

## Grand Prix Speed Tips

Grand Prix cars are gravity-powered vehicles. They start the race on a sloped track held back by starting pins. When the pins drop, the cars roll down the sloped track towards the finish line, guided by rails. Most tracks are built with a transition from the sloped starting section to a long flat section. On these tracks, cars must complete the flat section while maintaining as much speed as possible.

The only force that can be used to make the car move is gravity. But since gravity is a constant there is nothing you can do to get more! Fortunately, there are things you can do to get the most from this constant force.

While our ally, gravity, pulls the car down the sloped track, our enemy, friction, is hard at work slowing down the car. In every place where moving parts are in contact (wheels rubbing on the track, the axles, the car body, and the guide rails) friction is at work. Even the air flow over the car body is a form of friction that slows down the car.

A final factor that must be considered is momentum. In an automobile, momentum helps the car keep rolling when you take your foot off the gas. In a similar way, momentum helps a grand prix car to continue rolling as fast as possible on the flat section of the track.

So, to build a fast car you must maximize momentum and minimize friction. How is that done? Keep reading to find out how.

### The 5 Keys to Grand Prix Performance

Champion car builders have discovered many secrets for getting the most speed from a car. However, there are 5 Keys to Grand Prix speed performance. Whether or not you learn all of the extra little tricks, careful application of these 5 Keys will guarantee that you will have a competitive car.

#### Key 1 - Maximize Momentum

As stated earlier, momentum must be maximized for top performance; and the key to momentum is weight. In each race, there is a maximum allowable weight for the car (usually 5 ounces, but certainly check your local rules). Momentum is maximized when your car has the maximum allowable weight for your race.

For a five ounce maximum weight, you will likely need to add 2 or 3 ounces of weight to the car. But where on the car do you add the weight? Add weight towards the rear of the car.

Tests show that best performance is achieved on most tracks when the weight is added towards the rear of the car. This can be overdone, but a simple test to make sure the car is

properly weighted is to balance the finished car on a Balance Stand. The car should balance about 1 inch in front of the rear axle.

Does the type of weight matter? The maximum weight can be achieved with any type of weight; however, the type of weight does affect how easily the desired weight can be achieved. Denser weights (such as Lead or Tungsten) take up less space, so it is easier to reach the maximum weight. Also, since denser weights require a smaller volume of space, they allow creation of more aerodynamic cars (which is Key number 2).

## Key 2 - Aerodynamic Shape

There are many elaborate ways to improve aerodynamics, but to simplify matters, let's use the following principles:

1. Low-profile cars (smaller surface area as viewed from the front of the car) will tend to outperform higher-profile cars.
2. Cars should taper from a smaller surface area in the front to a (possibly) larger surface area in the rear.
3. Edges running across the car should be rounded or tapered.
4. Wings, sails, flags, pennants, etc. add to the surface area, thus they tend to decrease performance.
5. Unfilled (major) holes or pockets can catch air and slow down a car.

Key 2 (aerodynamics) is not as important as the other 4 Keys, so don't sacrifice looks to achieve an aerodynamic shape. So, if you want to build a car that is not particularly aerodynamic, don't worry about it. Just make sure that the other 4 Keys are carefully followed.

## Key 3 - Wheel & Axle Preparation

All of the frictional losses in a car come from the wheels and axles. Start by inspecting the parts in your kit to make sure they are usable. If a part has a serious flaw, replace it.

Next, prepare the nails.

1. Place the nail in the chuck of a drill and use a Mini-File to remove the flashing under the nail head and minimize the ridges on the shaft. Beveling the nail head slightly is also a good idea.
2. Optionally use a press to ensure that the nails are straight and round.

3. Finally, polish the axles with fine sandpaper or steel wool until they are bright and shiny.

To prepare the wheels, use a mandrel and some wet, fine grit sandpaper to polish the wheels. If allowed by your local rules cone the inside wheel hubs.

#### Key 4 - Lubrication

Lubrication is an extremely important key. The difference in time between a well-lubricated car and a car without lubrication can be one-half second or more (this translates into several feet on the track).

Most people use graphite for lubrication. Graphite is carbon that has been ground up into a fine powder. There are many varieties and qualities of graphite available at hobby and hardware stores, so make sure to get a good brand.

When lubricating with graphite, take the time to work it in thoroughly; a casual puff before the race is not sufficient. After lubricating, make a few test runs to break in the lubricant (or free spin the wheels several times). Since graphite works best after a break-in period, don't re-lubricate between race heats.

#### Key 5 - Alignment

In order for the car to get to the finish line as quickly as possible, it needs to go straight. If it zigzags down the track, it will travel a longer distance, but worse it will continually lose speed as it bumps and rubs against the guide rail.

To minimize the amount of alignment adjustment needed, make sure that the axle slots/holes are perfectly parallel to each other and the axles are straight. Also, when using axle slots, make sure that the axles are inserted perfectly straight.

There are a few different alignment procedures, but the simplest method is as follows:

1. Determine which of the front axles appears to be the most firmly on the ground (or with a raised wheel, adjust the wheel/axle that is on the ground).
2. Remove the axle from the car and remove the wheel.
3. Put a slight bend in the axle.
4. Replace the wheel and re-insert the axle with the bend upwards.
5. Roll the car on a smooth and level surface.
6. If it does not roll straight, slightly rotate the bent axle by grasping the axle head with a pair of pliers.