHT PICTURE-

You can see the machined axle mount in this picture. I accidentally bought to long of bolts and had to use a spacer.

If you look closely at the bearing of the wheel, you will notice it is not the stock bearing.



If you take a close look, you might be able to see that, we have placed the axle mount farther back on the front cross member.

It was not placed on center of the front cross member.

This Cubmobile is currently un-beaten, and has received 1st place and best of show trophies !

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## How To Build a Cubmobile

### The Frame:

In the photo at right is one of the aero-styled cross members.

The shape is not the standard 2x4 or 2x6 shape.

The goal was to have more aerodynamics to allow smoother air flow over the wood.

Even though The Cubmobile goes relatively slow, Every bit of less wind resistance can give you a better chance of winning !

Notice the shine! If you take your time you and your child can have a well-looking Cubmobile.

Later, I will discuss on how to make a glossy car !



At right is the basic shape of your Cubmobile:

Front and rear cross members and the frame (or rail.)

It is very important when cutting your pieces that the ends of the wood be straight and true. Especially critical, are the ends where the wheels mount to the ends of the cross members.

Use a square to scribe your cuts and do not use a fine toothed finish saw blade.

If the ends of the cross members are not straight it will make the alignment of the frame and wheels very difficult.





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### **The cross member:**



In this picture, (provided by a purchaser of the manual).

A Cubmobile was built. The rules were more open and allowed for more creative design. The Cubmobile has aero dynamic front and rear Cross Members.

Older soap box derby wheels were used, 4x4 for the frame, cut and altered for a really nice lower profile, shape and design.

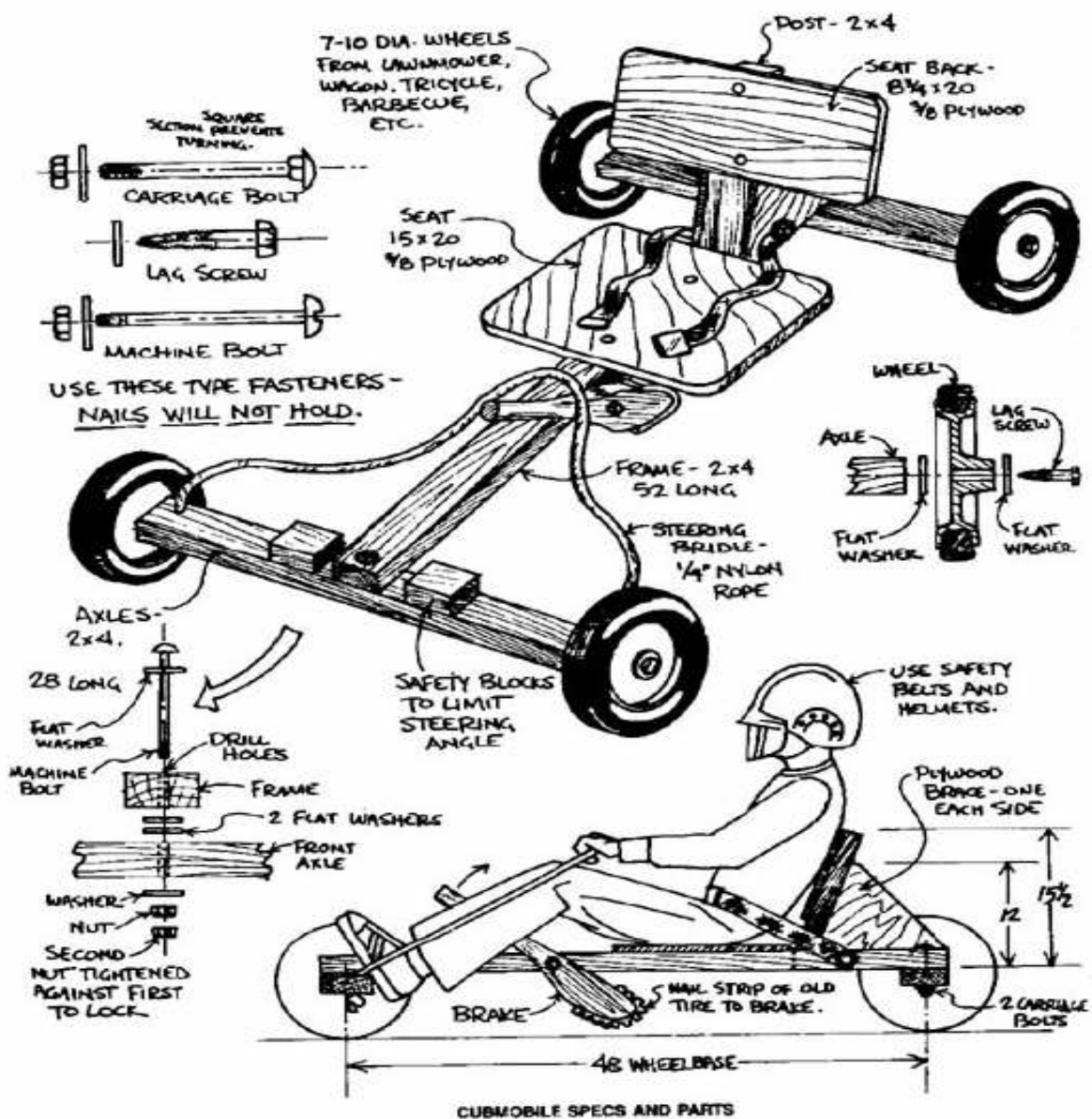
The brake lever was placed in the center of the frame, instead of on the side. A rear roll bar was placed for safety. The seat was made out of old street signs, bent and shaped to create the seat you see in the picture.

The seat angle allows for a lower profile, greatly reducing wind resistance during the race.

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### ASSEMBLY VIEW OF BASIC CUBMOBILE:

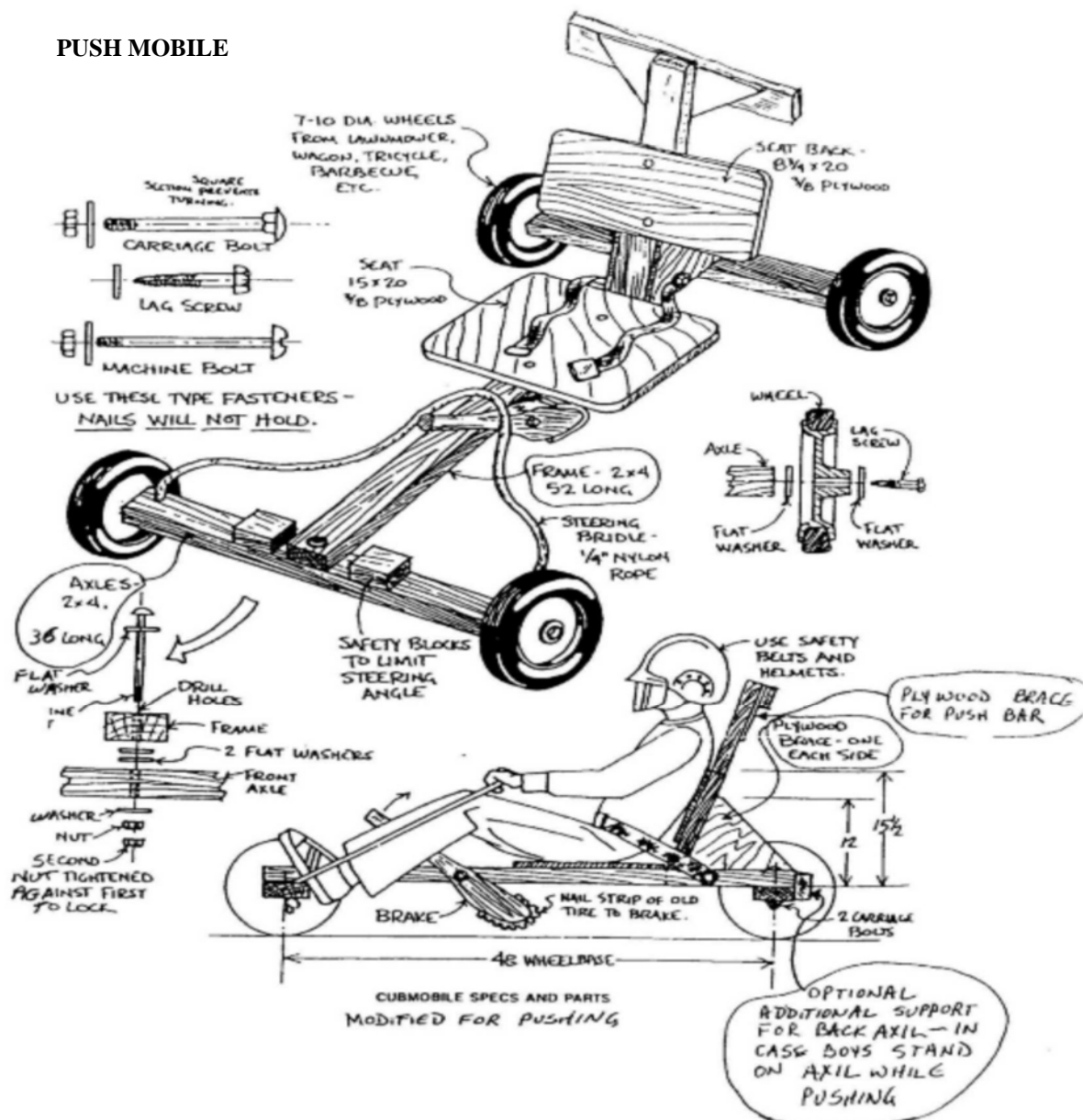


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## How To Build a Cubmobile

### ASSEMBLY VIEW OF BASIC CUBMOBILE:

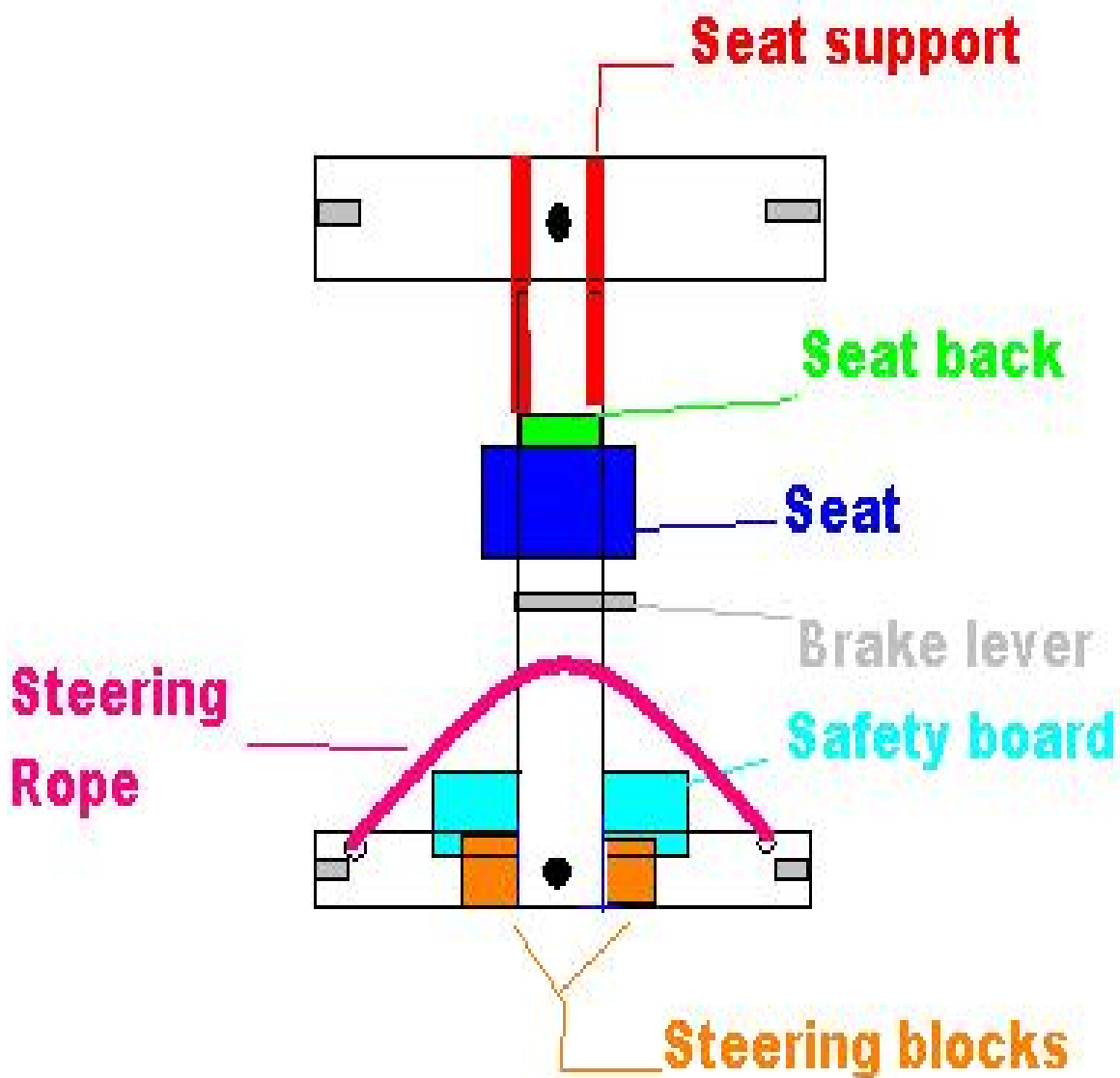
#### PUSH MOBILE



# *CubMobile*

## How To Build a Cubmobile

ASSEMBLY VIEW OF BASIC CUBMOBILE:





# *CubMobile*

## How To Build a Cubmobile

### Frame Centers:

**At the right** is a diagram of the unassembled frame and cross members. Note the yellow holes.

These holes are very important and crucial to the alignment and assembly of your Cubmobile.

It is especially important that the front cross member hole be placed in the exact center of the frame.

The steering and wheels need to be true so that the Cubmobile wheels run together in a true line in order to not create resistance with each other.

So if your wholes are not in the center of each piece of wood. Alignment well be very hard to achieve.

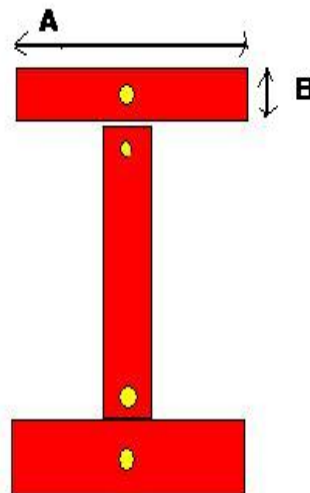
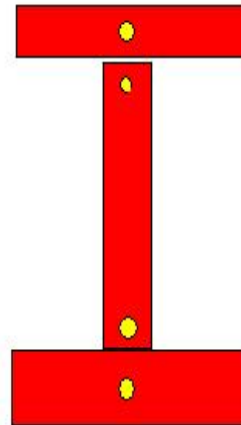
To obtain the center for the **CROSSMEMBERS**

**A** - Measure the length of the crossmember 'A' and divide buy two. (For dimensions see the Assembly View on the other page.)

Mark the center point on both sides of the board and also on both edges. Your marks should align. Make sure they do. (Mark with a small dot no bigger than 1/8th of a inch.)

**B** -Now do the same with crossmember width 'B'. Measure and divide buy two to get your center point.

Now repeat the marking on the opposite side of the wood.



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### Bushings:

Pine lumber is soft and dents very easily.

The use of a bushing can help reduce the damage to the frame and cross members by helping keep your drilled holes from becoming elongated or oval, and provides a tighter fit for the bolts.

Through the handling and practicing with the Cubmobile, It can become misaligned if the bolts become loose or the mounting bolt area becomes damaged.

The use of bushings on both sides of the wood can greatly reduce this from happening and provide greater accuracy and precision when setting up the Cubmobile.

Most local hardware stores carry bushings in stock.

The inner diameter of the bushing will be the same size as the bolts.

You will want to make sure that you have a drill bit that is the same size as the bushing.

The outer diameter of the bushing is larger than the inner diameter.

The bushing's will likely need to be pressed into the wood, flush with the surface.

You can achieve this by either, tightening the bolt until it sinks into the wood or by carefully taping it into the wood..



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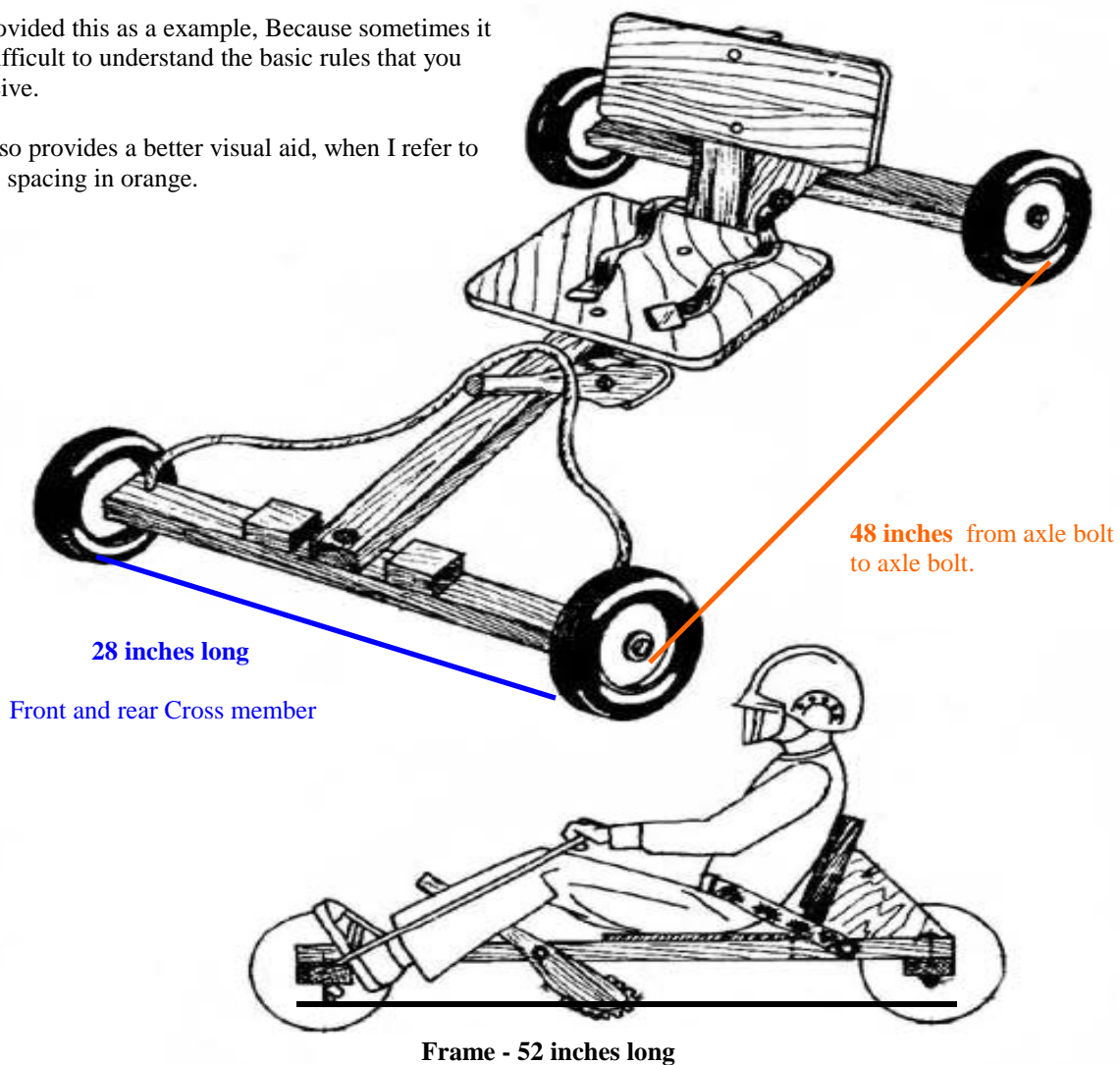
## How To Build a Cubmobile

### Frame Assembly Measurements:

These measurements are what our local rules state.

I provided this as a example, Because sometimes it is difficult to understand the basic rules that you receive.

It also provides a better visual aid, when I refer to axle spacing in orange.



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## How To Build a Cubmobile

### **Frame Assembly—Edges:**

Here is a few examples of how the ends of the boards should look after you have cut them.





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### Frame Assembly—Side View:

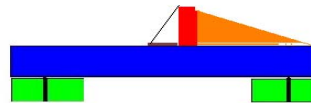
**Now**— You are going to measure and locate where the holes will go for your **frame**.

The frame is shown in blue, the side view at right.

The cross members are shown in green.

The best way to measure and mark where your holes will go is to make sure that the width of the cross members are the same. (Sometimes 2x4's or 2x6's are not the same width, but have slight difference's.)

The frame must be **flush** with the cross members !



### Marking

Measure the frame, using the distance of the cross member as the end line.

The white line shown at right separates the wood on the frame and is the same location as the edge of the cross member.

Measure and divide by two and mark with an 1/8th inch dot, and do the same for the bottom end.

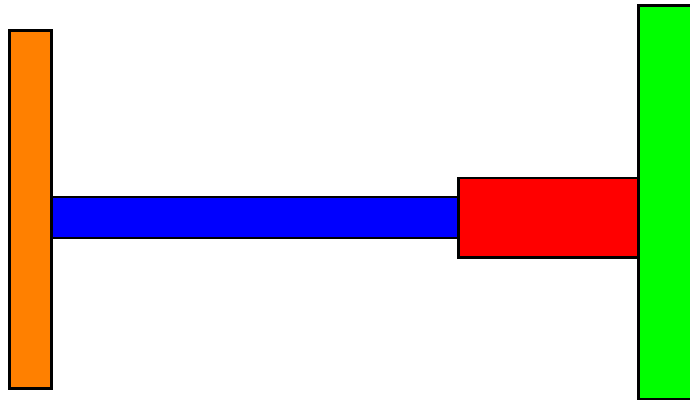
Repeat the steps for the other end of the frame.



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### Frame Assembly—Top View:



**2x4 -28 inches**

**2x6 - 28 inches**

**2x6 - blue (2x4), 52 inches long**

**2x6 - red, 16 inches, then reduced to 2x4**

Here is a design, that has the frame reduced in size. (reduction in blue) (normal size in red)

The seat would be placed in the red colored area.

This design, would allow for maximum rear weight potential and also for balancing of the Cubmobile.

A heavier or larger driver, would have a tendency to create more forward weight. Meaning, that the balance of the car would be more forward than center. This set up would help reduce or eliminate that problem.

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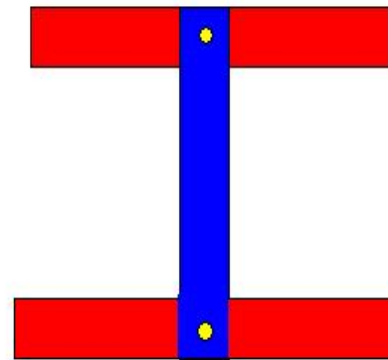
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### Frame Drilling:

With your boards marked, you are now ready to drill the holes in the wood.

I prefer a 1/2" diameter bolt for connecting the front and rear cross members. However, a 3/8" or 5/16" dia. bolt works too.

It is important to know your bolt diameter before drilling your holes in the wood.

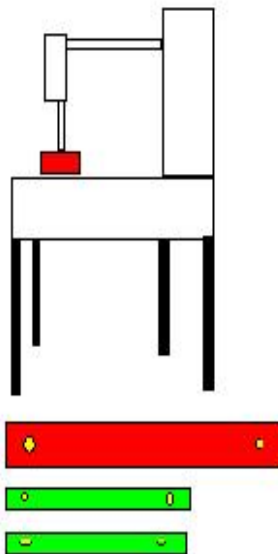


The drilling of the holes is a very critical stage.

The holes need to be drilled level and straight up and down (plumb), or this can cause alignment issues and you may not be able to true up your car.

I recommend the use of a drill press to make sure the holes are drilled straight and true.

If you do not know anyone who has a drill press, try your best to not tip the drill at an angle as you drill through the wood.



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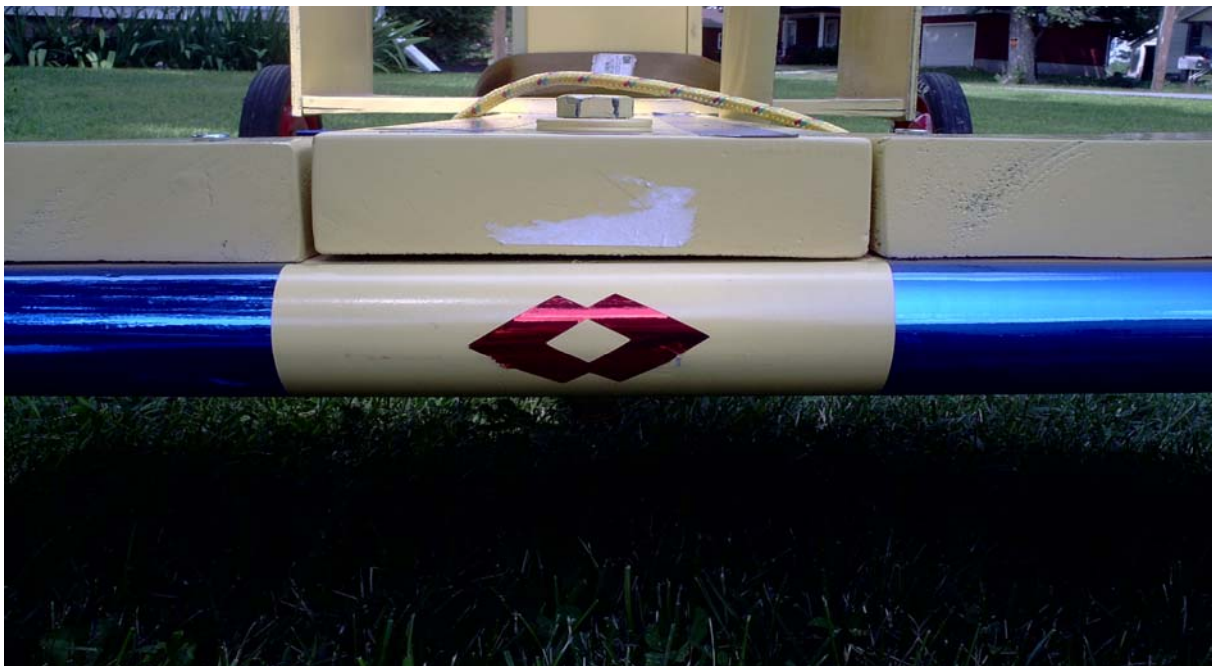
### **Added Lip:**

I used a piece of a hand rail and I glued it onto the front of the front cross member.

Aside from adding a little more aero dynamics to the front of the Cubmobile. The main reason I did this was to have the Cubmobile a little farther up the ramp.

Now are rules only allowed for a 52 inch long car. But I had accidentally went over that length, when I added the Lip to the front of the cross member. It added a extra 1 inch and 1/4 to the length.

So if you are going to add a lip to the front of the Cubmobile. Keep that in mind during the build process, so you don't exceed your maximum allowed length.





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## How To Build a Cubmobile

### Frame Alignment:

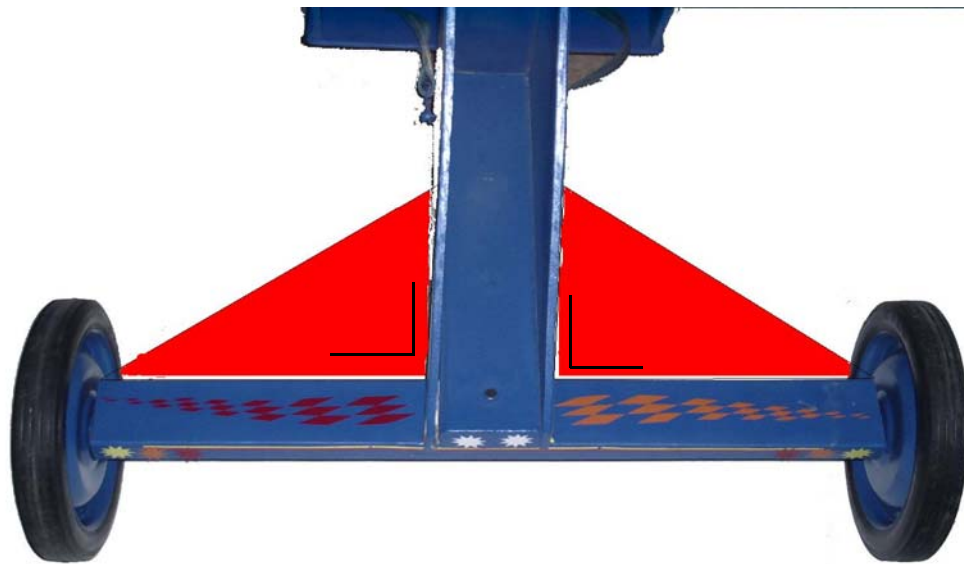
The photo below, shown in red is where the frame to cross member connection should be at a right angle or 90 degrees.

If not, you should un tighten the cross member center bolt to adjust it to perpendicular and then re tighten.

Once the proper alignment has been achieved, I recommend you use epoxy glue between the frame and cross member to keep the alignment in place.

Glue only after you have checked for cross bind, discussed further on in this manual.

Pine lumber is soft and after a few runs down the track the bolts need to be checked and re-tightened, if loose. Vibration may loosen the bolts too so check to see they are snug.



# *CubMobile*

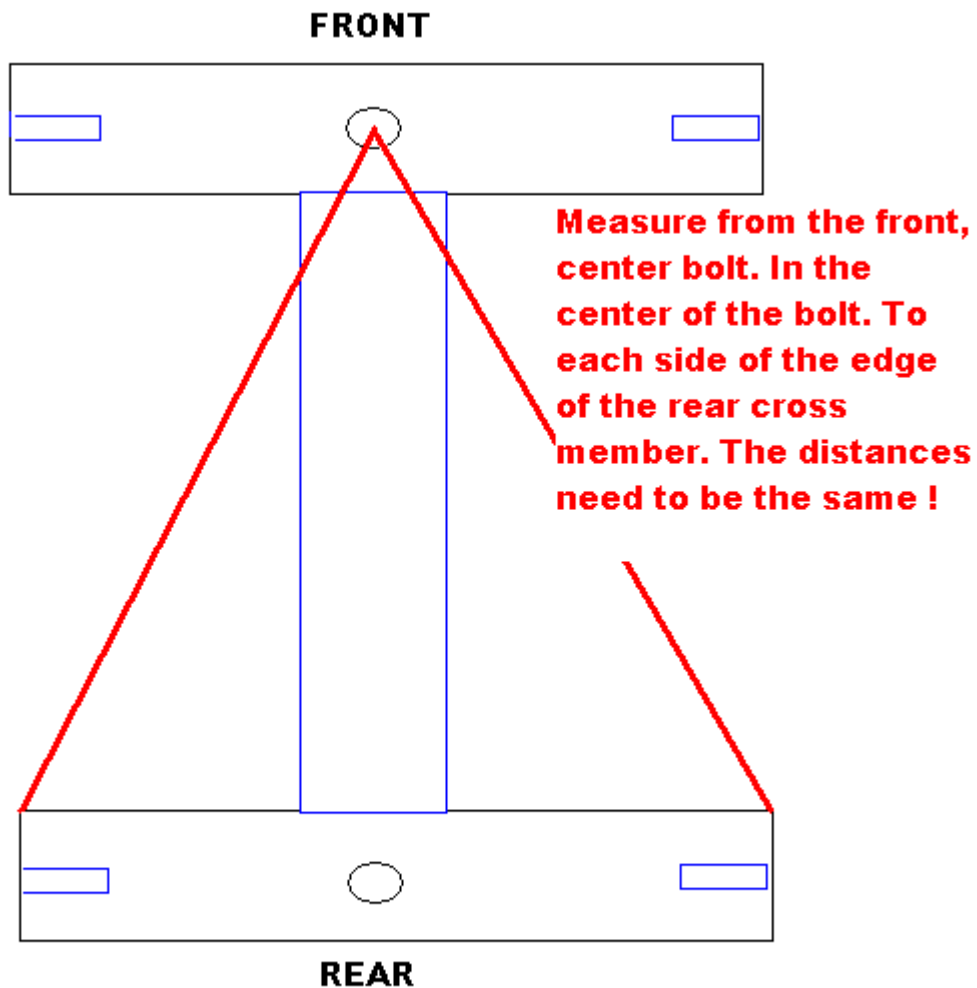
## How To Build a Cubmobile

### Frame Alignment, Part Two:

If you're wholes that were drilled into the wood, for the bolt connecting the frame and cross member were not dead on. Then it will be very likely you will find your alignment to be off.

1st, check and see if you can adjust the alignment with the rear. By loosening and adjusting rear cross member to get alignment. If not, you may have to use another piece of wood and re-drill.

However, determining which piece of wood is off, will take double checking your cuts and drilled wholes.



# *CubMobile*

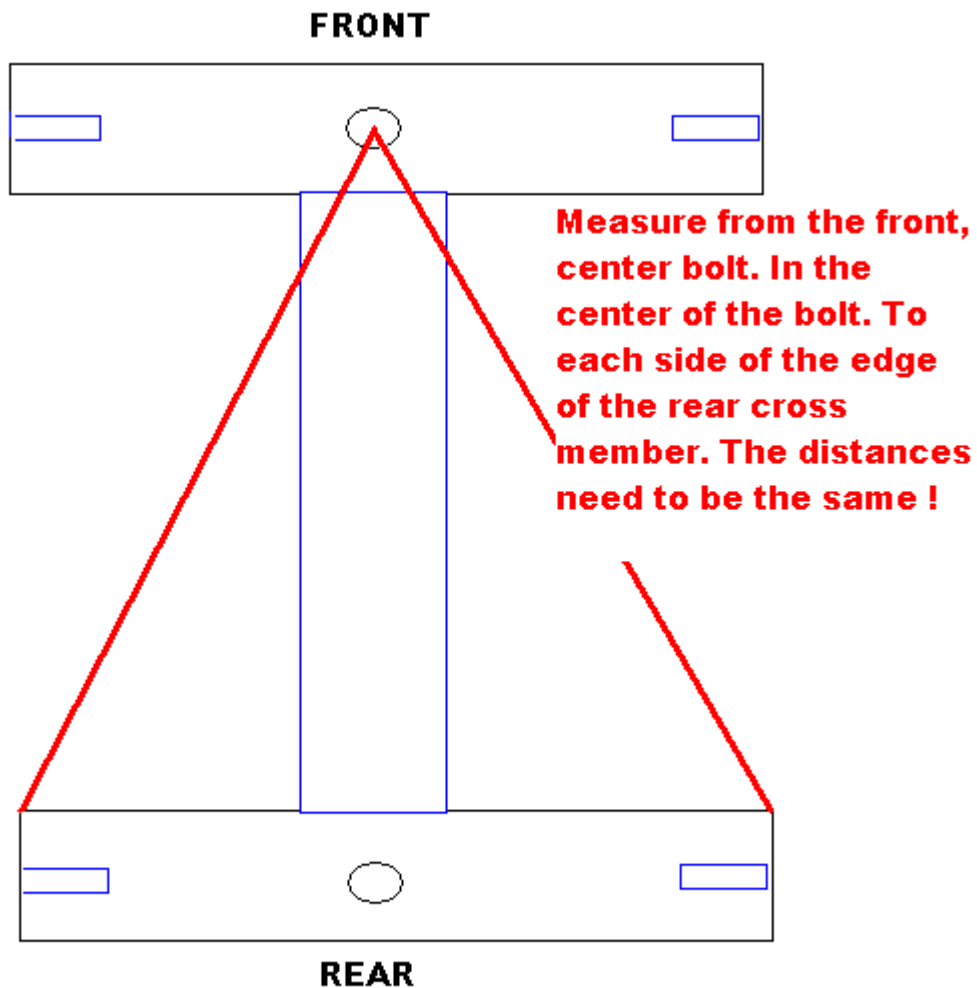
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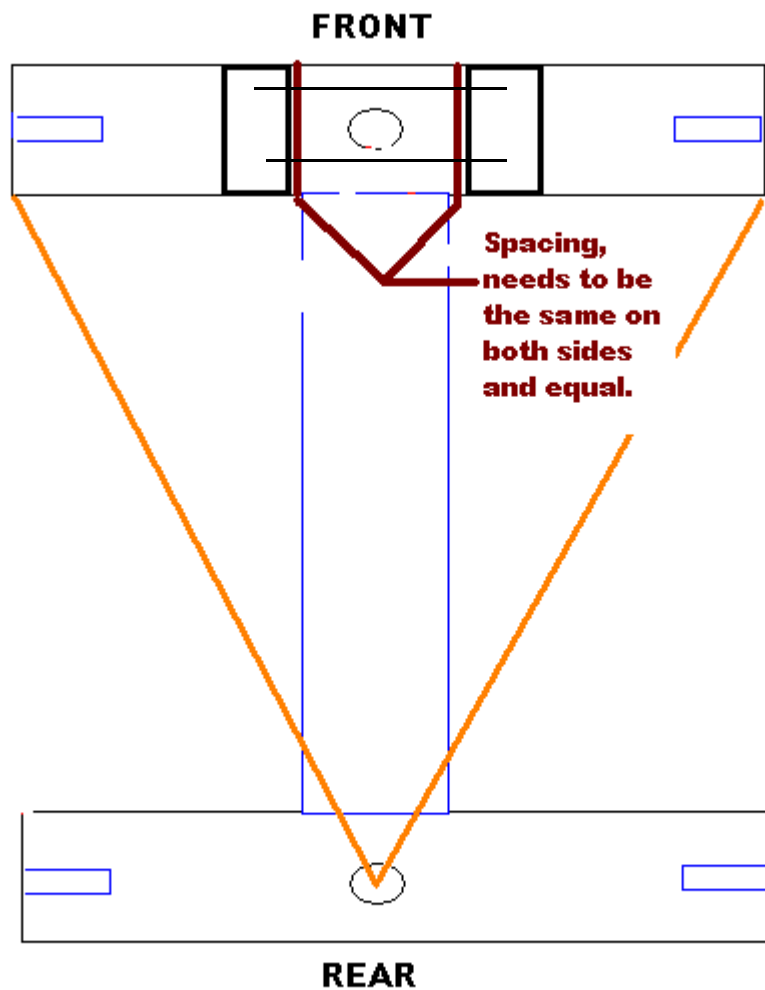
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### Frame Alignment, Part Three:

When you are measuring the front. Keep in mind that the spacing between the foot blocks need to be the same and equal.

This alignment is harder to do and check. Due to the front cross member also being the steering. This is where I like to mark on the foot blocks and top of bolt. A sticker or painted line to show the driver, how to keep the Cubmobile strait and aligned while driving. Also for when placing on the ramp.





# *CubMobile*

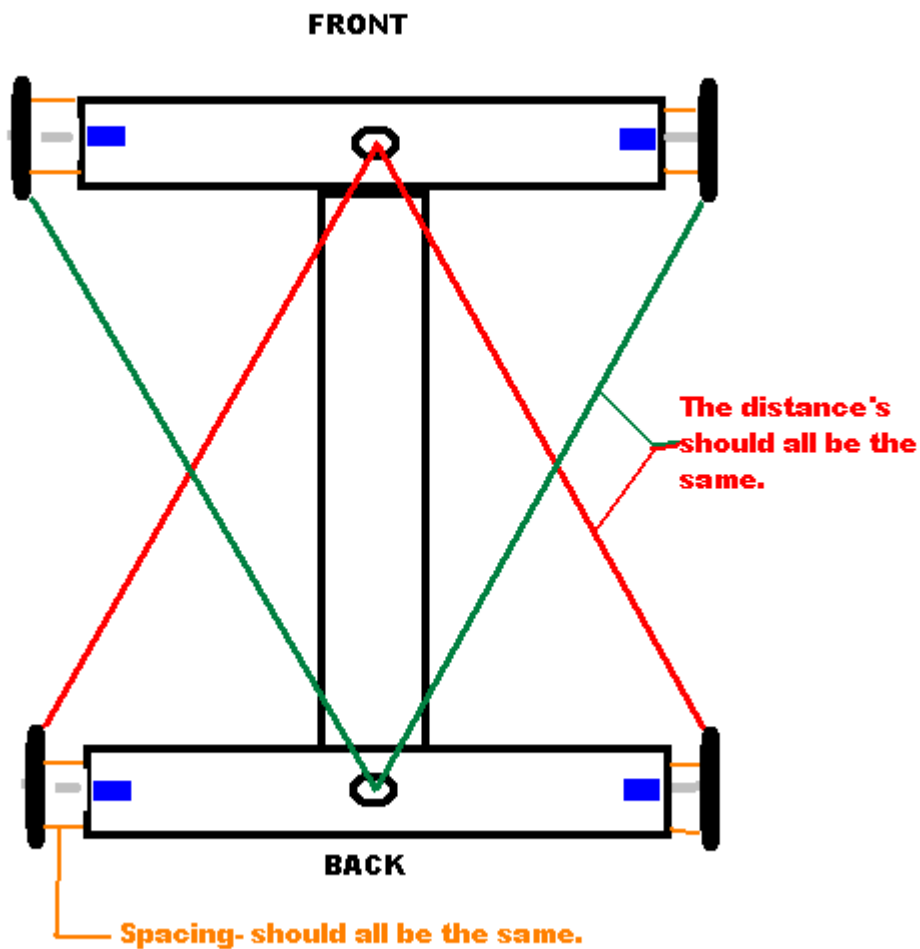
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### Frame Alignment, Part Four:

Washers work well to correct this alignment, shown below.

Either by adding them or removing them to get equal spacing.

This also will tell you, if you have tow in or tow out on your wheels.



# CubMobile

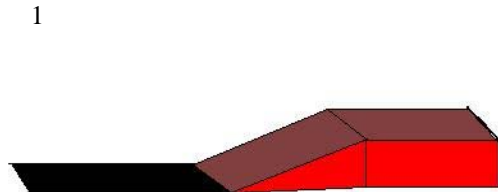
## How To Build a Cubmobile

### Types of Ramps for Races

Note: The type of track you will race on will determine how you construct and determine the balance point of your Cubmobile.

Some of the different types of race tracks used are shown here.

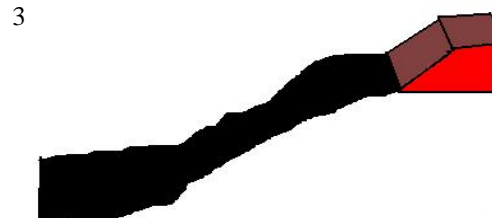
**Figure 1**– In this image, you see the ramp and that leads to a flat surface. This is the most commonly found types of race track.



**Figure 2**– This track has a ramp that transitions into a slightly sloped surface. This type of track provides the Cubmobile with continuous and gradual momentum.



**Figure 3**– This ramp is on a hill. There is a lot of slope and good momentum is achieved. This type of race track usually provides enough energy to the Cubmobile to allow it to travel to the end of the track. However, the faster rate of speed makes it more difficult to steer.



**Figure 4**–This is a flat surface with no ramp and is used for a push/pull race where two people are involved. One is the driver and the other is the pusher. With this type of race track the results depend on how fast and how far the pusher can go. The driver must be able to control any jerkiness if the push is not of consistent force during the race.



# CubMobile

## How To Build a Cubmobile

### Balance Point Locations for Ramp Types

#### Cubmobile Set Up

**Figure 1–** You will want to have the center of gravity 15 to 18 inches from the rear of the car.

The best way to try and balance a Cubmobile is through placement of the seat and driver.

It is not allowed to add weight. However, thicker wood in certain places can better optimize the balance of the car.

**Figure 2–** With this type of race balance the Cubmobile to be more towards the center. However not in the dead center !

I recommend trying to achieve 18 inches from the rear of the Cubmobile for the balance point.

**Figure 3 -** Placing the balance point as far back as possible is going to give you the maximum potential for top speed on this ramp setup.

Try to get the balance point to be 12 to 15 inches from the rear of the car. Without adding weight and a driver having some very long legs.

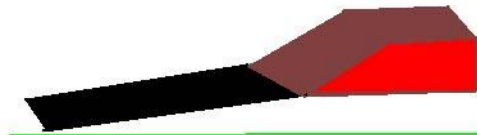
The best chance to try and achieve this would be using thicker and heavier Seat Supports. Also having the maximum height of the Cubmobile. As the rules will allow for.

**Figure 4–** With a all flat surface. The balance point is best placed in the center of the Cubmobile. It is also the most easiest balance point to achieve.

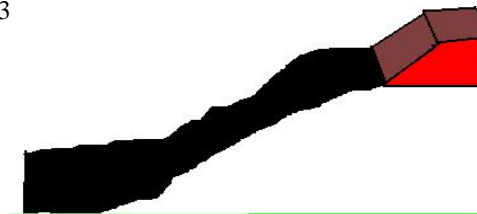
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# *CubMobile*

## How To Build a Cubmobile

### Cross Bind

Cross Binding, is a large factor in racing.

On a flat and level surface, which is hard to find. Is needed to determine if the Cubmobile has cross bind in it.

What is Cross Binding ?

Cross binding, is when there is more weight on one or more wheels than the other wheel or wheels.

This creates more rolling resistance on the wheel or wheels that have more weight (pressure) on them.

The Vehicles weight is not evenly distributed !

If there is more pressure (weight) on one or more wheels. Then this will reduce the speed of the Cubmobile !

The 2nd picture, shows arrows to the right rear and front left rear.

If those two wheels have more weight on them, than the rest of the wheels. These two wheels have more load on them.

They are carrying more load than the other two wheels and have to work harder than the other wheels to maintain momentum.

In doing so, they reduce the Cubmobiles, potential energy and speed.

The Cubmobile will go slower ! It will not be as fast as a Cubmobile that does not have cross bind.





# CubMobile

## How To Build a Cubmobile

### Cross Bind, Part Two

A way to check for cross binding.

Taking a scale, is the best way to check for cross bind.

The surface, again needs to be flat and level. Also the driver needs to be in the car. The driver needs to have his helmet on and also should be sitting in his driving position.

(driver movement and placement will also effect cross bind).

You really need (four) scales to check for cross bind. It's pretty hard to try and check for cross bind with just one scale.

The 1st picture to your right, gives you a example of what you might read on your scale with cross binding.

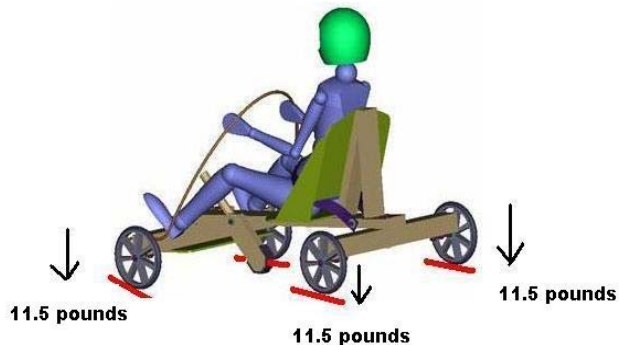
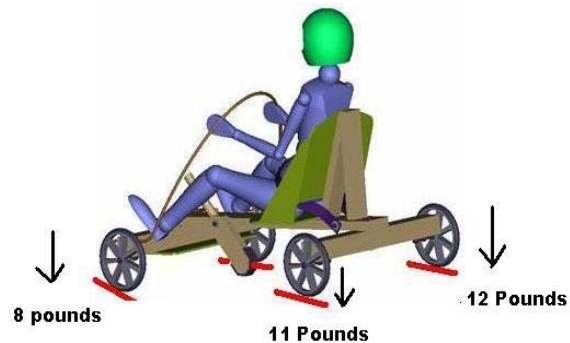
In that illustration, the right rear wheel would be caring the heavier and greater load of the Cubmobile.

The added weight and pressure to that wheel, would reduce the speed of the Cubmobile and slow the Cubmobile's overall performance.

Bottom, right picture.

Gives a example of a Cubmobile, not in cross bind.

The weight is distributed evenly on all four wheels.



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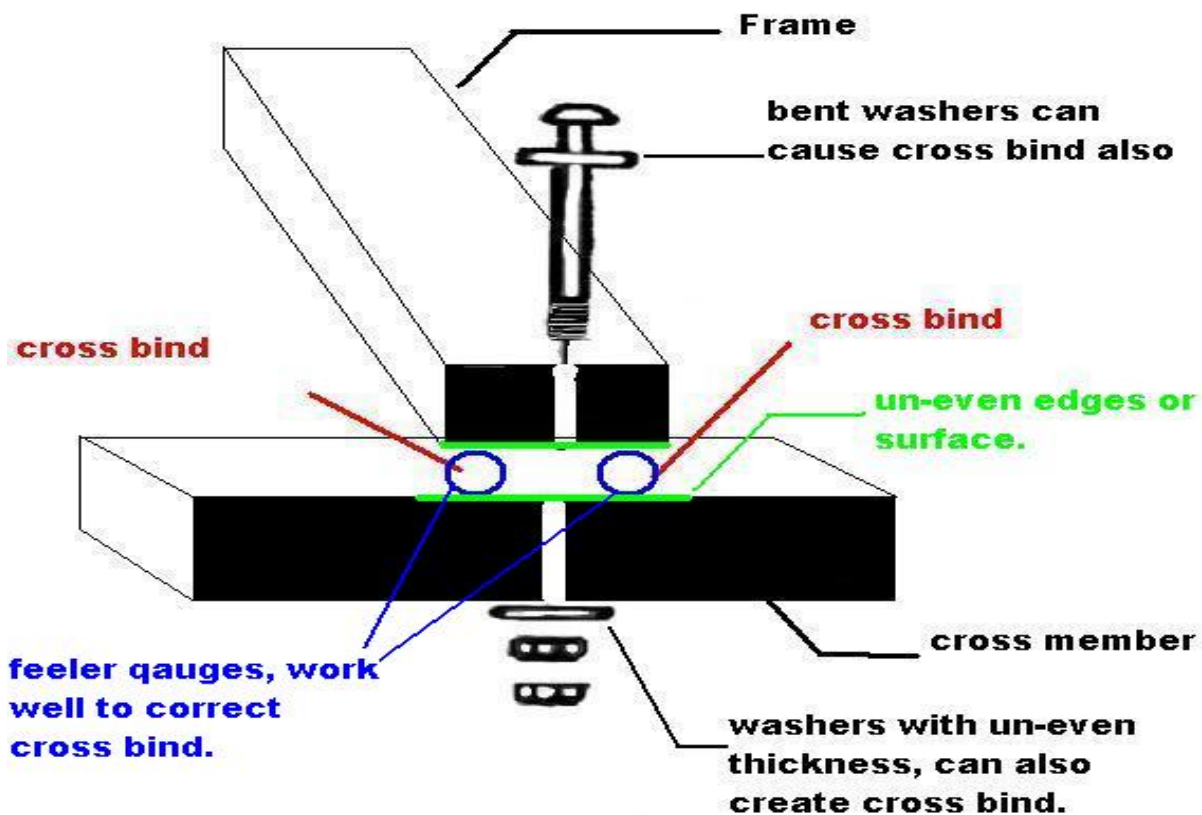
### Cross Bind, Part Three

One of the ways to reduce or eliminate cross bind, is to use a feeler gauge.

Just the like one pictured to your right. This feeler gauge, has a variety of sizes and it is found at most local hardware stores.

It comes apart easy, to find the one you need . You leave the feeler gauge you need between the frame and cross member.

It will take several tries, to find the right size you will need.



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### Cross Bind, Part Four

With a Cubmobile, there are other areas that can cause cross bind !

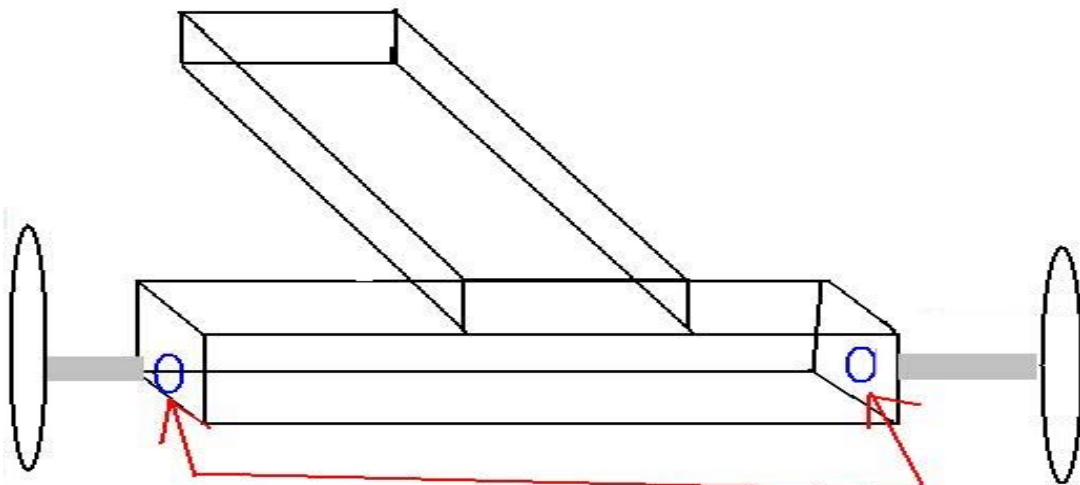
Cross bind, can also be created or caused by poor mounting of the axle's !

Mounting the axles in the wood, is one of them. Even with good drilling and measurement. The wood is soft and can create cross bind. Dropping the car, loading and unloading, running into something with the Cubmobile. Will cause the angle or alignment to become off also.

When this happens, cross bind will also occur too !

There is a lot of factors that can create cross bind and how other areas of the Cubmobile can affect this. (see picture below)

It is something to keep in mind, when you are looking to eliminate and prevent cross bind. Also to keep in mind, while building the Cubmobile.



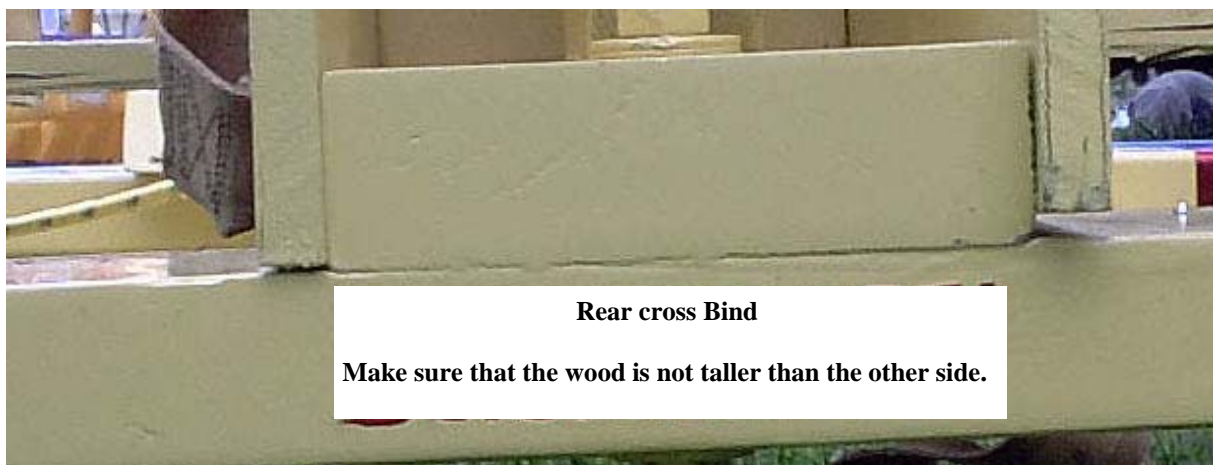
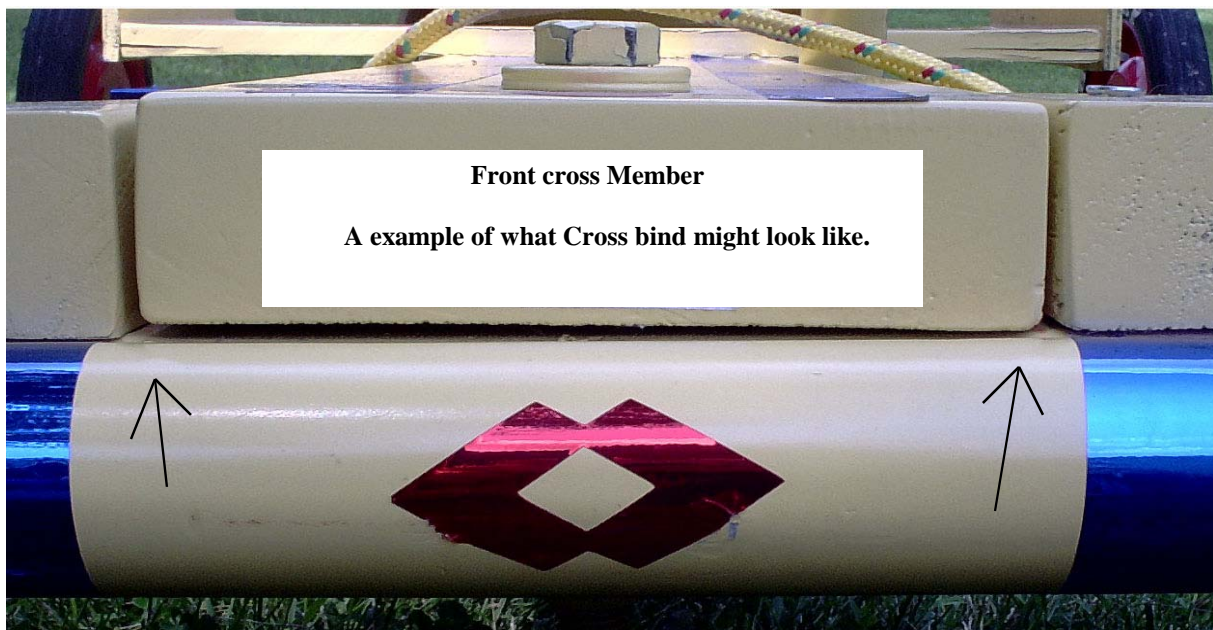
**Cross Bind -**

**By not having the axle wholes or mounting the same (equal) on both sides. Or different from the front and rear mounting !**

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### Cross Bind, Part Four

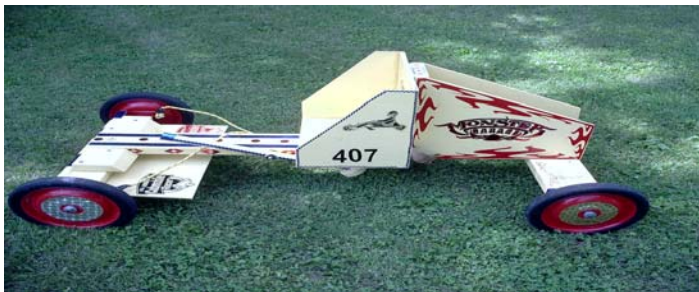




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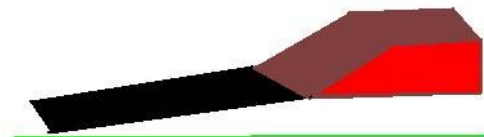
### Examples of Balance Points for Ramp Types



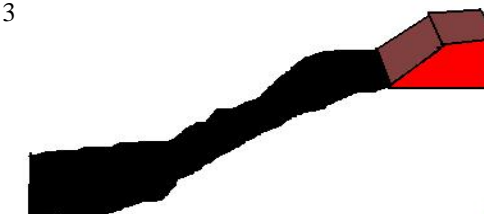
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### Wheel Examples:

#### Wheels

There are a few common wheels that many Cubmobiler's use.

The most common wheel is the Blain's Farm N Fleet Wheel. The typical diameter is either 10 inches or 12 inches. I prefer the 12 inch wheels.

In the photo at right, the wheel on the left, the widest, is a 12 inch Blain's Farm N Fleet wheel.

The yellow wheel in the middle, it is a 12 inch Steel rimmed Soap Box Derby Wheel !

At the far right is a 10 inch plastic-rimmed wheel from a wheel chair, made by Comtech.

The middle and bottom photos are of 8 inch wheel chair wheels, taken off of wheel chairs.

#### Approximate Wheel Prices:

Blain's Farm N Fleet 12 inch wheel: \$12.00 each.

12 inch Soap Box Derby Wheel, 1960's. (Found a set of 4 used off of e-bay)

10 inch Comtech Wheels: \$5.00 each from Comtech.

The other two 8 inch wheels I found for free at a local wheel chair store.



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### Wheel Examples:



<http://www.shepherdhardware.com/Pages/Catalog/miscind.html> part # 9584



Blain's Farm N Fleet  
Bearing not shown in picture



[http://www.gleasonwheels.com/semi\\_narhubwh.html](http://www.gleasonwheels.com/semi_narhubwh.html)



[http://www.gleasonwheels.com/semi\\_smooth.html](http://www.gleasonwheels.com/semi_smooth.html)



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### Wheel Examples III:



[www.comtech2000.com](http://www.comtech2000.com)



[http://www.gleasonwheels.com/semi\\_narhubwh.html](http://www.gleasonwheels.com/semi_narhubwh.html)

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### 60's Soap Box Derby Wheel

#### Soap Box Derby Wheel

In the picture to your right. The middle yellow colored wheel Soap Box Derby Wheel. This 12 inch wheel is thinner and takes a 1/2 inch axle bolt. The rim is made of steel.

This wheel is the perfect wheel to use for your Cubmobile.

It is a very narrow wheel, providing little contact surface to the ground.

Less contact surface, means less friction.

This is a 1960's era wheel which I purchased used in a set of 4 from e-bay.

The wheel has a good bearing. They are pressed in and do not come out easily. Do not try to remove them.

I soaked the bearings in brake cleaner and used a can of compressed air to clean the bearings.

I then used WD-40 to lubricate them.

I sanded, primed, and finished painting the wheels.

#### Caution

Brake cleaner and many sprays will dissolve the paint off the wheel or ruin your paint job. Be careful when using any corrosive and/or flammable chemicals—like brake cleaner.



# *CubMobile*

## How To Build a Cubmobile

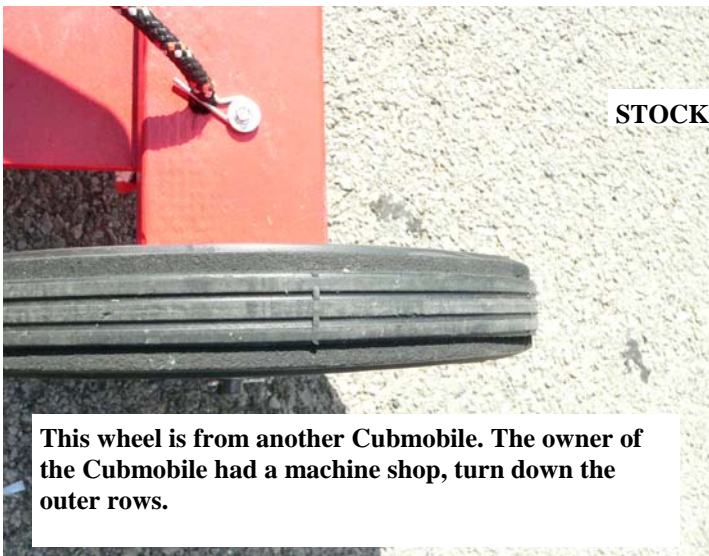
### Wheel Edges:

Using a palm sander and some time. You can round the edges off the stock wheels.

60 grit sand paper seems to work pretty good. Plan on spending about 15 to 20 minutes on each wheel.

The less tread touching the surface of the ground, will help reduce the loss of speed through the surface friction of the wheel.

Always check and make sure your race rules permit this.



# *CubMobile*

## How To Build a Cubmobile

### Stock Bearing from Farm & Fleet Wheel:

In the photos at right, shown are the stock sealed bearing assembly that comes in the Blains Farms & Fleet 12 inch wheel.

The bearing is a industrial grade bearing and has quite a bit of play between the inner race and outer races.

The bearing unit itself does not dissemble !

You can remove the bearing assembly to clean them or to install the Boca Bearings.

Using a thin tipped flat bladed screw driver slowly and carefully pry up the lip of the outer race, working the bearing up and out of the wheel bore..

Or you can, buy going inside the inner diameter of the bearing with a small tipped screw driver. You can tap out the bearing on the opposite side of the wheel.

I recommend a piece of wood with a whole larger and deeper than the size of the bearing.

Place it under the wheel and the whole over the bearing that you will be removing.

I have bought 16 brand new wheels, with this type of bearing in them.

More than 1/2 of the wheels, had bad or damaged bearings in them.



# CubMobile

## How To Build a Cubmobile

### Good Wheel Bearing:

There is some good news. I spent some time calling and contacting many bearing companies and found a great firm. [www.bocabearing.com](http://www.bocabearing.com)

They sell a bearing that is much better and will greatly improve your speed .

The part number is —FR8-ZZ and sells for \$11.99 each. Note: You will need two of these per wheel.

The bearings come with a cover that is easily removed by popping it off. This will further reduce the rolling friction on the bearing.

It does not have a protruding inner race, that means you will have to use a washer or use a piece of tubing so the washers or axle bolt do not cause pressure on the bearings or outer race. If there is contact it will create drag and slow the performance of the bearing.

Any roller bearings that are used, either stock or after-market, should be soaked in brake cleaner to remove all of the grease. Then lubricate with a very light oil or WD-40, or PBR .

Doing this will prevent rusting of the bearing !

You want the wheels to free spin for at least 3 minutes.

The more free spin-the less drag, and the less drag the faster and the longer the wheels will rotate. (Free spin means to spin them by hand without the wheel tread contacting anything.)

The more precision the bearing, the less wobble to the wheel. Less wobble means less loss of speed !



# *CubMobile*

## How To Build a Cubmobile

### **Frame Assembly:**

Now that you have drilled your holes and checked to make sure the bolts fit and go through straight and vertical.

I recommend, at this time, you not assemble or tighten the bolts.

You will want to mark and pre drill the axle mounting holes—if you are not using the basic method of lag bolting the wheels into the end of the crossmembers.

There are a few ways to mount the axles. Let's look at three options available.

1. Use four wood blocks—one for each axle— and lag bolt the wheels to them.
2. Use electrical tubing mounting clamps (that have rubber on the clamps). See axle mounting sheet.
3. Use a machined aluminum block. You will need four of these. This is the most costly option, however, it will ensure you have a straight hole for the axles. It will also help in aligning the Block to the wood easier and decrease the chance of being off some with straightness and angle of the wheels.

Please keep in mind that any poor alignment or having an angle will cause more drag on the wheels.

### **These factors are what slow your Cubmobile down !**

If a wheel is not level on the ground with the others or is slightly tilted, it will cause un-even pressure on the bearing of that wheel or wheels. This friction and drag will greatly reduce the speed of the Cubmobile and the distance and speed that it will roll.



# *CubMobile*

## How To Build a Cubmobile

### Axle Mounting with Clamps:

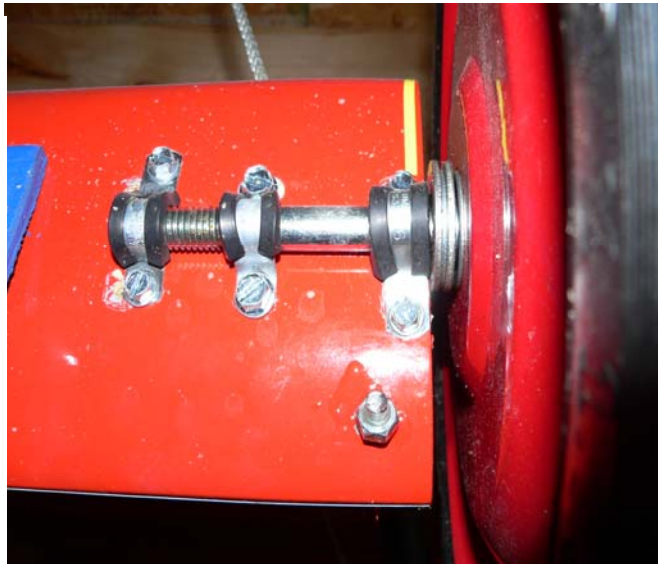
#### The Clamp Method with Conduit Clamps

At the right you is a picture of a wheel already clamped.

If you have not already marked the center of the board, measure the width of the board and divide by two. This determines the center.

Double check the other side, repeating the same process. This is to double check that your 1/2 way mark comes out the same.

Take a ruler and line up with the center mark you have made. Then draw a line approximately five inches long.



The clamps are not an exact fit as they are not perfectly shaped to fit the bolt. Therefore, you will need to do some adjusting of the clamps to get them suited for mounting the axle bolt.

This is a great time to have your little helper help hold the center of the axle bolt in place.

You will need the wheel and two or three washers as shown in the photo. Keep the bolt in the center and on center of the line you have drawn onto the wood.

Now place the 3 clamps as seen in the picture. You likely will have to do this process a few times until you get the tabs bent around the clamps just right—so that they lay flat on the surface of the wood.

Once you have gotten the clamps on and everything adjusted. You now want to take a black marker and mark the holes onto the wood. You will do this for each end that a axle / wheel will be mounted.

Now, you will pre-drill the holes. I recommend using sheet metal screws. Determine your screw length and diameter before pre-drilling the holes.

**Do not assemble at this time !**



# *CubMobile*

## How To Build a Cubmobile

### Machined Axle Bracket:

#### **Option 3 for mounting your axles**

At the top right are 4 machined aluminum axle mounting brackets shown in different positions. Each has a precision drilled hole for the axle and counter bored mounting holes.

At middle right is the mounting bracket with axle—an upside down T.

The dimensions of these axle mounting brackets are:

Length: 3 inches

Width: 1 3/4 inches

Height: 1 inch overall

Bottom plate thickness: 1/4 or 3/8 inch

The holes are:

Axle: 1/2 inch precision drilled

Mounting holes: 1/4" diameter.

The aluminum block is 1" wide by 3/4" tall.



This is the most expensive way to add axle mounts but may be the best way to gain accuracy and precision. It makes alignment much easier ! You may need a machine shop to fabricate them for you, if you did not know someone who can make them.

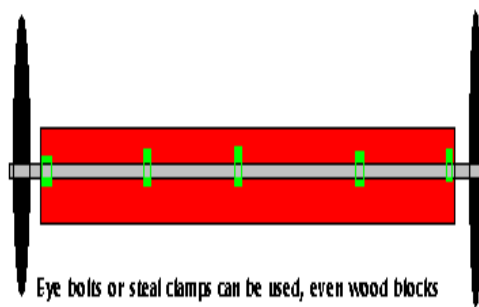
# CubMobile

## How To Build a Cubmobile

Axle rod:

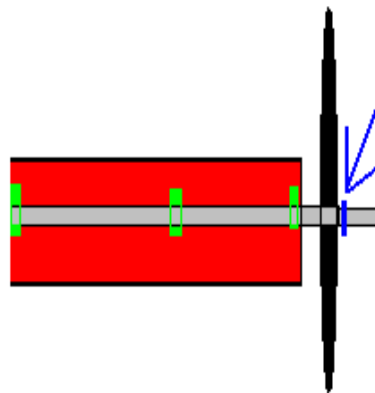


Steel Rod Used for axle



Eye bolts or steel clamps can be used, even wood blocks drilled out.

You will though have to drill or thread the rod ends to mount the wheels.



Will need drilled to mount wheel.

1- you will have to make sure that the axle is long enough

2 - make sure 3 washers before wheel & 2 washers after the wheel.

3- mark where it is needed drilled.

4- Pay close attention, not to tight and not to loose.

5-place in vise and use drill press to drill out whole.

6- Make sure you drill strait up and down.

# *CubMobile*

## How To Build a Cubmobile

### Axle Mount Placement:

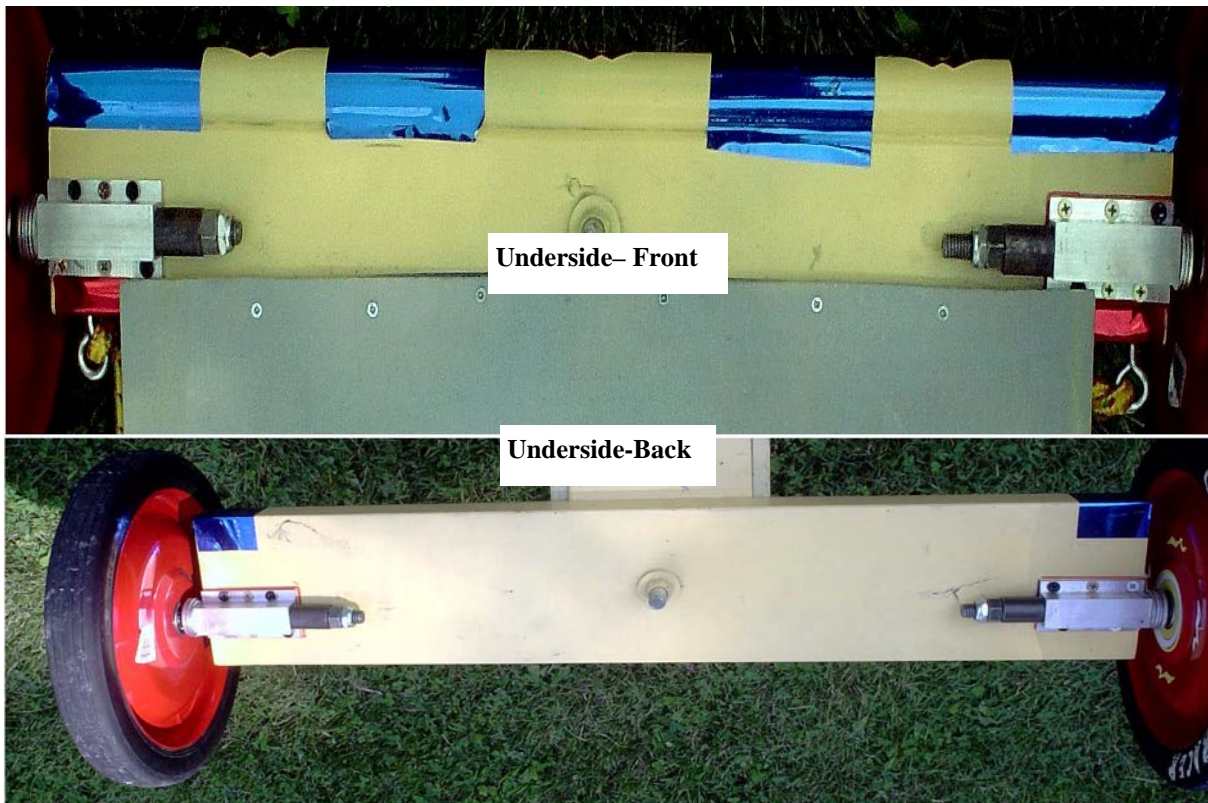
The axle mounts were not placed on the center of the underside of the wood cross members.

Our rules only allowed 48 inches from front to back. (From front axle bolt to rear axle bolt)

Placing the axle mounts as farther back on the under side of the cross members. Allows the cubmobile to be placed up farther on the ramp. In doing so, gives you more angle of decent off the ramp. If the other Opponents Cubmobile did not do this. Then your Cubmobile will have a slight advantage over him.

The pictures shown below, show this. However my placement from center was not very much. They were placed a 1/2 back from the center of the cross member.

If you decide to place them even farther back on the cross member. Keep in mind that the balance of the car is effected by this. So this step is not one that you would want to do after you have already balanced the Cubmobile.



# *CubMobile*

## How To Build a Cubmobile

### Axle Mount Placement, part Two:

Shown below, is a fine example of another builders Cubmobile.

The recessed design, allows for the Cubmobile to be lower to the ground. Lower to the ground, reduces wind drag and also helps maximize the weight of the Cubmobile to be lower to the ground.

1/2 inch axle rod was placed inside then covered with a piece of steel. It was recessed so that the underside of the cross member was flush and smooth.

This was done also to reduce wind drag (resistance) on the under side of the Cubmobile. A lot of time and hard work went into these cross members., To achieve really good aero dynamic's !

Make sure you check your rules, a lot of the Cubmobile races do not allow for adding extra steel to the Cubmobile.





# *CubMobile*

## How To Build a Cubmobile

### **The ramp:**



Above, is a picture of a Cubmobile ramp. All though there are different kinds of ramps. The one pictured above is a typical ramp that is used.

# *CubMobile*

## How To Build a Cubmobile

### Tips for the ramp:

The front cross member touches the back edge of the gate.

The gate holds the car in place, until the lever is pulled to release the cubmobile.

It is important to have the center of the cross member lined in the center of the gate.

This helps to ensure, the car is centered and also to give the racer a better chance of coming off the ramp strait.

Also, check to make sure the rear wheels are aligned with the front. So the rear is also strait and not angled to one side or the other.



# *CubMobile*

## How To Build a Cubmobile

### **The slight advantage:**

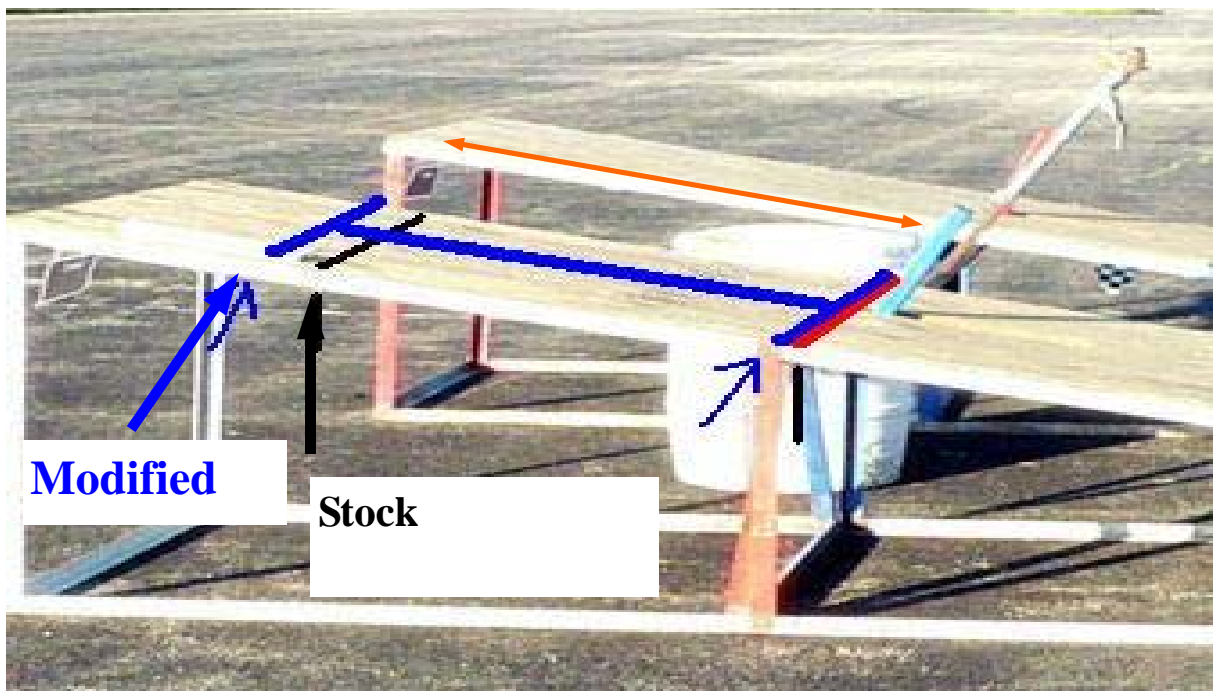
Now, as I mentioned previously. You can gain a slight advantage if the wheels are a tad farther back on the ramp.

This is possible, due to the ramp angling down. So the farther the wheels are up the ramp. The more angle you have.

Now with your rules, you most likely have a set length the Cubmobile can be.

But where you place the mounting brackets for the wheels on the cross members, can help you place the wheels a tad farther back on the ramp. If the other racer has not done this. Then it will give you that slight advantage.

Adding a lip or edge to the front of the Cubmobile and keeping that in mind when you are cutting the frame. So you don't go over your maximum allowed length. The front cross member will then be slightly farther back. This add that into when mounting the axles as far back as you can on the cross members. Giving you a little more advantage





# *CubMobile*

## How To Build a Cubmobile

### Wheel Alignment:

With the Cubmobile sitting on a flat level surface;

Measure from one wheel to the other with a tape measure . The top measurement should be the same as the bottom measurement.

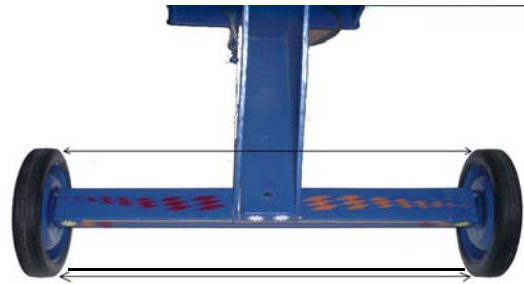
Once the wheels are installed properly, there should be very little play or side to side movement.

In the photo at right notice the small red arrows at the gap between the end of the cross member and the wheel rim. This gap between the edge of the wood to the wheel rim should be the same, assuming you have cut the end of the cross member at a proper right angle.

If the distance is not the same, the easiest way to correct, is to add or remove washers and/or move the axle bolt inward or outward.

A good way the check to make sure that the wheel is not cambered is to use a level and check to see if the wheel is straight up and down.

Again, make sure that you are on a flat and level surface.



# *CubMobile*

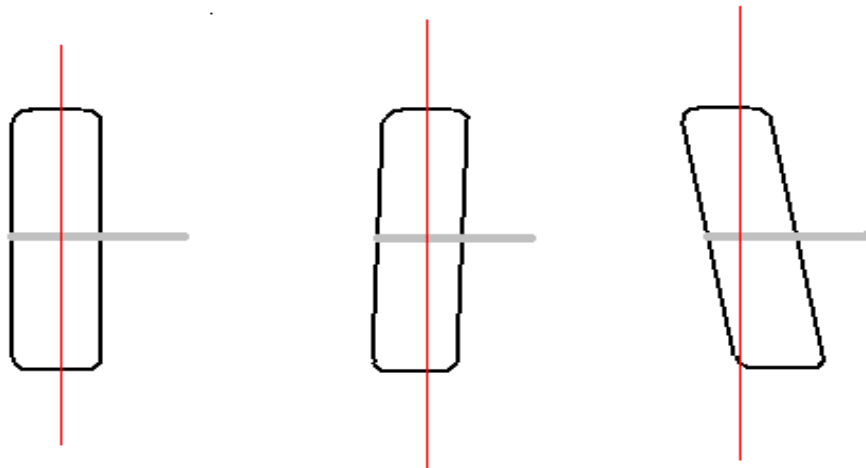
## How To Build a Cubmobile

Wheel Alignment, Part Two:

### **SIDE VIEW WHEEL CAMBER**

**Camber In**

**Camber Out**



# *CubMobile*

## How To Build a Cubmobile

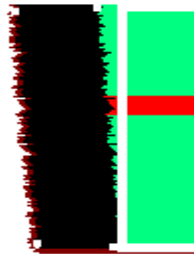
Wheel Alignment, Part Three:

**TOP VIEW  
TOW IN / TOW OUT**

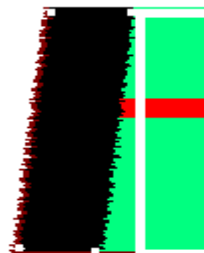
**TOP VIEW OF TIRE**



**STRAIT (NO TOW IN OR OUT)**



**TOW OUT**



**TOW IN**

# *CubMobile*

## How To Build a Cubmobile

### Seatback Location:

Once you have completed the pre-drilling for the axle mounting;

NOTE : Please first read the sheets on Ramp Types and how they set the balance point of the Cubmobile.

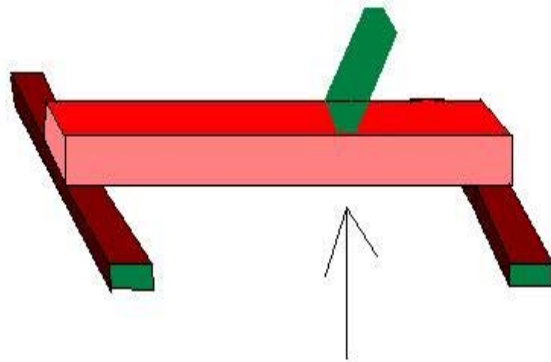
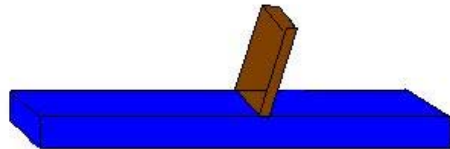
Typically, you want the balance point of the car to be as rear as possible - yet allow the driver to have a good ability to steer the Cubmobile and have good foot placement.

The seat back should tilt around 10 to 12 degrees towards the rear of the Cubmobile. Typically try placing the seat back about 15 to 18 inches forward of the back of the frame.

The bottom edge of the seatback will be angled at the same angle as the tilt of the board. If that angle is not cut into the wood, it will be harder to mount the seat back.

Use a ruler and tape measure to mark the angle you wish to have and then cut the board edge to this. It will help to trace the outline of the seat edge onto the frame at the desired location.

Draw lines on the side of the frame so when you flip the wood you will be able to see the placement of the seatback. This helps in pre-drilling the holes. You pre-drill the frame but NOT the seat back !



# *CubMobile*

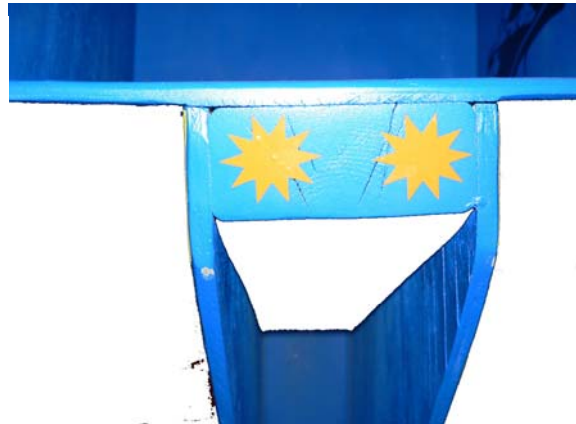
## How To Build a Cubmobile

### Seatback Location Continued

Make sure that the holes that you pre-drill are slightly smaller than the wood screws you will be using.

I recommend using 1/4 inch diameter screws and wood glue on the bottom edge of the seat back ann frame.

At this time, **Do not assemble the seat back** as the wood still needs to be sanded and painted !



Above are a few more photos.

The one above shows you the angle of the seat back and the photo at left shows the back of the seat and back.

# *CubMobile*

## How To Build a Cubmobile

### Seat Sides:

Measure the width of the driver and add a couple of inches.

You can build a seat out of 1/4 or 1/2 inch thick plywood or a high quality board—which will require less sanding.

You have flexibility here to make a more personal shape or contour.

At right in gray primer is a seat that has more flare to it and the blue seat has less shape and very little flare to it.

The back of the seat solid or have an open space.

I recommend you make a template out of large art paper and then tracing and cutting out the shape of the seat and using it as a template.

3/4 inch long wood screws and wood glue are recommended for constructing your seat.

You want your seat to be stiff and rigid !

Spacing the screws every 1 inch will provide a sound and sturdy seat.



#### Note:

Before final assembly make sure you have the proper fit and alignment of the seat with the seatback angle. The bottom of the seat and the seat back should be flush with the surface of the seat back.



# *CubMobile*

## How To Build a Cubmobile

### Seat Support Types:



Top Left —Seat flush to seat back.



Top Right —Support.

### Seat support types:

In the two right pictures are two different shaped supports.

Due to the angle of the seat back. I recommend making a template out of art paper or poster board before doing any cutting or marking on your wood—especially if you plan on adding some flare to the shape of the wood—as seen on the red Cubmobile.



Bottom Right —Seat Support.



# *CubMobile*

## How To Build a Cubmobile

### Seat Belt Attachment:

You should be able to get a automobile seat belt from a junk yard for around \$10 to \$15.00

In the photos at right are shown two different ways to mount the bolting for the seat belt.

**Top Photo** – Eye bolts were used to mount the seat belt ends.

**Bottom Photo**– A lag bolt was used to mount the seat belt bracket.

A seat belt that comes out of truck or center seat of a car works best. Often no cutting is needed to have the seat belt adjust small enough to give the rider the proper fit.

You may, however, end up with extra material which can easily be cut so that it does not drag on the ground.

To keep the ends of a cut off section from fraying, use a lighter to heat the end. Use caution when doing this to prevent burn or injury. Keep in mind that the smoke is toxic and do not breath it.



# CubMobile

## How To Build a Cubmobile

### Steering Rope and Driver Leaning:

**Picture 1** shows the proper angle of the feet and hand location. The driver should lean forward AFTER going off the ramp.

Leaning forward on the flat part of the track can help shift the balance of the Cubmobile more towards the center.

**Picture 2** shows the driver leaning back while he is ON the ramp. He should stay leaning back until the Cubmobile is off the ramp. In doing so, the weight of the rider is shifted somewhat to the rear of the car and maximizes the length of time his weight is on the slope. This will hopefully, provide the optimum speed.

**Picture 3**, below, shows the proper placement of the hands while grasping the rope.

Note: A seat belt is required in most of the Cubmobile races.

**Picture 4** below right, shows how the brake lever affects the riders leg position.

1



2



3



4



# *CubMobile*

## How To Build a Cubmobile

### Steering Rope Attachment

The photos at right two different methods of attaching the steering rope.

The top photo shows a drilled hole through the cross-member with the rope coming up from the bottom. The ends of the rope have large knots.

A 1/4 inch diameter nylon rope was used in a 5/16 inch diameter hole. A segment of a nylon rope purchased from the boat section at the local Wal-mart store was used. The hole was placed 1 inch in from the end and 1 inch from the rear edge of the crossmember.

The rope should be long enough so that the rider can sit back in the seat with the arms bent. Note: See the sheet on Leaning. The drivers arms should not extend fully nor should the driver have to pull the rope all the way back to his chest.

In the lower right photo an eye-hook was used to attach the rope. A 1/4 inch diameter eye-hook was mounted to the top of the cross member with a washer and bolt on the bottom.

The rope must be strong enough to pull the weight of the driver and Cubmobile combined.



# *CubMobile*

## How To Build a Cubmobile

### Steering Limit Blocks:

The steering blocks limit the turning of the Cubmobile, provide a place for the drivers feet, and allow the driver to assist in the steering with his feet by providing a counter force to the pulling on the rope.

The steering blocks should not be farther away than a 1/2 of a inch on either side of the frame. Make certain that the front cross member is completely straight and the frame and cross member make a 90 degree angle on each side of the car.

In the photo at right note the back angle on the steering blocks that allow the driver to have his feet at a more comfortable position.

Black foam has been glued to the face to prevent the driver feet from slipping. (This type of foam can be found at most hardware stores)

Note the sloped floor board at right. This is required by many Cubmobile Race Events to prevent serious injury to the drivers foot in the event his foot slips off the blocks.

In the blue photo at right, are shown white markings on the center of the frame and on the steering blocks that have been added to give the driver a visual assist in maintaining straight steering down the track.





# *CubMobile*

## How To Build a Cubmobile

### Brake Mounts:

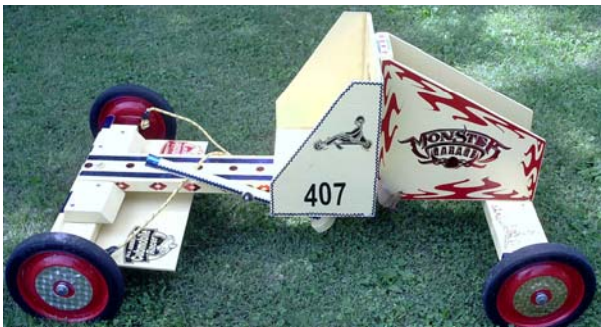
**The photos at right show two different ways to mount the brake lever.**

The brake lever in the red is mounted to the frame with a 1/4" x 6 1/2 " bolt. A rubber washer can be placed on each side of the brake lever to add resistance to keep the lever from falling. During the race if the brake lever were to lower and contact the ground, it would create drag and slow the car. The driver may be too busy concentrating on steering the car that he may not even notice that it is dragging.

The picture of the blue brake lever in the middle photo shows it mounted to a wooded block, that is in turn mounted to the frame.

At the bottom right, note the rubber washer.

The placement of the brake lever should be no further than 3 inches away from the edge of the seat. If it is placed too far forward the driver would have to lean forward to grab it, slowing down his response time and may cause the driver to temporarily loose control of the steering.



# *CubMobile*

## How To Build a Cubmobile

### Brake Pads:

The brake pad can be made by using a piece of old bicycle tire as shown on the Basic Assembly View Sheet.

Other options are to use an old broom handle or a piece of dowel rod. This allows you to use a piece of hard rubber or a hockey puck.

The photos at top and middle right, show a hockey puck mounted to a dowel rod.

Note the dowel rod was cut at an angle so most of the hockey puck contacts the ground.

In the second photo is a view of the bottom of the hockey puck. Notice that a recessed hole was made for the screw to provide maximum contact of the rubber to the track surface.

Use epoxy glue between the bottom of the brake lever and the hockey puck to prevent the hockey puck from coming loose.

The lower right photo shows a block of hard rubber. This was a scrap piece from a local junk yard. Notice that it is mounted to an oak 2x2 board.

The end of a broom handle was doweled into a piece of an oak 2x2 and glued and fastened on securely. This gives the driver a round surface to grab and strengthens the lever. The screw holes in the bottom of the rubber block were also counter sunk before attaching to the wood.

It is important to test the brake for its ease of use, its strength, and to allow the driver to learn the proper pressure required to stop the Cubmobile in time.





# *CubMobile*

## How To Build a Cubmobile

### Preparation for Painting:

**Before this point, your Cubmobile should be pre-cut, pre-drilled and ready for assembly.**

#### **Sanding -**

If you are wanting a nice paint job and a smooth finish, the key is sanding - lots of it !

If you don't have a electric sander or electric palm sander it can still be done by hand—it's just going to take longer.

The difference in the finish between the Blue Cubmobile and the Red Cubmobile, shown in this article was the amount of sanding !

Begin by using a 60 or 80 grit sand paper.— depending on how rough the surface of the wood is.

60 to 80 grit will take off all the rough stuff and start you in the direction of working towards a smooth surface.

You will likely go through 1 to 2 sheets of the 60 or 80 grit sand paper.

I try and get 4 pieces of sand paper out of each sheet.



# *CubMobile*

## How To Build a Cubmobile

### Preparation for Paint Continued

Once you have sanded with the 60 or 80 grit sand paper you are ready to start sanding with 100 grit or 120 grit sand paper. (You can expect to use 2 to 3 sheets.)

I recommend sanding all areas of the wood, front and back, top and bottom.

Once you have sanded with 100 or 120 grit sand paper you want to sand with 200 grit or 220 grit sand paper. (Plan on using 2 to 3 sheets.)

You should start to see a big difference in the appearance of the wood and it should also feel much smoother to your fingertips.

When a piece of sand paper is bad the surface appears worn or small pieces of wood begin to stick to the sand paper.

That's when it is time to replace the sand paper. If you do not, the wood that has filled the sand paper, can scratch the wood and cut into the wood that you are trying to smooth.



# *CubMobile*

## How To Build a Cubmobile

### Prep Continued and Primer

#### Continued Prep

By now the wood should really be looking smooth and feeling smooth. Any dimples or pits can be filled in with wood putty.

Make sure you allow enough time for the wood putty to dry. If you sand too hard on wood putty, you may find yourself re-applying it.

If you would like to have slightly rounded edges use 200 or 220 grit sand paper.

The 200 to 220 sand paper will give you a light edge. If you want a more rounded edge you may have to use 100 to 120 grit sand paper.

You are now near the end of sanding and should start thinking about either a saw horse or a place to lay flat your wood to start painting.

#### Primer Paint

Now is the time to primer the pieces of wood.

Primer is a flat gray paint. I prefer using enamel paint.

If you want a final smooth and shiny surface, this work will help you achieve it.

You should plan on using several spray cans of primer. The first couple of coats will absorb into the wood.

On the Cubmobile at right I used over 8 cans of gray primer.



# *CubMobile*

## How To Build a Cubmobile

### Primer and Wet Sanding:

#### **Primer Paint**

You will want to lay down several light coats of primer. Primer is much more faster drying then your finishing paint. You will be able to paint more coats in a shorter time frame than you will when it comes to your finishing paint.

Also do not worry about runs very much at this point. Primer paint is easily sanded and you will be sanding before you start your finish coats. I typically wait 10 to 20 minutes between coats of primer, depending on paint type and conditions.

I used approximately 2 cans of gray spray primer for each cross member. And 2 1/2 cans of primer on the frame. The seat and side supports took 3 to 4 cans of primer.

Each board should have around 10 to 12 coats of primer. This should build up a nice smooth semi glossy surface. You should not be able to see or feel any imperfections at all.

Because so much paint was put on in a short period of time it will need to dry more, otherwise, pressing with your finger or holding it will indent the paint surface. I feel you should allow the paint to dry for at least 10 to 12 hours but this will vary depending on paint type and conditions.

#### **Wet Sanding**

For those who have not done it before, wet sanding is just what it sounds like—you use wet sand paper.

The sandpaper is usually black in color. Get it wet and keep it wet as you sand the primer painted surface.

You will want to use 400 and 600 grit wet sand paper.

Wet sand paper will clog very easily, so keep a eye on the sand paper surface. If it starts to clog, get a new piece. I typically will use 5 to 6 sheets of wet sand paper on the Cubmobile.

If the paint is not cured completely the sand paper will gum up very fast.



# *CubMobile*

## How To Build a Cubmobile

### Finish Painting:

#### **Wet Sanding Continued**

When wet sanding the gray primer you want to press lightly and use semi fast, smooth strokes. Use a Back and Forth motion or Up and Down. A Side to Side motion is okay, however, try not to sand at an angle and do not in circular motions.

If you sand too much in one area and the wood shows through you will have to re- primer that area. If not, you will be able to see the difference in the final painting process and color.

#### **Paint and finish**

Now that you are done with wet sanding, you need to wipe off all the old residue that was left behind on the wood from wet sanding. A smooth clean towel will do just fine.

I use two clean cloths. The first cloth dampen and wipe all the primered surfaces. Then, go over it with a second clean dry cloth.

Make sure that the surface to be painted is lint free and dust free. Since you are painting a piece at a time it is always good to separate each piece away from each other so that paint dust does not get onto the adjacent piece that you will be painting.

If you use an enamel primer I recommend you also use an enamel paint.

As with any can of spray paint, shake the can well before using. Make sure that all nearby items that you don't want painted or over-sprayed, are either covered or far away from the area.

I recommend you apply at least 3 to 4 coats of spray paint on each piece of wood. Make sure that you have purchased enough of the same paint. (same lot, type and color) 6 to 8 typical cans of spray paint should be enough.

#### **Tips**

Hold the can as level as you can with in regards to the angle of the surface that you are painting. This will help prevent runs and will help give you a much more even coat of paint.

You should hold the can 6 to 8 inches away from the surface to be painted ! Start spraying the paint just before you reach the starting point of painting. You should continue to spray until you are past the paint area.

# *CubMobile*

## How To Build a Cubmobile

### **Painting Tips & Clear Coating:**

#### **Paint and Prep Tips**

If you have not painted before or have not did much painting, I recommend count the seconds as you paint. This can help prevent from going too slow and causing runs or build up in certain area's. For example, five seconds should equal about 18 inches of paint travel.

Overlap your paint when you start on the next area. You should try to over lap about a 1/ 4 of a inch.

Allow at least 20 minutes between coats of paint depending on type of paint and conditions.

After 2 to 3 coats of paint you should start to see the paint appear thicker and have a smooth and shiny finish.

Depending on how you did with your sanding or primer application you may have to add 2 to 3 more coats of paint.

Once you have the paint looking smooth, full and thick you are will want to allow the paint to dry for at least 48 hours. If there is high humidity you may have to wait up to a week before you are ready for the next step of painting.

#### **Clear coating**

If you are looking for that amazing finish, here is where it partly comes from. You will need to wet sand the painted surface with 600 and 800 grit wet sand paper.

Sand lightly and be careful not to sand through the paint and into the primer ! Again, use a clean wet cloth and wipe clean and use a second clean dry cloth to dry.

Remember the painting tips I mentioned above. Paint very light coats quickly. When the surface has been covered there should be about 4 to 6 coats of paint.

Try and move faster than 5 seconds in 18 inches. Clear coat runs very easy.! It is also much harder to see the thickness and build-up. A well-lit painting area is a must !



# *CubMobile*

## How To Build a Cubmobile

### **Paint Conclusion:**

Well you have done it ! Your Cubmobile is painted. You should allow for the paint to dry for one week—since you have not assembled anything yet.

You will be doing a lot of handling of the wood and parts to assemble the Cubmobile. Over the counter paint has a much slower cure time versus professional paint—which has a curing agent in it and also most often goes into a heat room.

Please have patience while waiting for the Cubmobile to completely cure and dry. If not, you will end up with finger prints and a dull looking surface where contact has been made with the surface of the paint.

# *CubMobile*

## How To Build a Cubmobile

### Tools and Supplies

#### Tools

1. Saw (circular preferred) For cutting the Frame, Cross members and Blocks for the Foot rest and Brake.
1. Jig or band Saw - For cutting the Contour of the sides the seat and seat support Panels.
2. Drill Bits— various sized to suit
3. Tape Measure.
4. Ruler.
5. Pen, Pencils, Marker.
6. Wrenches for bolts and nuts.
7. Screw drivers for wood screws.
8. A pair of saw horses.
9. Electric sander or palm sander
10. Sanding block, (if no electric sander is available.
11. Level ( to make sure the wheels are level)
12. T-square ( for alignment of angled seat support)

#### Supplies/Material

1. Sand Paper 60/80 grit, 100/120 grit, 200 grit. (3 to 4 sheets of each grit)
2. Wet Sand Paper 400 grit, 600 grit, 800 grit. 4 sheets of each
3. Wood glue (brown colored)
4. Epoxy glue.
5. Spray Primer (8 cans)
6. Spray Paint (6 cans)
7. Spray Clear Coat (3 cans)
8. Masking Tape
9. Wood, If using all 2x4's. then 3 at eight feet lengths needed Or if yare also using 2x6's or a mixture.
10. Plywood for Seat, seat sides and seat supports.

# *CubMobile*

## How To Build a Cubmobile

### Hardware/Fasteners

#### **Suggested Hardware and Fasteners**

- (4) axles bolts; the size depends on the wheel inside diameter; the length should be 6"
- (2) mounting bolts: for the front and rear frame/cross member connection  
suggest 1/2" diameter x 4 1/2" long.
- (1) 6 1/2" long bolt for the brake lever mount; Suggest 3/8" diameter
- (2) 1/4" dia x 6" long wood screws, (For seat support mount.)
- (31) Assorted Washers: (Most will be for 1/2" fasteners, with some for 1/4" and 3/8")
  - 5 per wheel: 3 between wheel and wood and 2 on outside of the wheel.
  - 3 washers for the brake lever; 1 on each side and 1 in the middle between the lever.
  - 2 washers for the rear cross member and rear frame.
  - 3 washers for the front Cross member and Front frame; 1 on top, 1 on bottom and one in the middle.
  - 1 washer for the brake pad mount
- (35) 1" long wood screws For mounting the side panels and seat bottom and seat back.
- (20) Wood screws for seat sides. The length depends on thickness of the wood used.
- (4) 1/4" x 3 1/2" wood screws for mounting the foot blocks..
- (4) rubber washers:
  - (2) for the front cross member, 1 in the middle and bottom of the cross member.
  - (2) for the brake lever, 1 on each side of the dowel rod.
- (1) Hard rubber block or hockey puck.
- (1) 3" long screw for mounting the hockey puck.
- (1) nylon rope: 1/4" diameter approximately. 7 feet long.

# CubMobile

## How To Build a Cubmobile

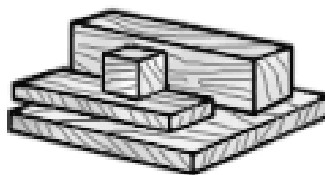
### Hardware/Fasteners



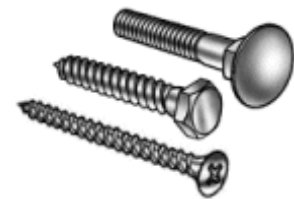
Paint & Primer



Wood Glue



< Brush Bushing



Axle Clamp



Frame & Cross Member bolt



< Lock Nut



Axle Bolt



< Nut



< Washer



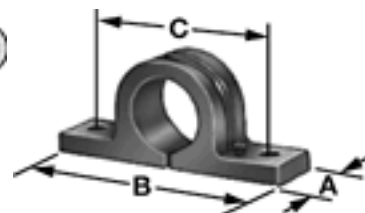
Wooden Doll Rod



U—Bolts (can be used for mounting axles or rod).

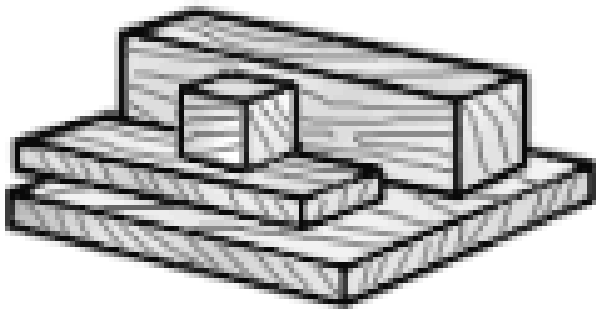


Eye bolts, can be used to mount axles or rod.



Another type of Axle mount

# Hardware/Fasteners



Rope



Wood Glue



Paint & Primer



Paint can Sprayer



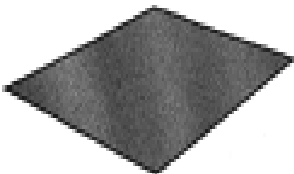
Canned Paint



Paint Brush



Rubber tire for brake



Sand Paper



Frame & Cross Member bolt



Axle Bolt



< Lock Nut



Nut



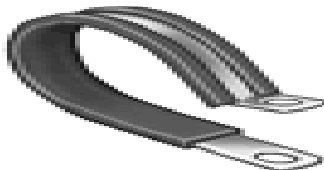
Wooden Doll Rod



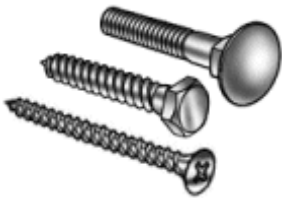
< Washer



Eye bolts, can be used to mount axles or rod.



Axle Clamp



Wood screw / Lag Bolt

# *CubMobile*

## How To Build a Cubmobile

### Cautions and Notes:

1. USE EXTREME CAUTION WHEN OPERATING ANY SAWS, DRILLS, OR OTHER POWER EQUIPMENT. MINORS SHOULD NOT OPERATE TOOLS OR EQUIPMENT WITHOUT PROPER KNOWLEDGE AND PARENTAL SUPERVISION.
2. DO NOT USE PAINTS, OILS OR SOLVENTS IN UNVENTED AREAS AND DO NOT BREATHE OR COME INTO CONTACT WITH ANY HAZARDOUS MATERIALS OR CHEMICALS.
3. USE BREATHING PROTECTION WHEN SANDING OR PAINTING.
4. CUBMOBILE CONSTRUCTION MUST MEET ALL REGIONAL AND LOCAL REGULATIONS AND RULES OF THE APPROPRIATE YOUTH GROUP.  
BE SURE TO CHECK FOR LOCAL ITEMS PROHIBITED OR REQUIRED!
5. THIS BOOKLET AND SHEETS ARE NOT SANCTIONED OR AFFILIATED WITH THE 'BOY SCOUTS OF AMERICA' OR ANY OF THEIR SUBSIDIARIES.
5. THIS BOOKLET IS INTENDED FOR A GUIDELINE ONLY, AS MATERIALS AND METHODS MAY VARY WITH INDIVIDUAL LOCATIONS AND PREFERENCES.
6. NEVER TEST OR OPERATE YOUR CUBMOBILE IN VEHICULAR TRAFFIC OR HAZARDOUS AREAS.
7. NEVER OPERATE YOUR CUBMOBILE IN AN UNSAFE MANNER AND DO NOT ATTEMPT TO STOP YOUR CUBMOBILE WITH THE USE OF YOUR FEET.
8. HAVE A SECONDARY MEANS FOR STOPPING YOUR CUBMOBILE AND KEEP IT WITHIN A SAFE AREA—SUCH AS BALES OF STRAW, NETS, OR RETAINING WALLS.

HAVE A SAFE AND FUN RACE !

The Author