



# Lions Downhill Derby Official Rules and Construction Manual

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Every effort has been made to make this manual as accurate as possible. However, as this is a learning experience for the Downhill Derby Committee as much as the builder, there may be unintended errors in this manual. This manual was created as a guideline to aid in the construction of your car. If you find an error, please let us know, but always err on the side of safety when building your derby car. Thank you for being part of this exciting event. We look forward to working with you on making this a great event!

## Introduction

The Lions Downhill Derby is a fun filled family event designed to encourage participation through a parent-child program. For the big and little it is an occasion to spend many happy hours designing and constructing racing machines or some very special looking cars. The adult should help in building the car with the child, and allow input on ideas from the child. 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 Downhill Derby is designed to permit as many races for each contestant as possible to determine a winner. The overall winner is not necessarily the fastest racer but that driver who has won all the races in which he or she has competed. Of primary importance is that the children have a fun and safe experience.

In the following pages, you will find the specifications for the racers, safety specifications, and some suggested design details. Apart from the safety and specifications, do not feel unduly restricted by the information given. Use your own imagination and design with the materials and skills that you and your child have.

It is important that you get started early on your racer. Plan to spend at least fifty hours on the task, including design, searching for parts and materials, building, and testing. The child should be working on the many small jobs involved. Arrange to have access to a work area large enough to accommodate the completed car and one that has a door large enough to get through.

We would like to take time to mention that this is a non-profit event and that volunteers and helpers are needed and always welcome for the committee and other associated tasks, before and during race day!

## Waiver

Every racer must have his or her waiver and permission slip signed and submitted in order to race.

## Registration

- Boys and Girls ages 8-9, 10-13 and 14-17 are eligible in three weight classes.
- Exceptions on age or class may be granted by the Lions Downhill Derby Committee, with an emphasis on safety and fairness. Please contact the committee for more information.
- Please see the registration form for more details.

### Car Specifications

<b>Wheelbase:</b>	<b>64"</b>
<b>Width (tire to tire):</b>	<b>32"</b>
<b>Nose to Front Axle:</b>	<b>6"</b>
<b>Ground Clearance:</b>	<b>3"</b>
<b>Weight (w/ driver):</b>	
<b>Age 8-9</b>	<b>210 lbs</b>
<b>Age 10-13</b>	<b>230 lbs</b>
<b>Age 14-17</b>	<b>320 lbs</b>
<b>Base Thickness:</b>	<b>1.5" (2 - 3/4" OSB Combined)</b>
<b>Axle Supports:</b>	<b>2x8" (Must be made of Wood - Yellow Pine or Stronger With Recessed &amp; Secured Axles)</b>

### Required Parts (See Parts List for complete detailed listing)

- ComTech 2000 Wheel Set (Available from Lions Downhill Derby)
- AASBD Steering/Brake System
- Steel Axles (Available from Lions Downhill Derby)
- Pulleys & Wire for Steering/Brake

### Safety Considerations

The overriding requirement in any downhill derby race is safety. Mishaps may occur, of course; but it's your obligation to design and build a car that is safe to drive, and presents minimal danger to the drivers and spectators. Keep in mind that safety of others is important and the design of the front of the racer should be kept from being too dangerous in a collision. The body of the car should obviously be very sturdy. There should be some form of bulkhead at the front and back end, securely fastened to the floorboard, protecting the driver. The speeds attained by downhill derby cars may exceed 40 mph.



## Car Rules & Regulations

- The car may be built in any shape desired; but driver's vision must be unobstructed.
- The car must comply with the above Car Specifications and use unaltered Required Parts.
- No windshields of any kind will be permitted
- Interior area must have easy access for inspection purposes
- All exposed cockpit opening edges must have secure pipe insulation or equivalent padding.
- Driver must be seated with legs forward in an enclosed vehicle design.
- Seat back may be used but must be movable for interior weight and inspection access.
- Wheels and axles must not be altered or exchanged. There is to be no changing of bearings, shaving of tires, covering of wheel hubs, or any alterations whatsoever to the wheels, except painting of hubs.
- Wheels must be securely attached to axles with heavy duty hitch pins.
- Steering stop blocks must be installed to limit angle to 30' circumference turn.
- Steering cable must have no slack or slippage on column (**Turnbuckles Required**).
- Steering and Braking cables must be secured with proper sized cable clamps and doubled.
- Vehicles must use all four wheels, two in front and two in rear, and all wheels must touch the ground at all times during race.
- No method of propulsion can be used; gravity driven cars only.
- Fitted helmet is required.
- Weights must be secured and unmoving and be equally distributed front to back.
- Car numbers must be displayed at top/rear of vehicle on both sides: Min. 6" characters.
- The weight of the car with the driver must not exceed their weight class (210, 230 or 260 lbs).
- All major components must be attached with through bolts (not screws), lock washers and nuts.
- Cars must pass inspection the day of the race.

## Getting Started

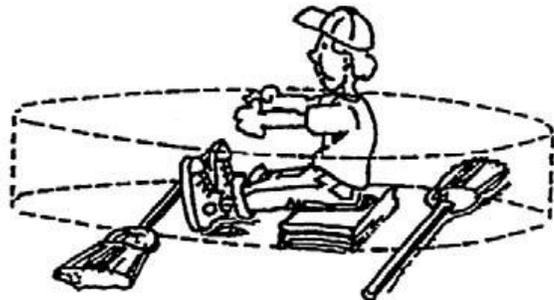
Read manual completely. You should have already purchased your starter kit. Begin with a sheet of 3/4" OSB cut in half and glued and screwed together to form a single 1.5" 2'x8' board. Decide roughly how long and wide the car is going to be. Points to consider regarding size are:

- Size of driver (now and race day).
- Transporting it to and from the race.
- Moving it in and out of the work area.
- Storage after the race.

The body width should be at least 12", and should not exceed the tire to tire width of 32" specified in the manual earlier. The length is primarily dictated by the height of the driver. If you sit the driver on the base, and use the starter kit axles, it is possible to get the basic dimensions established. Also mark the locations of the brake pedal and steering column. On the stock you are going to use for the floorboard, carefully draw a clear centerline. You will need this centerline many times during the construction. Mark the position of axles, brake, brake pedal, seat, tip of the nose, and rear end. With consideration being given to the type of body you are going to build, the design of the car and safety. You can outline, perfectly symmetrically around the centerline, the shape of the floorboard, and cut it. Allow room (at least 6") in front of the feet for a brake pedal and a post to add weights. Also have in mind the way you wish to finish the front end of the racer. Solid "bulkheads" are recommended at the very front to protect the driver in case of an accident and to support the car against the starting block on the starting ramp. This "bulkhead" should be solidly attached to the floorboard, which is the main structural element in the racer. Thus, an additional few inches in front of the feet may be required.

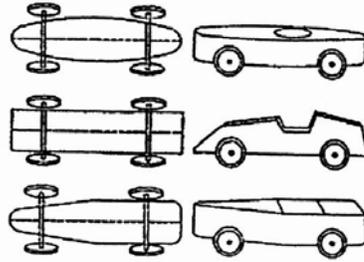
At this point, it is also a good idea to determine the shape of the car as seen from above. Is it going to be an elongated oval, a teardrop shape, or a rectangular box? Again, you don't have to make the final decision about the detailed shape, just a general one. Have the driver sit on the floorboard roughly in the driving position. Prop the child's back up. Remember that the feet stick up quite a distance from the floor, and that the eyes of the driver should be a few inches above the toes so the child can see the road.

Next is to determine the position of the axles for the wheels. Keeping in mind the official specifications for wheelbase (64"), you should try to distribute the weight of the driver evenly over the four wheels. Now think about where the brake/steering column will be placed. Finally you're ready to build the body itself. It can be done with plywood, sheet metal, fiberglass or any other material. This is where you let your imagination roam, and you can come up with new aerodynamic designs! Always consider your total weight though!



## Floorboard Base

The basic body shapes shown here may help you to get your design under way but please do not feel you are limited by these simple designs:



To create your base cut a 3/4" 4x8' sheet of OSB plywood or stronger down the middle and glue and screw the two sheets together to form one single 1.5" x 2x8' base. Draw your center lines and determine and mark your shape. Cut the base shape as desired. Next, mark the base as previously described for placement of the driver, axles, seatback, steering column, brake pedal, steering angle limiting blocks and weight rods (for and aft).



## Wheels and Axles

The provided wheels must attach to the provided 1/2" axle rod using heavy duty cotter/hitch pins. Since the rod isn't strong enough by itself, a 2x8 piece of yellow pine or stronger to support the axle is mandatory. The axle rod must set recessed in a slightly shallower depth (7/16") routed groove under the center of the 2x8 support. Steel plates can then be attached on either side to hold the axle in place as well as a center set screw to keep the axle from rotating. The 2x8 may be shaped for aerodynamics as desired, just use caution not to reduce the strength of the wood by reducing its size. When attaching the wheels use 7/8" washers with a 1/2" core to separate the wheel from the base and the outer pin.



## Wheels and Axles (Continued)

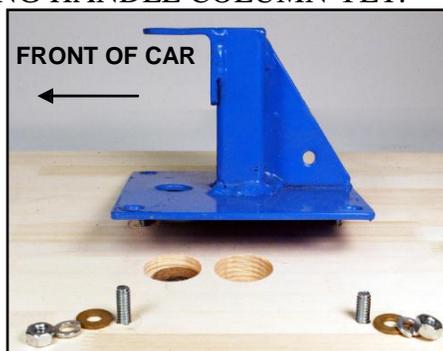
Once you have completed the axle assemblies you are then ready to attach them to the car. Start by drilling holes for attaching the rear axle with two bolts the same size as your holes. Use washers and lock nuts above the axle assembly. Space the bolts equidistant from the edge of the car. Be sure not to place the bolts too close to the edge that it compromises the integrity of the base. Also, notice the rear safety bulkhead in the photo. The bulkhead also aids in attaching the sides to the car. **BE SURE ALIGNMENT IS STRAIGHT!**



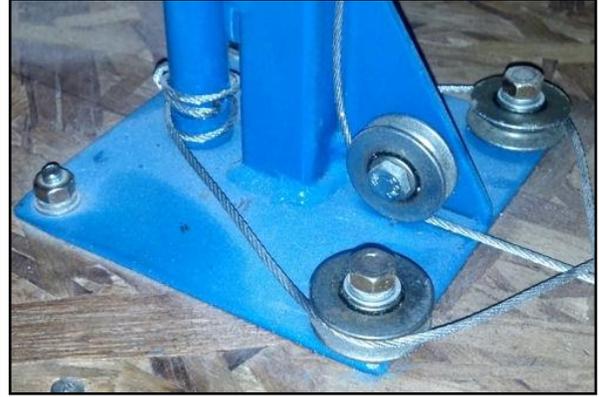
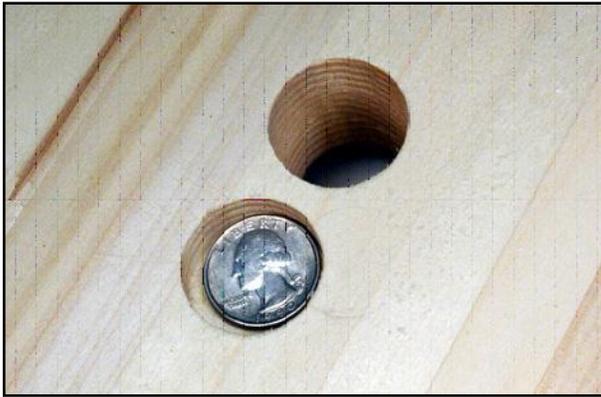
Once finished with the rear then work to attach the front axle. The front axle attaches by using one centered bolt with washers above and below the axle assembly to provide ease of turning. Be sure to drill the hole for the center bolt very carefully in the center of the base and exactly to size to avoid any looseness in steering. Do not tighten the bolt too much as you will want to allow the steering to move easily. Notice also in the photo the front bulkhead and the left side steering limiter block. The limiter blocks are used to limit the angle of steering to no more than a 30° circumference. The reason is to keep the axle assembly from turning any further in the event of an accident and to help the driver in avoiding over-steering which can cause rollovers. The front and rear bulkheads in the above photos were formed with 2x4s cut to shape and securely attached to the base frame. Remember that the front axle center must set 6" from the nose. Be sure to allow room from the front bulkhead for steering motion.

## AASBD Steering / Brake Mount Assembly

It's now time to attach the steering and brake assembly which came as part of the starter kit. First, place the steering mount in the proper location for the driver and mark its location, be sure it is centered on the base. Mark the 6 holes in the mount onto the base. There are 4 mounting holes, one hole for the steering handle column (forward), and one hole at the bottom of the brake plunger shaft. Once all the holes are marked drill the mounting holes with the proper sized bit. Then drill the brake plunger hole (center on the mount). The brake needs a 1" hole to clear the brake plunger. **DO NOT DRILL THE HOLE FOR THE STEERING HANDLE COLUMN YET.**



The Steering Handle Column which sets in front of the brake plunger on the Steering Mount sets down in a shallow hole, this hole DOES NOT go all the way through the vehicle base but is only about 3/8" deep so that the Steering Handle has a place to set down into. The width of the hole is about 1" and a quarter (or slug) sets in the hole to be used as a base for the Steering Handle. Be sure to put the quarter in the hole before you secure the mount. It is now time to secure the Mount to the Base of the car. First, bolt on one of the pulley wheels you received in your starter kit to the mount side. Be sure your bolt does not interfere with the pulley movement and that you use a lock nut and washer on the opposite side of the Mount.



Use (2) 1/4" x 2" Elevator Bolts (front).  
 Use (2) 1/4" x 2-1/4" Elev. Bolts (rear).  
 Fasten each using:  
 1/4" Flat Washer  
 1/4" Lock Washer  
 1/4" Nut



Now, attach the Mount to the Base with elevator bolts from the bottom of the Base and through the Mount holes. Secure two more Pulleys towards the rear with the 2-1/4" bolts. Use a washer, then lock washer, then nut for each. Your Steering/Brake Mount should now be attached to the Base.



Next set the Steering Column down into the front set of holes. It should rest on the quarter placed in the hole earlier. Lift the column up slightly and slide a 3/4" (inner dimension) washer up the column and insert a cotter pin to hold the steering column in place and prevent it from being removed. Bend the cotter pin around the steering shaft.

## Steering Cabling Installation

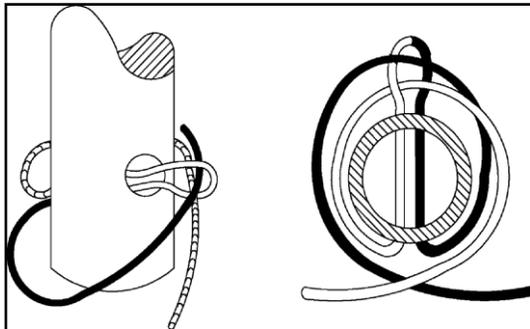
### Parts Needed:

- (2) 1/4" x 2-1/4" Elevator Bolts
- (2) 1/4" Lock Washers
- (2) 1/4" Nuts
- (2) 1/4" x 1-1/4" Fender Washer
- (2) Included Pulleys



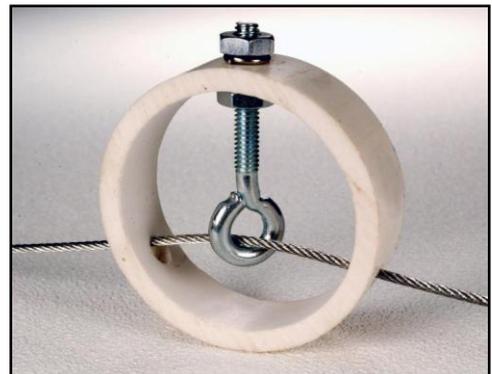
Drill two 1/4" holes placed 6" to the rear of the Steering Mount and 2" from the Base edge (above). Insert elevator bolts from beneath. Place the fender washer onto bolt, then Pulley, lock washer, then nut. Tighten.

Its now time to run the steering cable. Start by bending a 10' length of cable in half and threading it through small hole at the base of the Steering Column (see diagram below).



The cable next passes to the rear Mount pulleys, just setting in the groove of the pulley, and then onto the pulley on the opposite side of the car, where the wire is wrapped around the pulley and on to the front steering axles. There are several ways to attach the cable to the front steering axle, but the safest is to drill a hole forward of the steel axle and insert a metal grommet for the wire to pass through. The wire can then be clamped to itself with 3/32" cable clamps. Use at least two for safety. You may also install a cable turnbuckle to tighten the wire (there are many ways to do this). Below is a photo of the AASBD install design.

The nice thing about this design is that the cable remains intact and uncut at the turnbuckle which provides much greater security against clamp failure. If you use this design install one on both sides of the car just behind the Steering Mount before the wire reaches the rear pulleys.



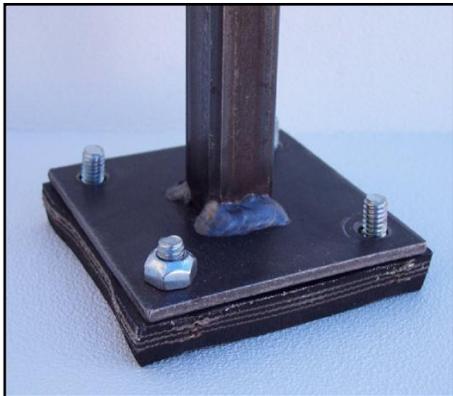
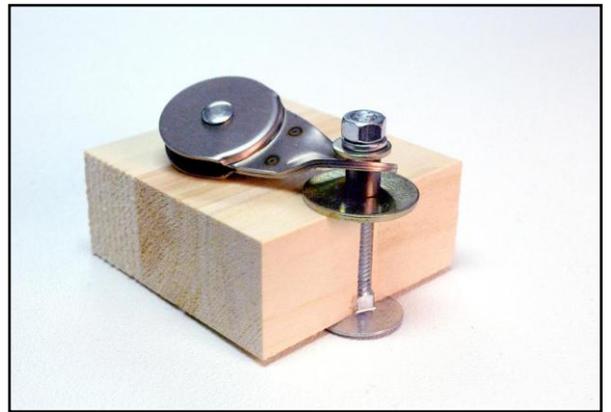
## Brake Installation - Pedal & Plunger



First create a sturdy brake pedal and attach it to the Base with a strong hinge. Bolt the hinge through the Base using approximately 2" elevator bolts. Do NOT use screws.

Drill a 1/4" hole in the top left and insert a 1/4" x 2-1/4" eyebolt. Use 1/4" nuts and washers on both sides to hold the eyebolt in place.

Now attach the included Awning Pulley by drilling a 1/4" hole centerline of the car located 10-1/2" to the rear of the Brake Mount. Insert a 1/4" x 1-1/4" elevator bolt from the Base bottom. Then place a 1/4" x 1-1/4" fender washer and a 1/4" x 1/2" tall spacer; followed by the awning pulley, a 1/4" flat washer, a 1/4" lock washer, and finally 1 1/4" nut.



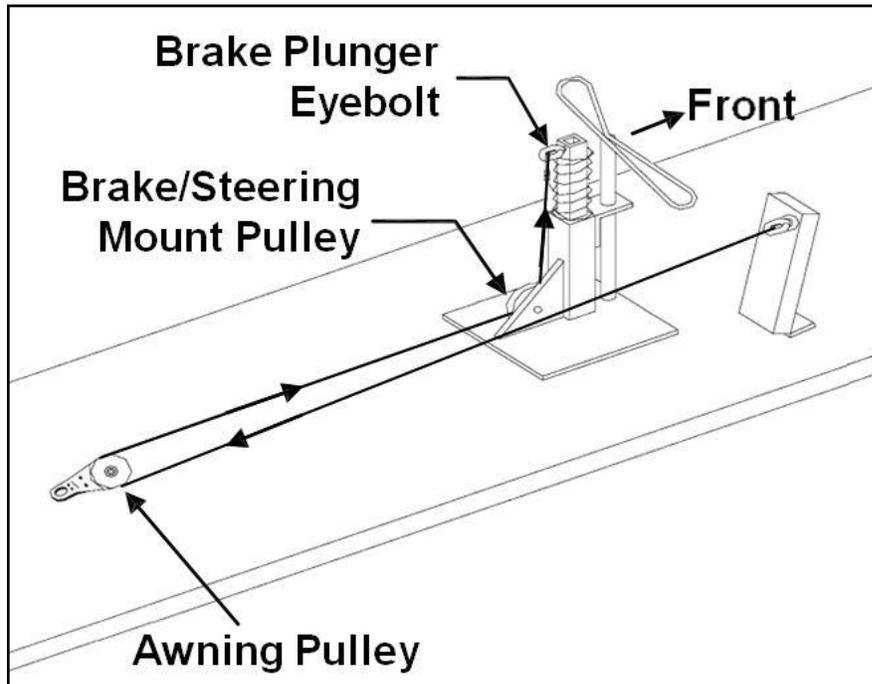
Next, attach the brake pad with the included hardware to the bottom of the brake plunger. It is recommended that approximately an eighth of the 1/4" flat head bolt (or three threads) is exposed.

Insert the brake plunger from the bottom of the car, up through the Brake Mount installed earlier. Be sure holes at the top of the Plunger are facing front to back. Set the included Spring onto the Plunger. Push the Spring down onto the Plunger and install a 1/4" x 2-1/4" eyebolt facing the rear of the car on the top of the plunger. Use a lock washer and 1/4" nut to tighten the eyebolt.



## Brake Installation - Cable

Next, install the brake cable. Attach approximately 5' of 3/32" cable (included in your starter kit) to the brake pedal eyebolt with two cable clamps. Run the cable through the awning pulley (which should now be located about 10 inches to the rear of the Steering Mount), then under the pulley on the side of the Steering Mount, finally ending at the eyebolt on the brake plunger. Be sure the cable is taugt and use two cable clamps on this end of the cable as well.



Your car is now substantially complete and is ready to be tested for steering and braking. Place the car on a gentle slope or have it pushed while the driver is behind the wheel. Have the driver check steering and braking. Brakes should respond to quickly stop the car. Check the wheel alignment (front to back) and be sure the rear axle assembly is square. Make any adjustments needed now while all parts are easily accessible (before the body is constructed). Now is a good time to add a seatback as well.



### Body Construction - Material Ideas

There are many ways to construct the body of your derby car. One of the easier woods to work with for its flexibility and ease of use is Luan. Luan will bend to form nice curves and can easily be mounted to the Base with screws. The demonstration car was constructed in this manner, and the following build plans are based on this type of wood. Please feel free to work with other build materials, but always keep in mind the total weight of the car with the driver must not exceed your weight class.

### Body Construction - Sides

If you have designed a simply shaped body it will be easy to measure the sides to get the total length of Luan needed. Also determine the height of the car based on your driver and their ability to flex forward during the race to cut wind drag. Once you know your dimensions then cut two equal pieces of Luan to form the sides. You should also cut two pieces of bulkhead (2x4s, etc) to be at the front and rear of the car to add sturdiness to the nose and frame, allow a place for the sides to meet and attach, and add rigidity to the nose for being placed on the starting ramp. In the photo below you can see how the front has been reinforced with a steel nose backed by a piece of 2x4 cut to shape.



## Body Construction - Top

Once you have attached your sides it's time to consider the top, including the cockpit access. On the previous page you can see in the photo that pvc piping was used around the top edge. The pvc is easy to mold to the correct shape and holds screws very well. Be sure to use proper length screws so the point does not come through to the interior which could be a hazard to the driver. Also, 1x2" cross braces were also used to give strength to the edges of the cockpit top.

Next, cut a length of Luan to the proper width and lay it on top of the car. Mark your edges and then cut your shape 1/4" inside your mark. This should allow the top to tightly set inside the sidewalls. Once cut, set your newly cut piece onto the top of the car and then sand the edges where needed to get a tight fit.



Next, cut out your cockpit entrance based on your drivers size. You may wish to consider how you can build a sturdier cockpit entrance as luan is easy to crack when weight is put on it, such as when the driver gets in and out of the car. One idea would be to make sure your cross braces (mentioned before) are placed at the rear and front edge of your cockpit to create a frame which moves the weight to the sides and the base.

Attach the top to the pvc piping so that it lays flush with the sides. Be careful not to tighten the screws too much or they may pull the top down too much or go through the luan. Drilling pilot holes and counter sinking the screws will provide a better finished look. Apply wood putty over screws, sand and paint your car.

Next you will want to attach the required padding to the edge of the cockpit entrance. Pipe insulation is a good choice as it will usually come with sticky tape on its edge ready to attach to the vehicle.

Remember. Be Creative. Have fun!

## PREPARING FOR RACE DAY

Now that your car is ready to race, your driver needs to gain experience and confidence. The Lions Downhill Derby will hold practice and qualification days on June 18th and 19th, before the race. Be sure to check the website often at: [www.LionsDownhillDerby.com](http://www.LionsDownhillDerby.com) All drivers have to pass qualification runs to enter the race. We also encourage you to join our Facebook page to post questions and get quick updates from the Committee: [www.facebook.com/LionsDownhillDerby](http://www.facebook.com/LionsDownhillDerby)

It is essential that you test the car carefully before qualifications and the race. Start on a flat driveway and give the car a healthy push, testing all systems. Ask your driver to execute steering maneuvers and also push hard on the brake. Your driver must be able to stop in a designated distance to qualify. On practice days a small hill will be available so the driver can work up to the higher speeds of the main hill.

## RACE DAY - JUNE 18-22, 2014

Race day will be here before you know it. Plan ahead on a way to transport your race car to the hill (pickup truck, trailer, van). Also, here is a list of some things you may want to bring with you:

- Car Platform: workmate, plastic totes, step ladders, etc
- Car Dolly: a device to pull your car from the pits to the starting gate.
- Tools: wrenches, pliers, screw drivers, etc
- Spare Parts: brake pads, hitch pins, cotter pins, nuts, bolts, weights.
- Helmet: You can't race without one!
- Misc: chairs, water, snacks, sunscreen, etc.

## SAFETY AND SPECIFICATION CHECKLIST

The following conditions are to be adhered to. The Lions Downhill Derby Committee is the only body permitted to make concession for non-compliance. Their decision is final.

The term “Major Component” refers to the following:

Steering system (Steering wheel, cable, pulleys, connectors etc.)

Braking system (Foot pedal, cable, pulleys, connectors, pads etc.)

Suspension system (wheels, axles, axle supports etc.)

## STRUCTURAL SAFETY

- All steering and brake system turnbuckles must be prevented from turning due to vibration.
- All “Major Components” must be mounted securely with through bolts, lock washers and nuts.
- All steering and brake system cables must remain snug throughout movement extremes.
- All steering and brake system cables must be terminated with double crimps/clamps.
- All parts of the “Major Components” must be accessible for visual inspection.
- Wheels must be secured via hitch pins, cotter pins, or other secure method.
- Wheels must not bind or rub anywhere throughout movement extremes.
- Axles must be securely fastened.
- No sharp objects are to be in the vicinity of the driver when seated.
- Car must be reasonably solid in construction and free of loose parts.
- AASBD steering/brake system must be used.
- Steering/brake cable must be 3/32".
- Wheels in starter kit must be unaltered. Painting of wheels allowed.
- Steering stops must be adequately positioned to limit steering.
- Car must not exceed weight limit for your selected weight class.

## DRIVER PROFICIENCY - QUALIFYING

- Brakes must be operated satisfactorily by the driver.
- Driver must be able to stop within the designated braking area.
- Steering must be operated satisfactorily by the driver.
- Driver must stay in their designated lane at all times.
- Driver must have proper fitted helmet.
- Driver must behave in a serious and mature manner in the race area.
- Driver must understand the structure of the race regarding:
  - Staying in own lane
  - When to brake

The driver must meet all of the above requirements and pass qualification to be allowed on the hill on race day. Should your car not pass you must make the necessary adjustments and have it re-inspected. Reasonable effort will be made to have your car qualify; but safety is the first priority!

CONTACT INFORMATION:

You may contact the Lions Downhill Derby at:

**[www.LionsDownhillDerby.com](http://www.LionsDownhillDerby.com)**

**[www.facebook.com/LionsDownhillDerby](https://www.facebook.com/LionsDownhillDerby)**

PO Box 732

Connersville, IN 47331

(765) 265-1273

scs47331@frontier.com

If you would like to volunteer for race day, please call (765) 265-1273.

There will be a LOT of help needed on race day!

Please join us to help make this an enjoyable and successful derby!

