HOW TO **BUILD**

Before you build a car, you need tools and materials. Even before you design a car that you know you can build, you need tools and materials. That is part of engineering: designing based on the resources available to you, either what you have on hand or what you can afford to purchase.

Pitsco and other sources have a variety of kits, materials, and tools to help you build your dream race car.

PITSCO
EDUCATION

MATERIALS AND TOOLS

These are the building blocks of your car. What kind of kit you choose depends on what your ultimate goal is and what tools you have available.

EASY

If you're simply looking for the experience of building a basic car and seeing it race down the track and you have almost none of the traditional woodworking tools available, you'll probably lean toward kits such as the Pitsco EZ Build Dragsters, laser-cut wood cars that require only white glue and a small screwdriver to assemble.

INTERMEDIATE

For those with some shaping tools such as coping saws and wood files, the Pitsco Precut Dragsters are a great solution. They offer four different rough shapes cut from basswood with predrilled cartridge holes – you fine-tune the design and add the perfect finish.

CHOOSING A BLANK: Check out our expert's tips on whether to choose balsa or basswood.

ADVANCED

If you have all the common shop tools such as a drill press and band saw, then you can start with a traditional dragster blank or kit.

The type of kit that would be used at the Dragster Design event at TSA and many school competitions is something like Pitsco's Metric Dragster Kit or LSRAV Dragster Kit. Pitsco sells several complete CO_2 race car kits and an exhaustive supply of wheels, paints, decals, and speed accessories.

If you're going for a CO_2 car that looks more like a real car, go for something like the Custom Cruiser Vehicle Design Kit, which includes the larger balsa wood body blank so you can create a design more like your favorite hot rod or sports car.

All of Pitsco's traditional kits – including the Metric Dragster Kit and LSRAV Dragster Kit – provide a balsa or basswood body blank, four wheels, washers, axle tubes, screw eyes, sandpaper, and a CO_2 cartridge (there are also class-size packages available). However, students might prefer to find different wheels or make their own and add other accessories.

WHEELS

Wheels are a key point in any dragster because of the friction of the axle as it spins, as well as the friction of the tire meeting the road. There are two options: buying and using premade wheels, which come in a variety of designs and sizes, or making your own wheels from a cylinder of acetal and using a lathe.

Manufactured wheels are a good solution for those just starting out in the activity; however, more advanced dragster designers and competitors will generally make their own.

CO_2 CARTRIDGES

This is the energy source, or fuel, of the dragster. Consider quality, safety, and consistency when buying cartridges for your races. Cartridges contain a consistent amount of gas, and safety seals guard against rupture when cartridges are exposed to excessive heat.

Eight-gram cartridges are the standard for full-length tracks.

Four-gram cartridges are great for shorter tracks (50 feet or fewer) to reduce potential for car damage during the sudden deceleration at the end of the race.

TOOLS FOR BUILDING A DRAGSTER

An essential part of building a CO_2 race car is having the right tools. Quality cars can be shaped from simple hand tools such as a coping saws, files, and a sharp knife. On the other end of the spectrum, an increasing number of classrooms are manufacturing race cars on CNC mills (a great way to experience the CAD/CAM process).

In the middle are those with access to a band saw and drill press. The building process is virtually the same when using hand tools. **Note:** Instructions in this document represent the middle ground in this area and assume that you have access to a band saw and a drill press.

BASIC TOOLS

- Wood rasp
- Half-round wood file
- Coping saw
- Sandpaper
- Ruler
- Scissors
- Spray paint
- 5/8" dowel (18" long)
- Scale

POWER TOOLS (OPTIONAL)

- Drill press
- Band saw
- Belt/disc sander
- Rotary multi-tool with accessories
- Carving tool set

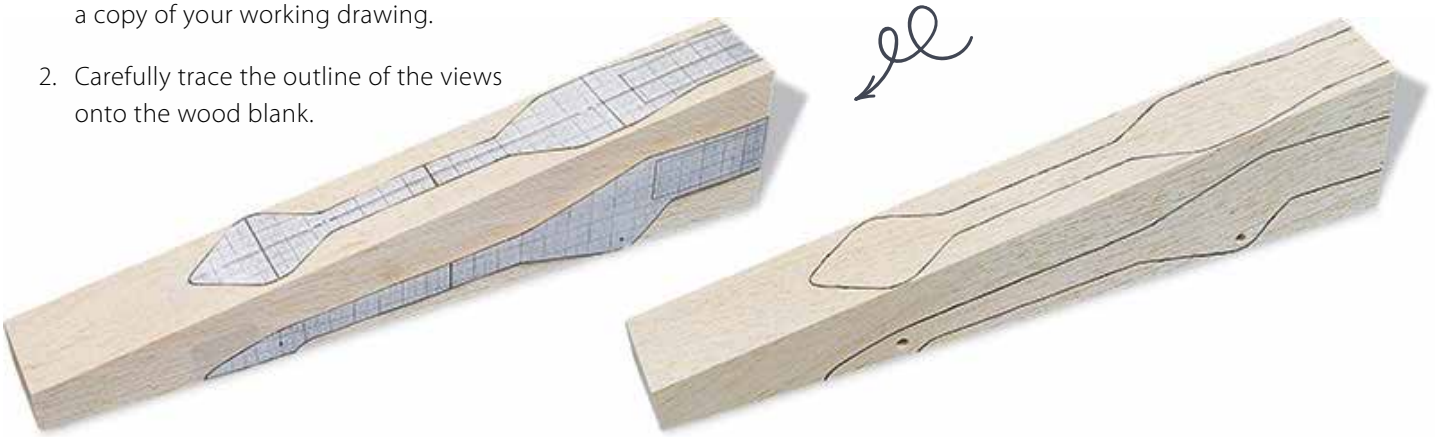
TEMPLATE TRANSFER **AND** AXLE HOLES

Ready to transform that block of wood into a sleek road rocket? It's time to get busy.

TRANSFERRING DESIGN TO BODY BLANK

1. Cut out the top and side (profile) views from a copy of your working drawing.
2. Carefully trace the outline of the views onto the wood blank.

TIP: Template Alternative: Use adhesive spray to attach blank-shaped templates to the top and a side of the blank. Drill and cut the blank with paper templates attached.



DRILLING AXLE HOLES

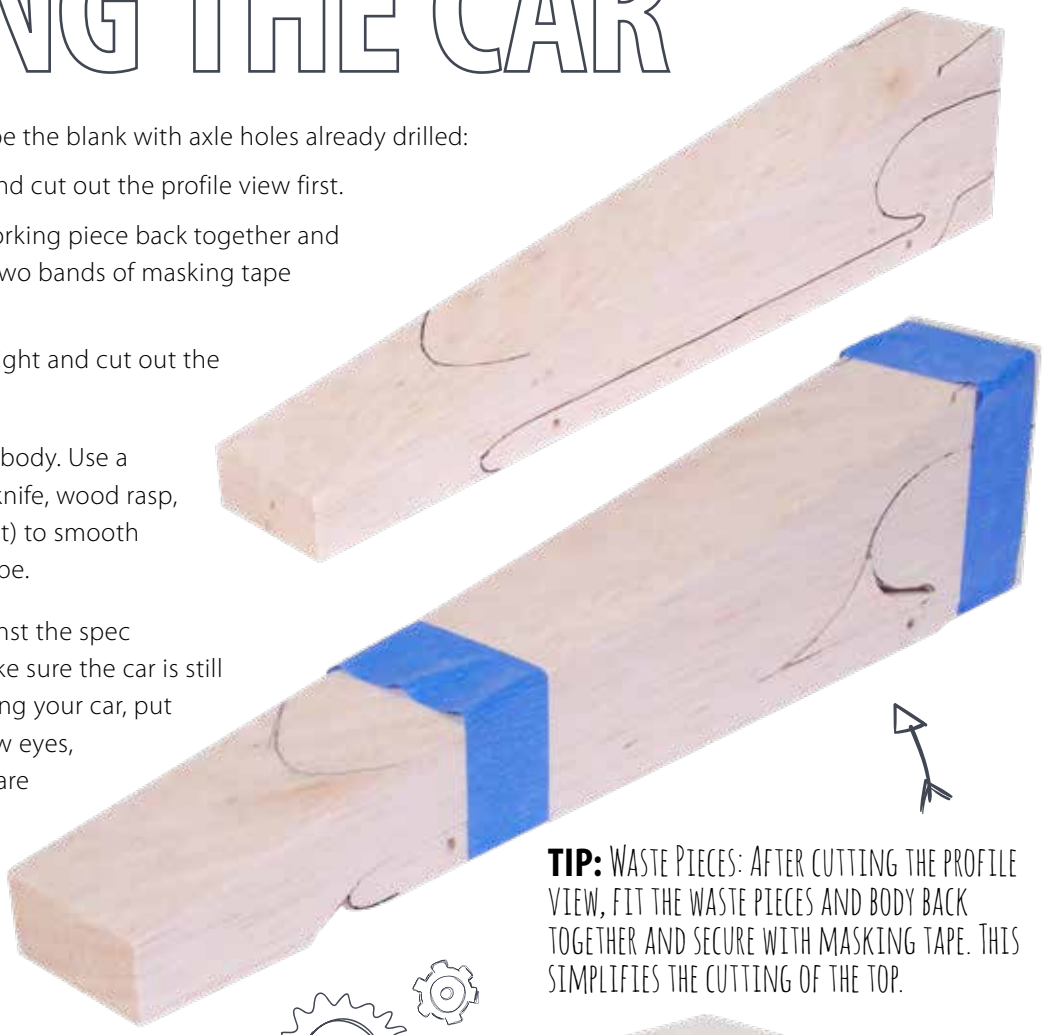
1. Transfer the axle hole locations onto the blank by using a sharp, pointed tool such as an awl to puncture through the template and into the wood blank.
2. Lay the car blank on its side and drill the axle holes. Axle holes should be drilled perpendicular to the car's longitudinal axis in order for the car to roll freely and straight down the track. A drill press is highly recommended because it makes drilling perpendicular holes a cinch.

TIP: Drill First: Axle holes in the body blank should be drilled before doing any shape cutting. Otherwise, it's difficult to drill straight.

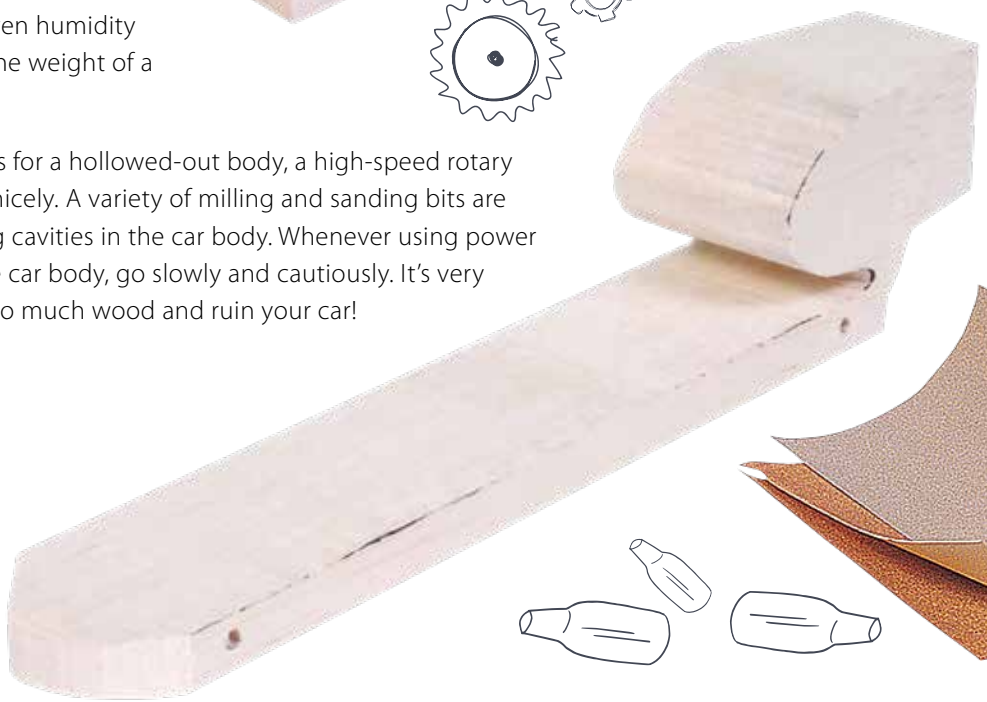
CUTTING AND SHAPING THE CAR

1. Use a band saw to roughly shape the blank with axle holes already drilled:
   - Turn the blank on its side and cut out the profile view first.
   - Fit the waste pieces and working piece back together and secure them by wrapping two bands of masking tape around the assembly.
   - Set the blank assembly upright and cut out the top view.
2. Smooth the corners of your car body. Use a bench-mounted sander, sharp knife, wood rasp, files, or rough sandpaper (80 grit) to smooth the car to its basic rounded shape.
3. Periodically check your car against the spec sheet (especially weight) to make sure the car is still within tolerances. When weighing your car, put the wheels, axles, washers, screw eyes, and any other necessary hardware on the scale along with the body to get a more accurate finish weight.

   Note: Keep in mind that even the paint finish will affect the weight slightly. Even humidity levels can affect the weight of a body blank.
4. If your design calls for a hollowed-out body, a high-speed rotary multi-tool works nicely. A variety of milling and sanding bits are helpful for making cavities in the car body. Whenever using power tools to shape the car body, go slowly and cautiously. It's very easy to remove too much wood and ruin your car!



TIP: Waste Pieces: After cutting the profile view, fit the waste pieces and body back together and secure with masking tape. This simplifies the cutting of the top.

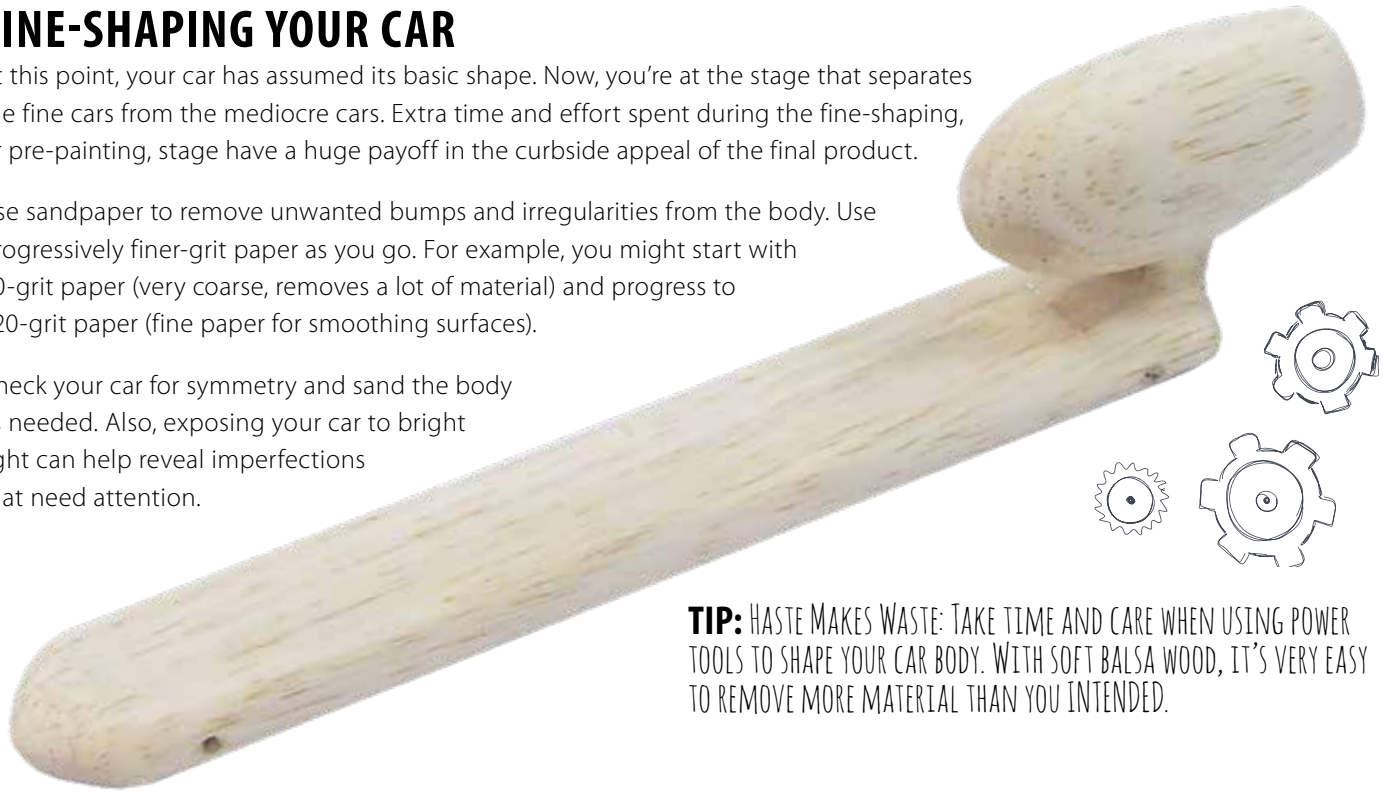


FINE-SHAPING YOUR CAR

At this point, your car has assumed its basic shape. Now, you're at the stage that separates the fine cars from the mediocre cars. Extra time and effort spent during the fine-shaping, or pre-painting, stage have a huge payoff in the curbside appeal of the final product.

Use sandpaper to remove unwanted bumps and irregularities from the body. Use progressively finer-grit paper as you go. For example, you might start with 80-grit paper (very coarse, removes a lot of material) and progress to 220-grit paper (fine paper for smoothing surfaces).

Check your car for symmetry and sand the body as needed. Also, exposing your car to bright light can help reveal imperfections that need attention.



TIP: Haste Makes Waste: Take time and care when using power tools to shape your car body. With soft balsa wood, it's very easy to remove more material than you intended.

PAINT, WHEELS, AND HARDWARE

As in the fine-shaping stage, extra patience and effort put into the finishing stage can pay big dividends. Be aware that using several coats of paint can add weight to your car.

- Insert a two-foot length of 5/8" hardwood dowel into the power plant housing of the car body. This makes a very convenient handle for turning the body to paint it from all angles. Pitsco also makes a dragster paint stand for this purpose.
- Use a spray can or airbrush to apply paint to the body. Spray light coats and wait several minutes between coats to allow the paint to dry.

TIP: Custom Graphics: Pitsco offers an extensive selection of decals and pinstripes specially designed for CO_2 race cars.

FINAL ASSEMBLY: MOUNTING WHEELS AND HARDWARE

Don't overlook the importance of this stage. A huge factor in race performance is how smoothly the car rolls down the track. Some meticulously shaped cars have failed to finish races because of improperly installed hardware!

1. Gather your hardware: two axles, two straw bearings, four wheels, four washers, and two screw eyes. Depending on the configuration of the car body, different hardware might be required. Shell cars (with internal wheels) often require wheel spacers and clips to affix the axles to the car body.
2. Check your spec sheet for rules about wheels, axles, washers, and spacers.
3. Carefully mount the wheels and axles as dictated by your design. Be careful not to damage the fragile car body during installation. Pitsco's Wheel Deal is recommended for avoiding car damage while installing wheels and axles.
4. Roll-test the car on a smooth, horizontal surface. The car should roll freely, and the wheels should spin without restriction. Make adjustments if necessary.
5. Install the screw eyes on the underside of the car body. **Important:** Plan the location of the screw eyes so the guideline does not rub against the car body or wheels.

TIP: Screw Eyes: Don't use screw eyes that are partially open. Doing so can cause your car to detach from the guideline and slow or even damage your car.

ADDITIONAL RESOURCES

If new to the dragster activity, there are many resources to help guide the process, from books to free online tutorials.

Pitsco also offers a selection of videos including the Dr. Zoon Dragster Video Series on DVD. Titles include:

- *Dragster Design*
- *Dragster Production: Hand Tools*
- *Dragster Production: Power Tools*
- *Dragster Finishing*
- *Dragster Testing*
- *Precut Dragster*
- *EZ Build Dragster*

Also consider Pitsco's Science of Speed 2 curriculum, two units that help teachers get the most out of the CO_2 dragster activity in the classroom! Offered in both digital and printed format.

CHECK OUT:
Our Science of Speed 2 curriculum

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