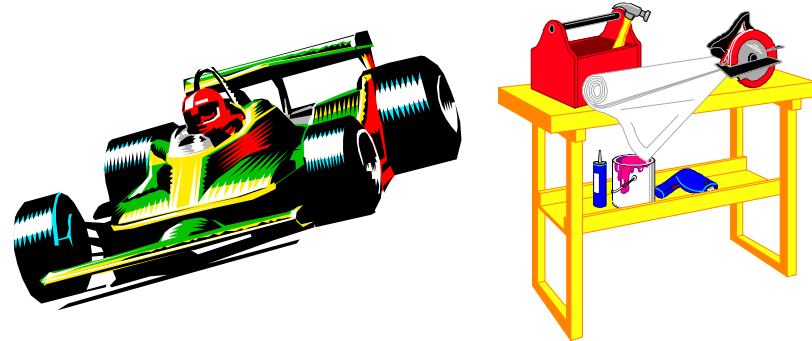


Maximum Velocity!™



Free
Pinewood Derby Car Plan

Maximum Velocity!

Free Pinewood Derby Car Plan

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Important Printing Information

While the booklet is open, use the File > Print command of Adobe Acrobat Reader (not the shortcut on the toolbar) and make sure the 'Fit to page' 'Shrink' or 'Expand' options are NOT selected. This ensures that the templates are printed to scale.

This booklet has some complex drawings that can overwhelm some laser printers equipped with small amounts of printer memory. If the printer does not successfully print the booklet, try the following:

- a) Using the printer's print properties, reduce the number of dots per inch (dpi) from 600 to 300 and try to print the booklet again. This usually resolves the problem.
- b) If a problem still occurs, leave the printer setting at 300 dpi and print one page at a time.
- c) Try printing on another printer, especially an inkjet printer.

Axle Slot Measurement

The standard wheelbase templates in this booklet use the official measurements from the Cub Scout Derby - Grand Prix Pinewood Derby Kit. However, the position of the axle slots in these kits (and kits from other manufacturers) are not always consistent with the official measurement.

If the slots on your block do not exactly match the slots on the template, line up the front axle slots and trace the front portion of the template, then line up the rear axle slots and trace the remainder of the template.

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Maximum Velocity!

Free Pinewood Derby Car Plan

Introduction

Welcome to the world of Pinewood Derby racing! This booklet provides you with a plan for building a basic Pinewood Derby car.

The plan in this booklet provides for best weighting and weight location. However, to build a car that reaches *Maximum Velocity!* you must also prepare the wheels and axles, and lubricate and align the wheels. If you don't know how to do these steps, detailed information is provided in the companion booklet, "*Maximum Velocity! - Pinewood Derby Car Construction Guidelines*".

To reach *Maximum Velocity!*, you must fully understand the car building process, and allow enough time to build the car. Please read this entire booklet, and understand the plans *before* starting to build the car. Also, *follow the steps in order*. The sequence of construction was chosen based on actual experience from building the car.

The plan in this booklet is organized very similar to the car plans in our other booklets. The differences are as follows:

- This free booklet contains the plan for 1 car. Our other booklets have plans for 3 cars.
- The plan in this free booklet can be used to build a car with the standard (scouting) wheelbase. The plans in our other booklets support the standard wheelbase and the extended wheelbase.
- A few informational sections contained in our other booklets have not been included in this free booklet. However, they do not affect the ability to build the car.

Maximum Velocity!

- Car Plan Booklets
- Lead and Tungsten Weight
- Decals
- Wood blocks and kits
- Axle Polishing Kit
- Display Stands and Cases

Visit us at: www.maximum-velocity.com

Tools and Supplies

In order to build the car in this booklet, you must have access to the tools and supplies listed below.

- 3.75" of 3/8" lead wire (*available from www.maximum-velocity.com*)
- Pencil
- Ruler
- Saw - A Back saw, Hack Saw, or Coping saw all work well for making the major cut. A Hack Saw is best for creating the triangular detail.
- Cutting tool capable of cutting lead - Diagonal Cutters work well
- Drill - An electric hand drill is fine. A drill press is like heaven on earth!
- 3/8" Drill bit (*Brad Point, Forstner, or equivalent*)
- Clamp or vise - To hold the wood block when drilling and cutting
- Particle mask and eye protection
- Sanding block
- Sandpaper - 60, 120, 240, 400, and 600 grit
- Paint Supplies
 - ⇒ One 2-1/2" or longer dry-wall screw (to insert into the body as a handle for painting) (*Hardware store item*)
 - ⇒ Clothes pin or binder clip - To hang up the car while drying
 - ⇒ Sanding sealer or wood primer (*Optional*)
- If spray painting (*suggested for older builders*):
 - ⇒ Spray paint - Krylon-brand paint is suggested
 - ⇒ Plastic bag - Large enough to cover your hand and wrist
 - ⇒ Rubber band - To hold the plastic bag to your wrist
- If brush painting (*suggested for younger builders*):
 - ⇒ Paint - Acrylic paint is suggested as it cleans up with water
 - ⇒ Paint brush (*1 to 2" wide*)
- 2" of 3/8" dowel rod
- Epoxy - 30 minute variety
- Toothpicks - To mix and apply the epoxy
- White or Carpenter's glue
- Wood Putty
- Graphite (used to lubricate the holes to ease insertion of the lead wire)

Important Safety Information

In order to keep from getting hurt, follow these rules:

1. **Protect your eyes** - Always wear eye protection.
2. **Protect your lungs** - Wear a mask when drilling, sawing, sanding, and spray painting.
3. **Protect your hands** - Be careful with sharp cutting edges. Treat them with respect.
4. **Be safe when using a drill** - To avoid serious injury, tie up long hair and avoid loose clothing when drilling.
5. **Be careful with lead**¹ - With long exposure and when ingested, lead is toxic. Therefore:
 - Wash your hands after handling lead.
 - Keep lead away from food, water, and food preparation areas.
 - Collect and properly dispose of any lead pieces.

Wheel Bases

The car plan in this booklet supports wheel bases (distance between the front and rear axles - see Figure 1) as follows:

- **Standard Wheel Base: Supported** - Scouting kits have this wheel base. One pre-cut axle slot is closer to the end of the car than the other. *The slot closer to the end is used for the rear axle.*
- **Extended Wheel Base: Not Supported** in this free booklet.
- **Centered Wheel Base: Not Supported** - Awana kits have this wheel base. To use these plans you must purchase a block with a standard wheel base.

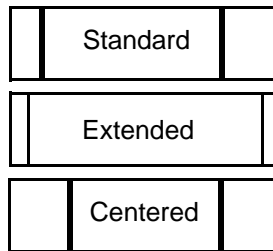


FIGURE 1
Wheel Bases

¹Serious Pinewood Car builders use lead for weighting cars. No-lead weighting material is available at hobby stores, however, that material is much less dense than lead, thus requiring the use of more material. In addition, the non-lead material is very hard, making it difficult to shape, cut, and drill. Thus, the designs in this booklet are based on lead as the weighting material. Modifications to the designs are required to use a non-lead weighting material.

THE WEDGE TURBO

THE WEDGE TURBO (Figure 2) is a relatively easy car to build, as it requires a minimal number of tools and woodworking skills. Three ounces of lead weight are required for THE WEDGE TURBO. Most of the lead weight is inserted into holes drilled into the back of the car, while a small portion of weight is placed under the car. This underbody weight will be reduced with a drill at the weigh-in, bringing the car to exactly 5 ounces.

Step by Step Plans for THE WEDGE TURBO

Marking the Block

1. Locate and remove the templates from the booklet. *Make a copy of the templates onto cardstock and use the copy not the original.*
2. Write “Back” on the end of the block closest to an axle slot. Then write “Right” on the right side of the block.
3. Perform the steps under “*Preparing Axle Slots*” on page 8.
4. Cut out template W2 on the *solid lines*. Place W2 on the right side of the block, making sure that the bottom and back of the drawing are aligned with the bottom and back of the block. Trace the outline on the block.
5. Turn template W2 over to the blank side and place it on the left side of the block. Make sure that the bottom and back of the drawing are aligned with the bottom and back of the block. Trace the outline and remove the template.
6. Cut out template W3. Place W3 on the bottom of the block, making sure that the rear of the template is at the rear of the block. Mark the center of the lead holes by pushing a pencil tip through the template into the wood. Remove the template.
7. Cut out template W4. Place W4 on the back of the block, making sure that the bottom of the template is aligned with the bottom of the block. Mark the center of the two lead holes by pushing a pencil tip through the template into the wood. Trace the top line and remove the template.



FIGURE 2
THE WEDGE TURBO

Cutting the Lead Wire

1. Using the cutters, cut the lead wire as follows:
 - ⇒ Two: 1-5/8” pieces
 - ⇒ Two: 1/4” pieces
2. If the lead pieces are bent, reshape them as needed by tapping the lead

segments with a hammer on a hard surface (concrete floor). *Make sure that none of the segments are larger than 3/8" in diameter.*

Drilling the Block

1. Clamp the wood block with the back facing upwards. Mark a depth of 2-1/8" on the 3/8" drill bit with masking tape (see Figure 3). *Measure the distance from the outside tips of the bit, not from the center tip.*
2. Drill the two rear lead holes. Make sure that both of the holes are parallel with the wood block, and are drilled no deeper than the tape on the drill bit.
3. Clamp the wood block with the bottom facing upward. Mark a depth of 3/8" on the 3/8" drill bit with masking tape.
4. Drill the bottom lead holes. Make sure that the holes are drilled no deeper than the tape on the drill bit

Inserting Lead in the Rear Holes

1. Cut two, 1" pieces of 3/8" dowel rod.
2. Squirt a small amount of graphite into each of the rear lead holes.
3. Insert a 1-5/8" piece of lead into one of the rear lead holes. Push the lead in as far as possible by hand. If the lead is bent, straighten it out.
4. Place one of the dowel rod pieces on top of the lead wire, and use a hammer to drive the lead completely to the bottom of the hole.
5. Repeat steps 3 and 4 for the other rear lead hole.
6. Insert ample glue into both rear lead holes and insert one of the dowel rod pieces into each hole.
7. Use masking tape to hold the dowel rod pieces in place, and allow the glue to dry before continuing.

Cutting the Block

1. Clamp the wood block in place.
2. Cut off the excess dowel rod on the back of the block. Avoid scarring the rear of the car with the saw.
3. Using the drawing on the right and

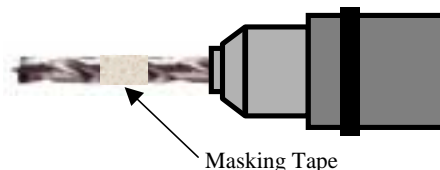


FIGURE 3
Marking the Drill Bit for Depth

material outside of the line. *Make sure the cut is outside the line.* Save the scrap piece of wood for later use.

4. Use the 60 grit sandpaper to sand the newly cut surface down to the line, and to remove the remainder of the dowel rod on the back of the car.
5. Shape the curve on the front of the car with the sandpaper.

Creating the Triangular Detail

1. Cut template W2 on the *dashed line*.
2. Place W2 on the right side of the block, making sure that the bottom and back of the drawing are aligned with the bottom and back of the block. Trace the newly cut line on the block.
3. Turn template W2 over to the blank side and place it on the left side of the block. Make sure that the bottom and back of the drawing are aligned with the bottom and back of the block. Trace the newly cut line.
4. Cut out template W1 on the *solid lines*.
5. Place template W1 on the top of the block, making sure that the back of the template aligns with the back of the block (see Figure 4). Trace the outline and remove the template.
6. Clamp the wood block in place with the top facing upwards.
7. Place the Hack Saw blade on the line on the right side of the car. Holding the blade parallel with the line on the top of the car, cut until the saw blade is even with the line on the top of the car (see Figure 5).
8. Place the saw blade on the right-side line on the top of the car. Holding the blade parallel with the line on the side of the car, cut down until the blade reaches the previous cut.
9. Repeat the previous steps for the left-side



FIGURE 4
Placement of Template W1

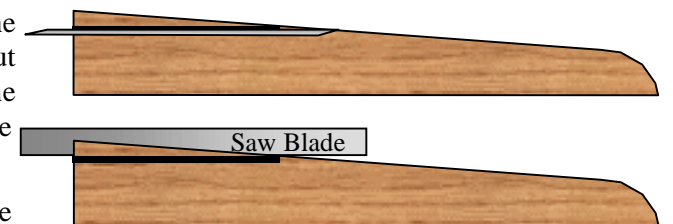


FIGURE 5
Cutting the Triangular Detail

triangular detail.

10. Finishing shaping the triangular area using 120 grit sandpaper. Wrap the sandpaper around a piece of wood with a square edge (the wedge-shaped scrap piece of wood is fine) to help shape the area.
11. It is not necessary to remove all gouges as they will be filled with wood putty.

Sanding, Detailing, and Painting

1. Follow the steps under “*Sanding the Car Body*” on page 9.
2. Follow the steps under “*Painting the Car Body*” on page 9.
3. To create a two-tone paint job, do the following:
 - Paint the entire car with the base color.
 - Use masking tape and paper to mask off the areas you do not wish to paint with the accent color.
 - Paint the exposed area with the accent color.
 - When dry, remove the masking tape. Any tape residue can be removed with a clean piece of masking tape.
4. The stripes and stars on the example car were created with 1/4” pinstriping. A set of 1/4” stars is included on the template.

Finishing the Car Body

1. Remove the screw and lay the car on its back on a clean rag.
2. Mix epoxy per the epoxy instructions and install the remaining pieces of lead in the bottom lead holes. Leave the car on its back until the epoxy is firm. NOTE: If desired, this step can be performed at the weigh-in.
3. Apply any desired decals, pinstriping, personalized painting, etc.
4. Attach car numbers (if required for your race).
5. Complete the car as described under “*Completing The Car*” on page 10.
6. Store the car until the weigh-in. See page 11 for weigh-in instructions.

Congratulations! You have built THE WEDGE TURBO.

Preparing Axle Slots

Before beginning construction, perform the following steps to prepare your axle slots.

1. Use a piece of notebook paper (or a square if you have one) to check if the slots are square with the car body (see Figure 6). If a slot is not perfectly square with the body, either re-cut the axle slots on the opposite side of the car, exchange the car kit for a new car kit, or purchase a new block at a hobby store.
2. Sometimes the wood block will split when the axles are inserted into the axle slots. To prevent this from occurring after you have built the car, place the block on its side, insert an axle into a wheel, and use a hammer to *gently* tap the axle into one slot (see Figure 7). Pull the axle back out of the slot by hand and repeat the process for the other three slot positions. If the wood block splits, exchange the car kit, or purchase a new block at a hobby store.

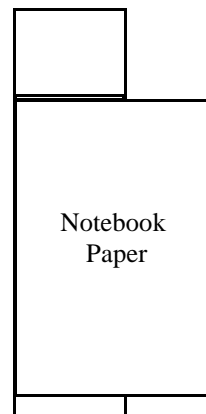


FIGURE 6
Checking for Square Axle Slots

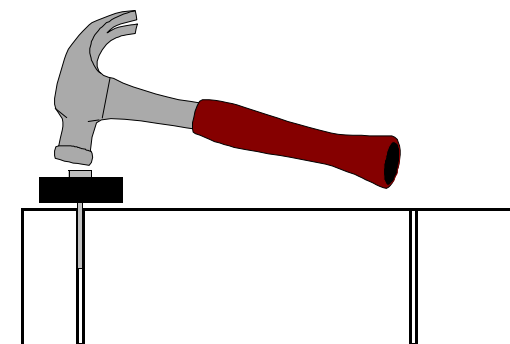


FIGURE 7
Pre-inserting Axles to Check for Splitting

Sanding the Car Body

Perform the following steps to sand the car body:

1. Fill any gouges, holes, etc. with wood putty.
2. Allow the wood putty to dry before continuing.
3. Sand the entire car with 120 grit sandpaper. To smooth in the triangular cut-outs, wrap the sandpaper around the edge of the scrap piece of wood.
4. Switch to the 240 grit sandpaper, and re-sand all sides.
5. Switch to the 400 grit sandpaper, and re-sand all sides.
6. Lightly sand all edges of the car to remove the sharp corners.
7. Use a rag to wipe off all excess wood dust, and remove any wood dust in the axle slots/holes.

Painting the Car Body

Perform the following steps to paint the car body:

1. Insert the 2-1/2" screw at an angle into the side of the bottom lead well hole about 1/4" (Be careful, don't go all the way through the car!). This screw is used to hold the car while painting, and while drying.
2. If desired, apply one or more coats of sealer/primer per the recommendation on the container. Lightly sand with 600 grit sandpaper between coats.
3. Apply a coat of paint. If spray painting, put the plastic bag over one hand and secure it with a rubber band around the wrist. In an area free of wind and dust, attach the clothes pin or binder clip to the screw and hang the car up to dry (We use a short piece of wire between two shelves in the garage as a 'Car Line'). Allow the car to dry.
4. Using the 600 grit sandpaper, *gently* sand all surfaces of the car.
5. Repeat steps 3 to 4 until you are satisfied with the paint job. Don't sand the car the last time!

Completing The Car

Now that the car body is finished, it is time to complete the car. Note that steps 1 and 2 below can be performed while the glue and/or paint is drying on the car. If you are not sure how to perform any of the steps below, please refer to the companion booklet "*Maximum Velocity! Pinewood Derby Car Construction Guidelines.*"

1. Prepare the wheels and axles
2. Apply Lubrication
3. Axle Slots Only - Press the axles into the axle slots with your hand, or use pliers to twist them into the slots.
4. Axle Holes Only - Insert the axles into the axle holes. If the axles do not fit tightly, then a tiny amount of glue can be placed into the hole with a toothpick before inserting the axle. ***Before inserting the axle, wipe off any glue that got on the body!***
5. Align Wheels
6. Axle Slots Only - To keep the axles from becoming misaligned during the race, place glue in the axle slots on top of the axles (see Figure 8). Use epoxy, hot glue, white glue, or a similar product. ***Keep the glue away from the wheels!*** Remove excess glue, making sure that the glue does not hang down below the car, reducing the clearance to less than 3/8". Set the car on its back to dry for 24 hours.

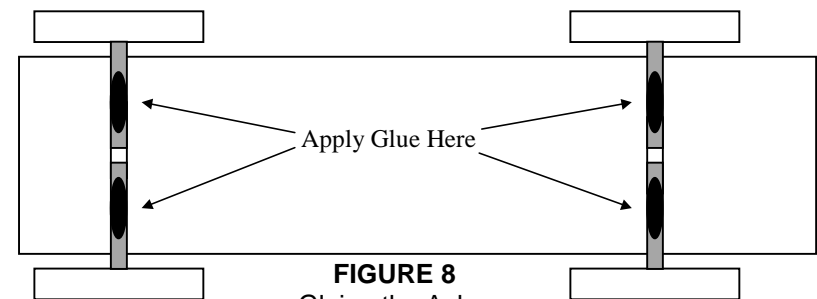


FIGURE 8
Gluing the Axles

Important!

Apply glue to the axles at least 24 hours before the weigh-in. If the glue is not dry, the wheels could become misaligned during the weigh-in and staging/storage process. Do not use a thin glue such as super glue. The glue may run down the axle and into the wheels, causing the wheels to become glued to the axles.

The Weigh-In

At the weigh-in, the weight of the car must be adjusted to equal 5 ounces. The WEDGE TURBO was designed so that the weight of the car will slightly exceed 5 ounces. Therefore, the extra weight must be removed by drilling out some of the lead from the bottom of the car.

Due to differences in the density of the pine block, there is a small chance that the car will be underweight. The instructions below also cover this possibility.

Along with your car, bring the following materials to the weigh-in:

- Drill and 3/16" drill bit
- 2 clean rags
- ~3/16" diameter lead split shot fishing weight
- White glue

Use the scale at the weigh-in to determine the weight of your car.

If the Car is Overweight

1. Lay the car on its back on a clean rag.
2. Hold on to the car very tightly with your hand, and slowly drill out a small portion of the lead weights on the bottom of the car. Try to remove an equal amount of lead from each weight.
3. Re-weigh the car.
4. Repeat the previous steps until the car weighs 5 ounces.

If the Car is Underweight

1. Drill a hole 1/4" deep into the bottom of the car somewhere in front of the rear axle.
2. Put a drop of glue into the hole, and press a split shot into the hole. Make sure the weight does not hang below the bottom of the car.
3. Re-weigh the car.
4. Repeat the previous steps until the car weighs 5 ounces.

When the car is properly weighted, remove any debris, and turn it in.

Specialty Tools and Supplies

Specialty tools and supplies can help your car reach maximum velocity. Here are our favorite products, all of which are available at the Maximum Velocity web site at: www.maximum-velocity.com

PRO-Hub - An innovative new tool that performs three wheel hub preparation steps:

- Squares the wheel hub to wheel bore, thus ensuring that the wheel will mount square and true on the wheel mandrel.
- "Cones" the inner wheel hub to reduce hub-to-body contact, thus reducing friction.
- Reams out undersized wheel bores, so that the wheel fits properly on the wheel mandrel.

Axle Polishing Kit - Take the guess work out of axle polishing! This set of industrial grade cushioned abrasive papers is designed for polishing metal to a high shine, and is thus ideal for polishing pinewood derby axles. The kit consists five papers ranging from 30 micron to 3 micron (finer than pumice). One set of axle polishing papers will polish 8 axles.

Hob-E-Lube Graphite - A top quality graphite containing molybdenum. This is the lube of choice of most pinewood derby champions.

Wheel Mandrel - This tool is used to mount wheels in a drill, and is an absolute must for preparing pinewood derby wheels.

Solid Lead - The traditional choice for car weighting, solid lead is much denser than the zinc product sold at hobby stores, and is readily cut and shaped. Just be careful in handling as lead is toxic if taken internally.

Tungsten - An alternate weight, tungsten is non-toxic and much heavier than lead (weighs the same as pure gold). If you want to create a minimalist design, then tungsten is the best bet for weighting your car.

About the Author

My wife and I, and our four children live in the greater Phoenix area (it's a dry heat!). My entire family is involved in the Awana² program at our local church.

Eight years ago, we began participating in the Awana Pinewood Derby (known as the Awana Grand Prix). Then five years ago, I began leading the derby, and began studying Pinewood Derby techniques. In a desire to improve the competition by making the techniques known to all the entrants, I wrote the booklet "*Maximum Velocity!* - Pinewood Derby Car Construction Guidelines." That booklet focuses on the techniques needed to build a fast car, and only slightly covers the design of the car, and the actual wood-working techniques.

Since the basic design of the car is critical to the performance of the car, and since many people are unfamiliar with the proper construction of a Pinewood Derby car, I created several booklets of car plans. As an introduction to these booklets, I created this free booklet.

My desire is that by using our booklets, not only will you create a competitive car, but that you and your parent (or guardian) will more thoroughly enjoy the car building process. Winning the race can be the secondary goal, but the primary goal should be the enjoyment of building and racing a Pinewood Derby car with someone you care about.

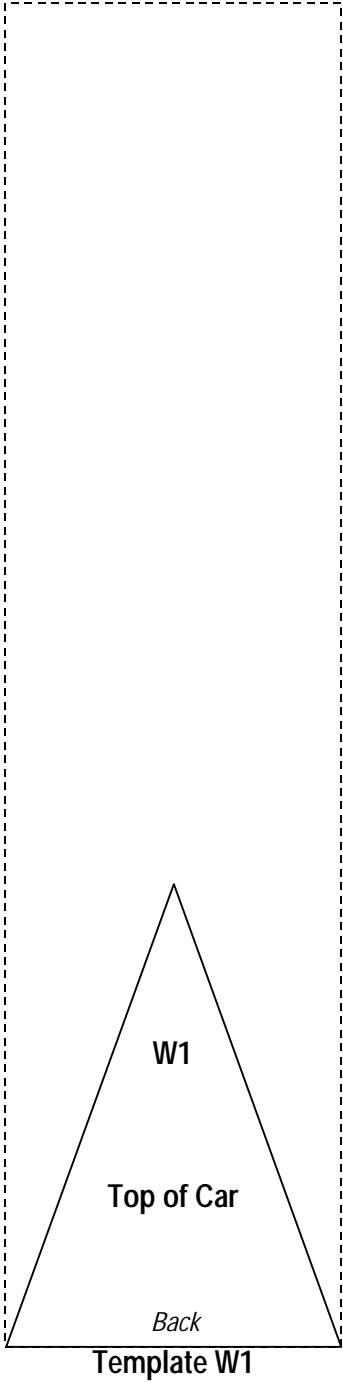
I would greatly appreciate any feedback as to how to make our booklets more useful to you. I would also like to hear about the result of your races. You can reach me by e-mail at:

info@maximum-velocity.com

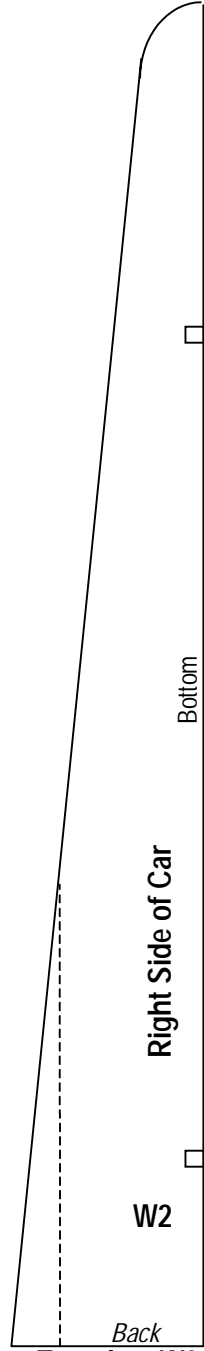
Good luck in your races, and may God bless you and your family!

Randy Davis

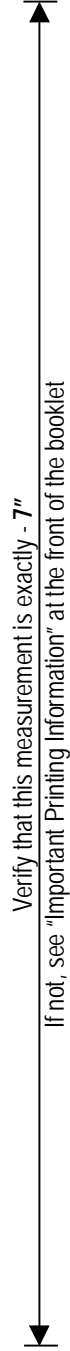
²Awana (Approved Workmen Are Not Ashamed) is a Bible-based club which began in 1950 and now has 12,000 clubs world-wide. The purpose of the club is to evangelize, challenge, and train the youth of the world to serve God. For more information on Awana, visit: www.awana.org.



Template W1



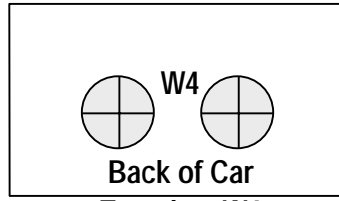
Template W2



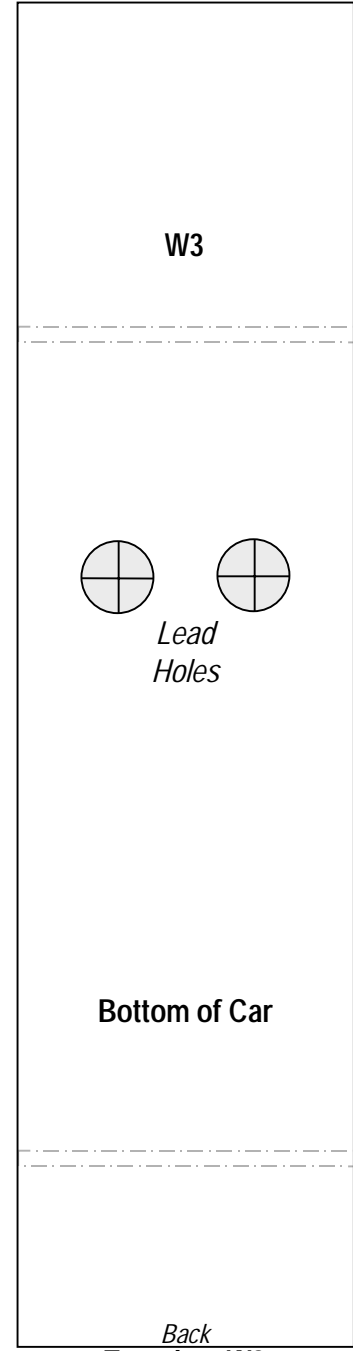
THE WEDGE TURBO



Star Template for Patriotic Design



Template W4



Template W3