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INTRODUCTION

The Clover Valley SoapBox Derby is hosted by the Nicomekl Area of Scouts Canada.

The Clover Valley SoapBox Derby is a fun filled family event designed to encourage participation through a parent-child program. For the big and not so big, it's an occasion to spend many happy hours designing and constructing machines for the challenge of speed, originality or just the "I did it!" feeling. The adult will help build the car for the child, and share closely the ideas that the child has to offer. This Derby is meant to be an enjoyable learning experience for both parent/guardian and child, and provide them with the opportunity to develop mutual respect and trust, and demonstrate the importance of individual pride and sportsmanship.

The Clover Valley SoapBox Derby is for "home-built" cars only. In the following pages, you will find the construction and safety specifications, and some suggested design details. Given these specifics, there is still plenty of room to use your imagination and design ideas with the materials and skills that you and your child have to create a unique racer. There are many jobs that your child can work on, either with your assists or on their own. This learning project will likely become a lifetime memory, so we should make it as positive and enjoyable as possible.

It is important that you get started early on your racer. Plan to spend at least fifty hours on the project, including design, searching for parts and materials, building, and testing. Low cost starter kits are available from the Association; kits include just the basic materials needed to start building your car. All the information you need to build your racer is in the official 'Builders Manual' received at registration. It is also available free of charge online at www.cloverdalesoapboxderby.com. This site also has Photos and information regarding Sponsorships, Costs, Rules, Other Derbies, Important Dates and a whole pile of other Neat Stuff. If you have any questions please do not hesitate to contact any of the listed technical support volunteers.

This is a not-for-profit Association and Volunteers and helpers are always needed and welcome on the committee and for other associated tasks, before and during race day.

REGISTRATION

Registration is on a first come basis and space is limited so register early to secure your car number. Registration alone does not guarantee you to race down the hill. **READ and follow the Associations rules and regulations; for everyone's safety, every year, car and driver together must pass a technical inspection.** Boys and Girls age eight and up on race day are eligible. Upon registration you will receive an official builders manual, with the option to purchase a starter kit to get you going. Each car owner is requested to provide at least one sponsor for their car. Sponsorship money is used to operate the race and does not go to an individual driver or car. Get your sponsor early, so we can promote them on our Website.



BUILDING RULES AND REGULATIONS

- 1) Wheels provided by the Association must be used so as to assure equal chance by all racers to compete. **Wheels must not be altered or exchanged.** There is to be no changing of bearings, shaving of tires, covering of wheel hubs, or any alterations what so ever to the wheels (lubrication of bearings and painting of the metal hubs are permitted).
- 2) Mandatory Car Dimensions must be followed. See the '**MANDATORY CAR DIMENSIONS**' section for specifics.
- 3) Gravity is the only form of motive power allowed.
- 4) Cars must run on four wheels - two front and two rear. All four wheels must touch the ground at all times when racing.
- 5) The floorboard of the racer must be made of 5/8" (19mm) plywood or of materials that provides equivalent structural support. Particleboard is NOT acceptable.
- 6) Feet must be foremost when driver is in racing position.
- 7) Seat belts are required. See the '**SEAT BELTS**' section for specific placement and attachment requirements.
- 8) A properly fitting helmet must be worn. Bicycle, motorcycle, football, or hockey helmets are acceptable. Full-face protection is preferred.
- 9) Drivers must wear shoes and eye protection during competition and may also be required to wear elbow and/or knee pads.
- 10) Foot-operated brakes only- **NO hand brakes & NO bicycle caliper brakes.** Brakes must be capable of stopping the car in a short straight line, with no damage to the road surface.
- 11) Steering must incorporate a steering wheel of some sort (circular, or similar design) fastened to a steel shaft. Steering wheel must not have any protrusions such as with a T-bar style that could pose a hazard in a collision. If cable is used, it must be of the "marine/aircraft" type. Clothesline cable is NOT acceptable.
- 12) Wrist or Forearm straps may be required to prevent hands from extending out of the car in the event of a rollover.
- 13) A headrest capable of restraining any sudden backward movement of the head is mandatory.
- 14) A roll bar is mandatory. See the '**ROLL BAR**' section for specific placement and attachment requirements.
- 15) Axles must be 5/8" solid or threaded rod or equivalent.
(Cars built prior to 1999 may use existing 1/2" axles and bearings if desired)
- 16) The weight of the car including driver must not exceed 250 lbs. (113.4 kg.)
- 17) There will be no "Kit Cars" (Derby racers purchased in kit form from Akron Ohio, etc.) permitted to race. This Derby is for home-built racers only.
- 18) All major components must be attached with through bolts, not screws. See the '**COMPONENT DETAILS**' section for the list of major components.
- 19) Turnbuckles must be safety wired or otherwise secured to prevent them from vibrating loose.
- 20) Each car must display its assigned number clearly on both sides of the car body.
- 21) No car shall display advertising or sponsorship not authorized by the association.



22) Each year, all **CARS** and **DRIVERS** must pass Clover Valley's official safety inspection.

RACING RULES AND REGULATIONS

Race Marshaling:

1. Each car is given one race in each of the three lanes. Each car is timed, so the other cars racing at the same time are of no consequence.
2. If time permits, a fourth race may be run in lanes assigned at random by the Marshaling Attendant. Each car's three fastest times will be averaged to determine the car's final standing.
3. If time allows, additional races may be run however the times of these will not be used in determining the final race times.

Multiple Drivers:

Where a car has more than one driver, the following rules apply:

1. The **CAR** will run the same number of races as each of the other cars, just as though it had one driver. The various drivers will take turns driving.
2. The car will be registered in the age category of the oldest driver.
3. Weigh-in is to be determined with the heaviest driver.
4. Only one Placement trophy (1st, 2nd, 3rd place) will be awarded per car.
5. Participation trophies/awards will be presented to each registered drivers.

Re-Races:

Re-races will be considered for the following reasons

1. Interference from spectators, obstacles or other cars entering your lane etc.
2. Malfunction of timer system
3. A false start as deemed by the starting officials
4. An emergency stoppage of the race

Re-races will **not** be considered for the following reasons

1. Mechanical breakdown of own car
2. Inadvertent or intentional braking (not due to interference)
3. Car leaving own lane (not caused by interference)
4. Car striking cones, hay bales (not caused by interference)
5. Weather conditions
6. General track conditions (manhole covers, surface conditions etc.)

In all cases, re-races will be determined by consensus of the committee and may be denied for such reasons as time restrictions etc. In such cases, the committee may opt to use the average of other races to replace the denied re-race time.



False Starts And Emergencies:

- Starting officials will determine if a false start has occurred.
- RACE OFFICIALS and/or SPOTTERS will determine emergencies along the racetrack.

In both cases, all drivers will likely be instructed to stop immediately. RACE OFFICIALS and/or SPOTTERS will give the command '**BRAKE**' repeatedly and will gesture with **BOTH HANDS PALMS DOWN**. At this command, all drivers must stop their cars immediately. Re-races will be determined as necessary.

Braking At Finish Line:

1. Brakes must be applied as soon as possible after the car has crossed the finish line.
2. Cars must stop in a **STRAIGHT LINE** without fishtailing or spinning.
3. Hay bales are **NOT** to be deliberately hit.
4. If braking is deemed by finish line officials to be inadequate or unsafe, the car will not be allowed to race until all appropriate adjustments to car or driver have been made.

Repairs And Maintenance:

Repairs necessary due to damage during the race must be made in order to make the car operable and safe. The marshaling system allows for postponing heats while repairs are performed. Enhancements to the car over and above necessary repairs are NOT permitted. Wheel bearings may be lubricated, if desired, only between heats.

Questions And Concerns:

All questions and concerns regarding the race will be dealt with through the officials at the information booth in the Greenaway Pool parking lot.

Decisions regarding controversial matters will be made by a minimum of three (3) members of the Official Race Committee. The Official Race Committee may elect to reserve final decisions until after race day.

UNDER NO CIRCUMSTANCES are the timing officials, operating the timing system at the top and bottom of the hill, to be **approached by drivers or drivers' representatives** to discuss results.



MANDATORY CAR DIMENSIONS

A. Axle length (front & rear)

Minimum **34"** (86.5 cm)

Maximum **36"** (91.5 cm)

B. Protrusion of axle beyond wheel hub

Maximum **1"** (2.5 cm)

C. Length overall

Maximum **84"** (213.4 cm)

D. Wheelbase (front to back axle measurement)

Minimum **40"** (101.6 cm)

E. Ground clearance

Minimum **3"** (7.6 cm)

F. Body overhang (front and rear)

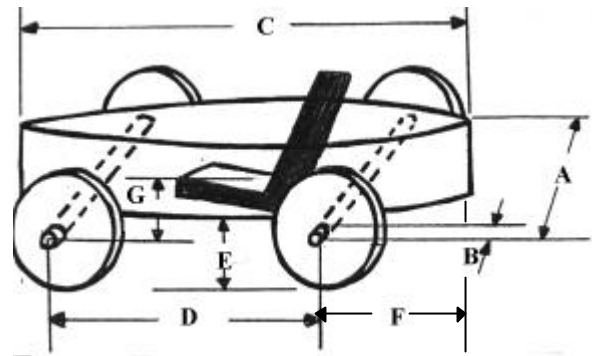
Maximum **12"** (30.5 cm) or

Provide a minimum 3:12 slope for ramp clearance.

G. Seat or seat pad height (above the center of the axles)

Maximum **5"** (12.7 cm)

Care must be taken to keep the center of gravity as low as possible.



All cars must meet the mandatory official dimensions or they will not be allowed to race.

HOW TO GET STARTED

Getting started properly is important and is a fairly simple step. You will not have to make all the decisions right at the beginning. **Please read through the complete manual before making any final commitments or cutting any materials.**

In most cases, you will start with a solid wood floorboard. A common material is a piece of 3/4" (19 mm) or 5/8" (16 mm) thick plywood. Decide roughly how long and wide the car is going to be. Points to consider regarding size are:

- Size of driver (Now and in years to come).
- Transporting it to and from the race
- You will need an area large enough to accommodate the completed car and remember, it also has to fit out the door later.
- Storage after the race

The body width should be at least 12" (30 cm), and should not exceed the axle width of 36" (91.5 cm) specified in the manual earlier. The length is primarily dictated by the height of the driver, and whether he/she is going to be in a sitting up or laying back position while driving. Remember the longer and wider the wheelbase, the more stable the car will be.



On the floorboard, carefully draw a clear centerline. You will need this centerline many times during the construction.

To get some principal dimensions established, sit the driver on the floorboard, and use a couple of broomsticks to indicate the positions of the axles. Keep in mind the official specifications for wheelbase (min.40"). Try to distribute the weight evenly over all four wheels.

Mark the positions of axles, steering wheel, brake, brake pedal, seat, tip of the nose, and rear end. You will need to know which type of brake you want to use as some may be positioned in a variety of locations while others cannot. The more common brake designs include a vertical plunger, horizontal hockey stick or drop arm. Allow room (at least 6" or 15 cm) in front of the feet for brake pedal movement. Also keep in mind the way you wish to finish the front end of the racer. Remember to leave room if a solid bulkhead is used at the very front to protect the driver in the event of a collision. Also, the feet will stick up a fair distance from the floor, and the eyes of the driver should be a few inches above the toes so the driver can see the road. It is not necessary that they are able to see the first 10 or 20 feet of roadway in front of the car, but the child should be able to see the road clearly beyond that.

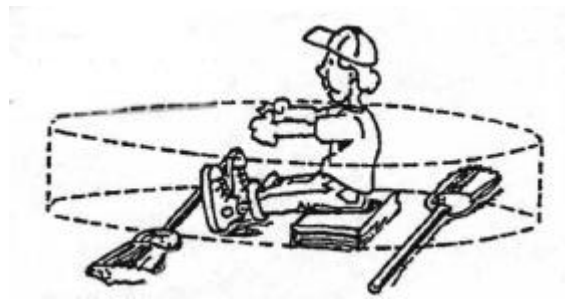
At this point, it is also a good idea to determine the shape of the racer as seen from above, the side and the ends. Is it going to be an elongated oval, a teardrop shape, or a rectangular wedge?

With consideration being given to the structural design, body type and safety, you can now outline the shape of the floorboard symmetrically around the centerline and start cutting.

Next, decide where and how to anchor the roll bar so that its an integral part of the main structure of the racer; for example the floor board and possibly also the main structures above the floorboard.

From here your next steps greatly depend on your design. In some cases the brake and steering components are easier to install before the frame or body. In others, the frame or body form the support structure for these components and must be installed simultaneously.

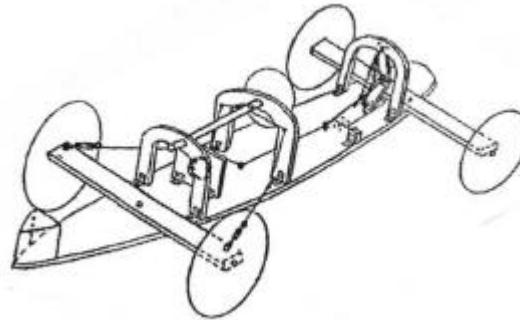
Finally you're ready to finish the body itself. It can be done with plywood, sheet metal, fiberglass, or any other material. This is where you let your (and your driver's) imagination run wild to come up with that unique new design.





COMPONENT DETAILS

This section explains some of the specific components in the design. The specifics of the components are only suggestions and may be adapted or replaced with your own designs as long as safety and fairness is not compromised.



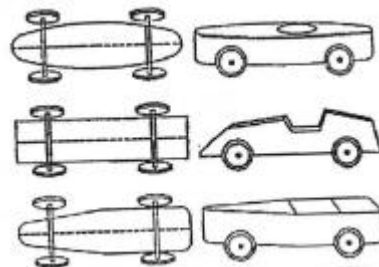
'Major Components' are parts that are critical to the cars safe operation and have some very specific requirements with regards to how they are installed. The following items are considered **'Major Components'**.

- Steering system (Steering wheel, cable, pulleys, connectors etc.)
- Braking system (Foot peddle, cable, pulleys, connectors, pads etc.)
- Seat belts (webbing, buckles, mounting hardware etc.)
- Roll Bar (Bar and mounting hardware etc.)
- Suspension system (Wheels, Axles, Axle Supports etc. including moving and nonmoving parts such as the rear axle bolted directly to the floor etc.)

All parts of 'Major Components' must be mounted securely with through bolts, suitable flat washers and lock nuts, lock washers or 'Lock-tite'. Screws are not acceptable.

Layout Of The Floorboard:

The basic body shapes shown here may help you to get your design underway.



Axles:

The wheels must attach to a 5/8"(1/2" prior to 1999) diameter axle rod or equivalent. This can be a threaded "Ready-Rod", which is simple because lock nuts can be used to position the wheel as opposed to cotter pins. A lock nut does not require a hole to be drilled in the rod for a cotter pin; but "Lock-Tite" or similar method must be used to hold the nut in place. Since the rod may not be strong enough by itself, a wood axletree or other equivalent support for the axle may be required.

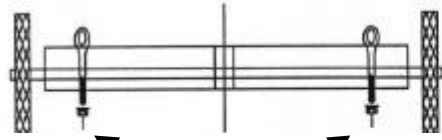


(See diagrams)



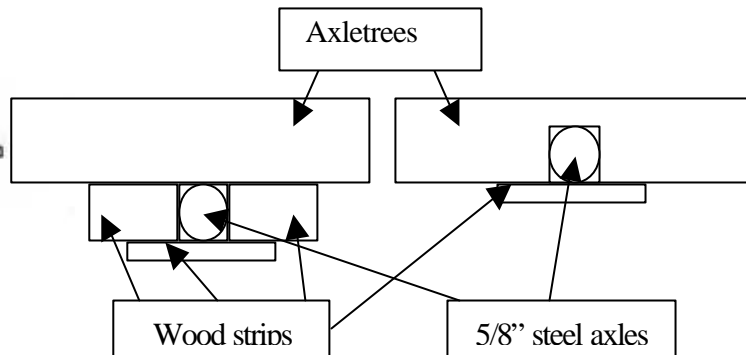


Front view of front axle with eye bolts for connecting steering cable



Eyes must be through-bolted

End views of two axle mounting options



- The axle rod is supported by a 2" x 4" piece of wood (tree).
- Wood strips hold the rod in place on the main 2" x 4" tree. A routed channel can eliminate two strips. The front axle pivot is a loose fitting bolt holding the axletree to the floorboard (locking the nut is required to prevent it from loosening off). The pivot should be in front of the axle for stability.
- Sturdy eyebolts backed with locking nuts and washers can be used to attach the steering cable to the axletree.
- The rear axletree can be bolted directly to the frame or floorboard.
- Mount the axles no more than 12" from the front and rear of the car or as defined in the **'MANDATORY CAR DIMENSIONS'** section.

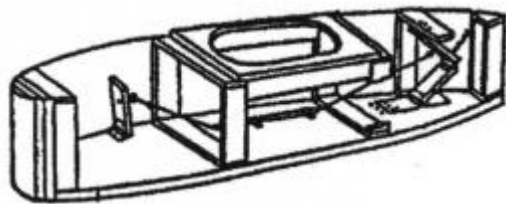
Suspension:

Although a suspension system is not really necessary, some increased performance and comfort may be achieved by building one.

Brakes:

There are several kinds of safe and reliable brakes. Some designs features to consider are:

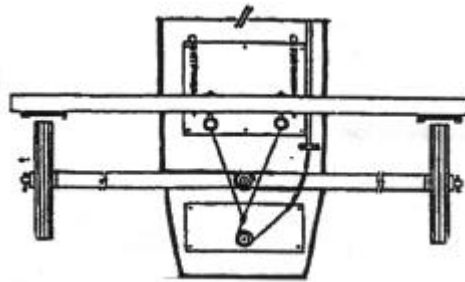
- Cost
- Ease of construction
- Choice of mounting location options
- Braking effectiveness
- Skid control
- Tire wear





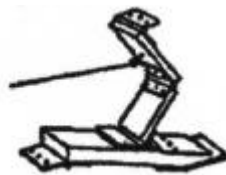
Hockey Stick Brake

The hockey stick brake uses a piece of strong hardwood parallel to the rear axle that is pulled up against both rear wheels by a cable. A spring pulls the bar off the wheels when the cable is released. It is quite simple and inexpensive to build. Make sure that the stick is mounted under the floorboard if it is behind the axle and above the floorboard if it is in front of the axle. In these positions the rotation of the wheels will force the stick against the floorboard, providing support. Tires wear somewhat as the brake is applied and flat spotting can occur if the brake is applied too hard. The maximum braking power available from this brake is dependent on the weight of the car on the rear axle.



Drop Arm Brake

The drop arm brake incorporates a hinged arm with a brake pad on one end that drags on the road surface. It is a popular design among serious racers because it can be designed to remain flush with the underside of the floorboard until the finish line, thus minimizing wind resistance. When the scissor or cam method is used to apply the brake, substantial mechanical advantages can be obtained providing high pressure with minimal pedal movement. The main hardware items needed to make the scissor brake are four large butt hinges. A cam system (not shown) made basically from plywood and one butt hinge can also be used to activate a drop arm brake. With a little geometry know-how, either is fairly easy to construct. This brake does not wear-on or flat spot the tires. Positioning it as far as possible ahead of the rear axle is best.



Scissor activated Drop Arm



Plunger Type

Plunger Brake

The plunger brake is a brake that can be easily mounted in the back or middle of the car. It consists of a brake pad that is pushed vertically down onto the road surface. Some welding is usually required to build this system. Somewhat surprisingly, the best place for a plunger (or most ground



contact type brakes) is slightly in front of the center of gravity of the car. The car's inertia during braking shifts the car's weight forward, applying weight from all four wheels equally. This provides more available friction and still allows good steering control.

General Brake Requirements

Over the years we have seen numerous types of brake systems, materials and fastening methods. Some have worked extremely well, some have failed miserably and some have worked for a few races and then suddenly failed. It is important that this information be passed on to the builders.

The brake pad is typically the material that rubs against the road surface or the car's tires to make it stop. The resulting friction causes heat. The more friction, the better the stopping power and the more heat that is produced. It therefore stands to reason that the better the stopping power, the more heat your system will produce. The point of all this is that no matter how good your brake system is, it is imperative that you have brake pads that can handle the heat and stress.

Unfortunately, brakes most often fail when they are being used, which is when you need them most. We have seen many types of materials used for brake pads, and lots of them have failed. Here are some pros and cons of some of them.

Automobile Tire Tread (Recommended):

This is by far the best and only material recommended for ground contact brake pads.

The tread needs to be deep so that bolt heads can be tightened down deep between the tread. Most tire shops will let you pick though their discarded tires for free. Very often you will find rejects or damaged tires that have almost new tread on them. Nylon or Kevlar belted tires are harder to find than steel belted ones but are easier to cut and do not leave prickly edges when cut. A hack saw or scroll (jig) saw with a metal cutting blade works on the tread. Mount the tire solidly and keep the saw kerf open. Tin snips or a sharp knife will work on the sidewalls. Again, keep the kerf open.

Advantages:

- Very wear resistant.
- The belting holds the washers and bolt heads from pulling through.
- Easy to find
- Inexpensive

Disadvantages:

- Somewhat difficult to cut

Hockey Puck (NOT recommended):

Hockey pucks are made of materials suited for cold temperatures. They are similar to snow tires in that they work well initially but also wear down much faster, especially when heated. Heads of bolts used to attach the puck, must be countersunk substantially so that, as the puck wears down, the bolt heads are not exposed. In one brake application, the puck can go from working fine to not working at all. Countersinking so far into the puck also weakens it.



This means that flat washers are needed to prevent the bolts from pulling through the puck. This also in turn reduces the amount of surface area available for friction. In short, you have a fast wearing, weak mounted, quick to fail brake pad.

Advantages:

- Does not require cutting to shape
- Easy to find
- Inexpensive

Disadvantages:

- Wears out very quickly.
- Bolt heads can pull through material.
- Bolts must be countersunk into puck.

Bicycle and ATV (All Terrain Vehicle) tires (NOT recommended):

Bicycle tires typically have a very shallow tread and ATV tires typically have a somewhat deeper tread that is spaced quite a ways apart. Since the treads are not deep enough to countersink a bolt head into properly, the pad is often wrapped up around and attached on top of the backing plate. Now comes the downfall. The tread usually does its job well at first but because of the small amount of tread, it wears down extremely quickly. Check out your kid's rear bike tire after a good skid. The belting that becomes exposed only provides the tires strength and is absolutely useless for providing traction. It is actually a very slippery material when dragged on pavement. On ATV tires, there is only a thin film of rubber over the belts.

Advantages:

- Easy to find

Disadvantages:

- Wears out very quickly. Compound is NOT made for contact with pavement.
- Must be attached above backing plate.
- Somewhat difficult to cut

Other Materials (NOT recommended):

Various other materials have been tried with limited success. We do NOT recommend any of these:

Truck bed liner – Most have no inner reinforcement fabric.

Conveyor belting – Too slippery and rubber layer is too thin.

Tire Retread material – The retread material alone has no belting beneath the tread so bolt pull through is a problem.

Brake pads must be attached to a backing material with through bolts and flat washers. The bolt heads must be sunk well below the contact surface so there is no chance of them ever coming in contact with the road.

Design your brake for the worst-case scenario keeping in mind that the road may be wet or slippery



making braking much more difficult.

The braking must be symmetrical with respect to the car. The car must be balanced from side to side and in the case of a hockey stick brake make sure pressure is applied evenly to both wheels.

Brake pads that drag on the ground must be able to extend 1" below the road surface to compensate for any road surface irregularities such as ruts etc.

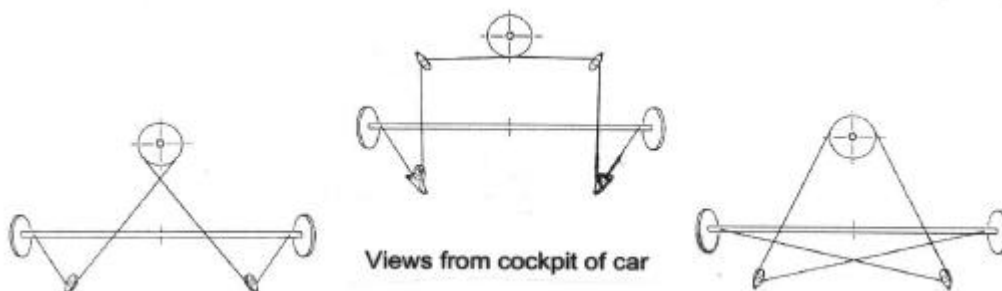
Remember: Foot-operated brakes only.

**Hand brakes and
Bicycle caliper brakes are NOT allowed.**

Steering:

The steering mechanism is one of the most interesting aspects of the car to design and build.

The simplest steering system consists of a cable that is wrapped around a steering column. The cable passes through pulleys and is attached near the ends of the front axle. The steering column may be vertical, horizontal, or for that matter at any angle. The cable is securely attached to the steering column or drum to prevent slippage and is tightened with turnbuckles. Make sure the cable is wrapped around the steering column in the proper direction to prevent backward steering. (See diagrams for some examples)



The steering wheel should be large enough to allow a secure grip, and have no sharp points or edges in any position. The sensitivity of the steering should be neither "too quick" nor "too slow". There should be minimal "play". The turning radius of the car can be relatively large since the racecourse will have very smooth curves if any. Should the car get off course, however, it is important that corrections can be made. A turning radius of 30ft (10m) is adequate. Stop blocks are mandatory and must be secured extremely well. They must prevent the axle from turning the steering wheel excessively if one wheel hits an object.

The cable used for the steering mechanism must not stretch. Clothesline is NOT acceptable. Use only marine/aircraft cable. **TWO** good quality crimps or clamps must be used at **EACH END** of all cables. Yes, there are good and bad ways to install cable 'crimps' and there is also a right and wrong way to install 'saddle' type cable clamps. These methods are often NOT indicated in the product's instructions so we have included some.



Cable Crimps/Clamps:

A proper crimping tool is obviously the best method for attaching cable crimps. It is also the only method recommended by the derby. (The derby has a crimping tool that you may use) Many alternate methods have been tried in the past, with varying success. Here are a few that we have rated in comparison to crimping with a proper crimping tool.

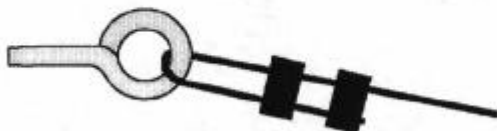
- Pound the crimp with a hammer on a solid object such as a block of steel or another hammer. **(Best alternative; 83%)**
- Squeeze the crimp in a LARGE vice. Most small bench vices cannot produce the pressure that can be obtained by a number of light impacts from a hammer. Chances are you will break the vice first. **(Not great; % not available)**
- Pinch the crimp with 'Side Cutters'. Depth of the pinch is difficult to determine and you will likely cut into it and damaging the crimp or even the cable inside. **(NOT acceptable; 32%)**
- Squeezing with vice grips or pliers. You may think you are getting lots of pressure on the crimp with these but it is not enough for a proper connection. **(NOT acceptable; 32%)**

'Saddle' type clamps are the ones with a 'U' shaped bolt that fits into two holes in a base piece called a 'saddle'. The 'U' bolt is tightened with two nuts clamping the cable between the 'U' bolt and the 'saddle'. These clamps are convenient in that they can be reused without cutting the cable, however the drawbacks are that the correct size (3/32") is hard to find, the 1/8" ones are only **45%** as strong as crimps and the nuts tend to loosen off as the cable settles over time.

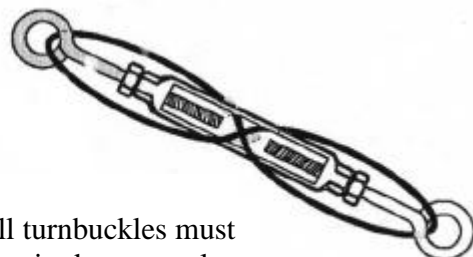
The tricky part with the 'saddle' clamp is, knowing the correct way to put it on. The reminder is, "NEVER SADDLE A DEAD HORSE". The 'DEAD' end of the cable is the end that is exposed (and pokes you) if you don't tape over it when you're done. The 'SADDLE' is the part of the clamp with the holes in it. When you put the first clamp on (about an inch from the 'DEAD' end), make sure that the 'DEAD' end of the cable is in the 'U' bolt side of the clamp and not the 'SADDLE'. Tighten the nuts evenly. The second clamp must go between the first clamp and the object you are attaching the cable to. The space between the two clamps should be 6 times the diameter of the cable. Remember, the nuts on the clamp must be locked and checked regularly.

When turnbuckles are used for tightening the cables, they must be wired or otherwise restrict from loosening themselves off.

For the mechanically inclined, direct linkage steering is another option that can be used on either a straight axle or on independent swivel type systems.



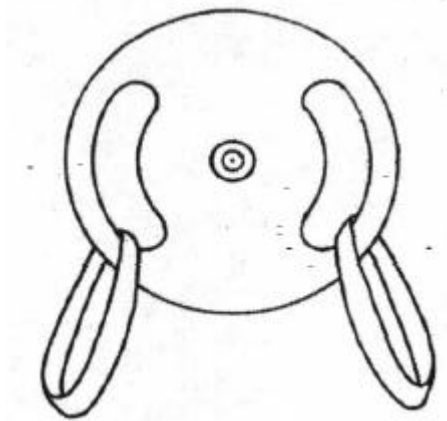
Two cable crimps or clamps must be used on each cable end. Cover the free ends of the cable with a crimp or tape



All turnbuckles must be wired or securely fastened to prevent them from loosening off.



Wrist/Forearm Straps:



Wrist or forearm straps are required in open cockpit designs. These straps are very loose fitting and are intended only to restrict the drivers' initial reaction of extending their arms out of the car in the event of a roll over. Straps may be attached in any effective location in the car.

CAUTION

DO NOT attach wrist straps to the steering wheel (as shown) if the steering wheel is able to rotate more than half a revolution in each direction. In this case, attach the straps elsewhere in the cockpit.

Seat Belts:

Seat belts have two main functions. They need to hold the driver in the car in the event of a roll over and they need to restrict the driver from hitting the steering wheel or dash of the car when involved in a frontal collision.

In a conventional lap/shoulder belt system, the lap belt holds the driver in the seat while the shoulder strap holds the driver's upper body from moving forward. This is the most widely used system that meets the minimum requirements in our derby. It is simple to acquire and install. Some auto racing and aviation type restraint systems are obviously more effective but may be difficult to come by or very expensive.

Another less popular system is the three-point, two shoulder belt, system. It uses a lower attachment point below the crotch. Depending on the style and position of the seat, a wedge as described below may be required.



Incorporating shoulder belts in 'Lean Forward' style cars has always been a challenge because if the shoulder belt is tight, the driver can no longer lean forward. We have found however that a shoulder strap can still be installed effectively in these cars. Because the intent of the shoulder strap is to prevent forward movement, it will still be effective as long as it is tight when the driver is in the lean forward position and does not allow the upper body or head to come in contact with the steering wheel or dash of the car. The belt also needs to be installed so that it cannot fall out of position (off the shoulder) while driving. Special attention must be made in the roll bar design so that it provides protection even when the driver is sitting upright with the shoulder strap loose.

In a 'Lay Back' style car, it is hard to prevent the driver from sliding forward when involved in a frontal collision. In this case, at least one of the following things is required.

1. A wedge can be installed in front of the driver's buttocks. The wedge should be as steep and high as possible without being too uncomfortable. The seat should resemble a chair leaned back with a shortened seat pad. The front edge of the seat pad can be scalloped to allow the legs to straighten when braking. The lap belt should be anchored as close as possible to where the seat and the back of the chair meet.
2. Leg straps similar to those on climbing or fall arrest harnesses can be used in addition to the lap and shoulder belts.

All seat belts must be securely attached to the floorboard, frame member or roll bar with through bolts.

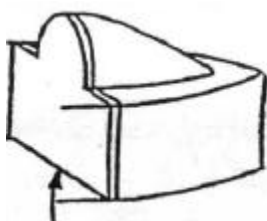
Roll Bar:

The Safety requirement here doesn't necessarily call for a metal tube shaped in an arch; but essentially a superstructure extending some inches above and to the sides of the driver's head and back. It should be made from solid materials and fastened securely to the floorboard and/or frame.

The kit provides a sturdy metal roll bar that should be easy to integrate into your design. The best place for the roll bar is slightly ahead of the driver's face. This position allows it to deflect on-coming objects more safely. The roll bar must be positioned so that the driver's helmet is not able to reach imaginary lines extending from the top of the roll bar to the nose of the car and from the top of the roll bar to the rear of the car. (See diagram) Roll bars must also extend on both sides of the driver's head. For 'Lean Forward' style cars, the roll bar height is determined when the driver is sitting upright.

It is very important to provide protection against potential whiplash by providing an adequate headrest for the driver.

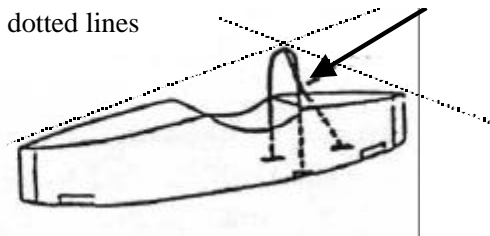
Body type roll protection



3/4" plywood

Helmet must not be able to reach dotted lines

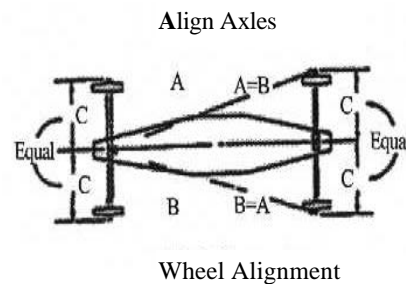
Optional support may act as a headrest





Alignment Of Rear Axle:

First, check that the exact center of the rear axle is located exactly over the centerline on the Floorboard. Next, measure the distance from the front axle center point to each tip of the rear axle. Distances must be exactly the same. Secure the rear axle to the floor. This alignment ensures that the centerline of the racer is parallel to the direction of travel and the car is balanced side to side.



Balancing:

An important factor in soapbox racer design is the weight distribution. A well-balanced car will roll cleaner downhill and will be more stable in handling and braking. The more weight over a wheel, the more resistance it presents. For this reason alone, you will want to have even weight distribution over all four wheels.

An unbalanced car may tend to wander. In a car in which more weight is positioned towards the rear, the light front end will steer sluggishly. This leads to erratic motion. Also, a light front end tends to bounce more when hitting bumps. If the front end is too heavy, the car will tend to fishtail easily and rear mounted brakes will be less effective.

Body:

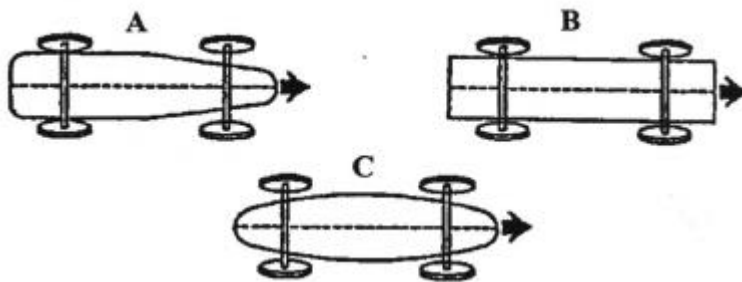
Safety must be given priority with regards to building and racing the cars. Mishaps do occur, and it's your responsibility to design and build a car that is safe and presents minimal danger to the driver and spectators in the event of an accident. Keep in mind that the shape of the front of the car can present a serious hazard in a collision, as these cars can reach speeds in excess of 35 mph (60 km/h). Sharp pointed designs are to be avoided.



Aerodynamics is the study of the interaction between air and solid moving bodies. In racecar design there are many factors to be considered. We will only discuss drag here, which is the most important to us. Drag is the resistance air exerts on an object that is moving through it. The most obvious factor is frontal area. This is the maximum cross-section of the racer as seen from the front. All other things equal, the car with the smaller cross-sectional area is faster.

Shape is important to "air management". The three cars shown have the same cross-section area. Car `A' will be faster than Car `B' because the air travels around the front more smoothly but Car `C' is faster than Cars `A' and `B' because the air flows around the back more smoothly also. The airflow behind Cars `A' and `B' is turbulent and creates a negative pressure that pulls the car back. The car's rear design can be as important as its front.

Imagination is the only limiting factor when designing the body shape. The various designs and colors will give the Clover Valley SoapBox Derby a memorable and unique flavor. Racers don't need to be super streamlined to be fast. Wheels, suspension and alignment are at least as important. Please refrain from designs that may pose a hazard when involved in a collision such as sharp points, ornaments or trim that may come loose.



TESTING THE RACER

An extremely important part of building a soapbox racer is the thorough testing of it before the race. You can start testing well before the car is completed, by running it on a flat or slightly inclined surface. When the car is completed, test it at higher speeds. Just pushing the car around the neighbourhood with friends is important to help the driver get the feel of the controls. Perform brake tests where there is no danger if it fails, or if the car starts to skid. Let the driver get used to the car and learn to control it in a straight line, around a smooth curve and in braking situations.

The ideal place for a test run is a secluded paved footpath at least 6' wide, with no solid objects nearby and a very long horizontal run-out at the foot of the hill. There should be at least two adults present, one at the top and one at the bottom of the test course within shouting distance. All parts of the course should be visible to a least one of the observers. It is essential to keep people and animals out of the way for the few seconds of the test run. When you test the car at moderate to



high speeds, remember the full safety regalia (helmet, pads, safety belts, goggles, shoes, etc.).



Carefully re-read all sections of the manual. Make a copy of the following checklist and use it during testing to help you pass the Safety Inspection easily.

SAFETY AND SPECIFICATION CHECKLIST

The following conditions are to be adhered to. Remember, only the Safety Inspection Committee can concession non-compliances.

Structural Safety

- All '**MANDATORY CAR DIMENSIONS**' must be met.
- All steering and brake system turnbuckles prevented from turning due to vibration.
- All parts of 'Major Components' are mounted securely with through bolts, suitable flat washers and lock nuts, lock washers or 'Lock-tite'.
- All steering and brake system cables remain snug throughout movement extremes.
- All cables are terminated with double crimps or double clamps.
- No open pulleys are used (where cable may come off the pulley wheel).
- Brake pads that drag on the ground are able to extend 1" below the road surface
- Wheels and front axle king pin are secured with locking nuts, double nuts, cotter pins, or other suitable method.
- Wheels do not bind or rub anywhere throughout movement extremes.
- Axles are securely fastened.
- No sharp objects are in the vicinity of the driver when seated.
- All parts of the 'Major Components' are accessible for visual inspection.
- Car is reasonably solid in construction and free of loose parts.
- Weights, if used, are securely fastened.
- Braking system design is mechanically sound and effective.
- Steering system design is mechanically sound and effective.
- Steering wheel design does not present a potential hazard.
- Steering stops are adequately positioned and secured.
- Wrist/Forearm straps are installed where applicable.
- Seat belts are installed and properly adjusted.
- Roll bar is mechanically sound and effective.
- Helmet is present and fits.
- Goggles are present and don't fog up.
- Elbow and/or kneepads are present where applicable.
- Weight (no more than 250 lbs including driver and safety gear).



Driver Proficiency



- Driver can operate brakes satisfactorily.
- Driver can operate steering satisfactorily.
- Driver understands the structure of the race regarding:
 - When to brake
 - How to brake safely
 - Staying in own lane
 - False start procedures

INSPECTIONS

All cars must pass a formal inspection **with their drivers** prior to race Day. You will be provided with the place, dates and times for the inspections. Two inspection dates are usually held and you are encouraged to attend the first inspection even if your car is far from being completed. This will allow you to identify potential problems before you develop them too far. When changes are indicated, the car must be re-inspected to assure total compliance. The Safety Inspection Committee is the only body permitted to concession non-compliances and their decision is final.

- Car must pass final inspection **prior to race day**. All mechanical components of the car will be inspected for structural, design and safety adequacy.
- Driver(s) must pass final inspection **prior to race day**. The driver(s) will be checked for driving and braking ability, fit in regards to roll bar and seat belts, adequate protective wear and overall car/driver weight.
- No revisions are permitted after the final inspection.
- Due to time restraints, **no car will be given a final inspection on race day**.

Only after the racer passes all of the above requirements will it be allowed on the race hill. Reasonable efforts will be made by the committee to have your car qualify; but as you know safety is the utmost priority!

DERBY DAY

The big day has arrived. Your racer is ready and tested, and the paint job is almost dry. Remember to bring your tools, spare parts, helmet, goggles, nuts and bolts, extra cotter pins, oil etc. Packing these the night before may be wise. Some form of platform for the car is very useful for doing minor repairs and wheel lubrication. A milk crate or collapsible workbench such as a 'Black & Decker Workmate' will do fine. **Don't forget the camera!**

With your **passed inspection**' sticker proudly displayed, the day will start by dropping your car off in the pit area behind the starting line. Proceed to the check-in table where you will receive your race tickets and instruction package. Please read this information carefully and keep your tickets in a safe place with the driver or car.



Take time to familiarize yourself with the MARSHALING BOARD. This is where **you choose** who you will race with and when you will run in each lane. If time allows, you may be able to test your car down the hill one hour before the racing begins so get to the race early.

The RACE MARSHAL will answer any questions you may have.

Track setup is a big job requiring the help of **EVERYBODY**. Up to one thousand hay bales must be strategically placed along the track. These will also need to be bagged if rain is expected.

TROPHIES

Participation Awards: Every car/entrant will receive a participation award.

Specialty Awards: Various awards will be presented for specific criteria that may include, Engineering, Paint Job, Original Design, Sportsmanship, etc. Decisions will be weighted with respect to the driver's involvement and knowledge of the building process and workings of their cars.

DRIVER'S NOTES



OTHER RACES

PORT COQUITLAM SOAP BOX CHALLENGE

DATE: TBA

Jack Giesbrecht (604) 942-7214
Gord Graves (604) 941-5140
Richard Simonson (604) 942-8141

ADERGROVE FESTIVAL DAYS COMMUNITY SOAP BOX DERBY

Sunday, June 13, 2004

Bruce (604) 856-4907
Jan Mazerall (604) 856-4650 (Call after 11:00 AM)
Email: info@AldergroveFestivalDays.com

MISSION

Saturday, June 26, 2004

Bernice Ruley (604) 820-6761 Or (604) 709-4701
(Reg. forms available at Mission Branch of VanCity Credit Union)
Toll Free 1-800-980-8777
Email: info@missionsoapbox.com

KITSILANO SOAPBOX DERBY (% THE MAIN EVENT)

Sunday, June 27, 2004

Cheryl McNeil (604) 263-6443
E-mail: cherylmc@axionet.com
Fax (604) 263-6442

PHANTOM SCREENS/ ABBOTSFORD OPTIMIST SOAPBOX DERBY

Sunday, September 12, 2004

www.abbotsford.net/optimist/soapbox_derby.htm
(Click on Abbotsford then on Soapbox Derby)
David Morrison (604) 852-2860
E-mail demorrison@telus.net

CLOVER VALLEY SOAPBOX DERBY

Saturday, September 18, 2004

Traci or Kevin Penner (604) 574-4898



E-mail soapboxderby@shaw.ca
E-mail kevintracipenner@shaw.ca