

Changing the Front Brake Pads on a 2002 Toyota Prius

Required Tools and Materials:

- 14mm socket wrench
- 14mm open-ended wrench
- 4" C clamp
- block of 1x2 scrap wood
- four new brake pads: I bought Satisfied part number PR822-C "Pro Ceramic VS" for about \$55 at my local Checker Auto Parts, and this package contained all four pads, but there are other brands that make pads compatible with the Prius. I could also have used cheaper semi-metallic pads—I think the OEM pads were semi-metallic—but ceramic are supposedly better, and I wanted better quality than my OEMs, which failed prematurely. You should always replace the left and right brakes at the same time, so they are matched, but you don't need to replace the rear drum brakes at the same time as the front disc brakes.
- disc brake grease: You can get this in small packets with just enough for one brake job.

Optional Tools and Materials:

- hydraulic floor jack *
- two jack stands *
- cross-buck-style lug wrench *
 - * You can do the job one tire at a time using the emergency jack and wrench in your trunk, but these tools are helpful. Overuse of the emergency jack will wear out its bearings—it was only designed for occasional use.
- two ramps: I need these to get clearance to pump my jack handle. I made some simple ones from 2x6 wood.
- torque wrench
- two new brake rotors: These will be about \$60 each, and you will need to buy two if you want to replace your rotors. It doesn't take much more effort, so you might want to do it, because there is a small chance that your old rotors were unevenly worn enough to cause problems with the new brake pads.

Procedure:

Note: I changed the brake pads on both sides, but the steps are identical, so I only narrated the left front tire. Repeat this procedure for the right front tire. The whole process took me one and a quarter hours, but it would have gone faster if I didn't stop to take so many pictures.

Note: Unlike the procedure for the 2004+ Toyota Prius (NHW20 body style), it is not necessary to pull any brake fuses on my car. This same procedure applies to all 2001-2003 models of Prius (NHW11 body style), and it probably applies to the 1997-2000 models originally sold only in Japan (NHW10 body style). For details of changing the brakes on an NHW20 Prius, see Hobbit's write-up: <http://www.techno-fandom.org/~hobbit/cars/brkjob/>.

Step 1: Loosen the lug nuts.



You have to break the lug nuts loose *before* you get the car up on jack stands, because this rocks the car significantly. A cross-buck-style lug wrench is helpful, because the mechanic who put on the lug nuts probably over-torqued them with an impact wrench, and the cross levers of this lug wrench allow you to apply more force to the nut than you can with the little emergency wrench in your trunk.

Step 2: Raise the car.



The front jacking point is the center of the front suspension bar. I use these simple ramps made from 2x6 lumber, because otherwise there isn't enough clearance under the engine for my jack handle to go up and down. Your floor jack may not suffer from this limitation. (Be sure to set the parking brake and/or block the rear wheels so they can't roll.)

Step 3: Support the car.



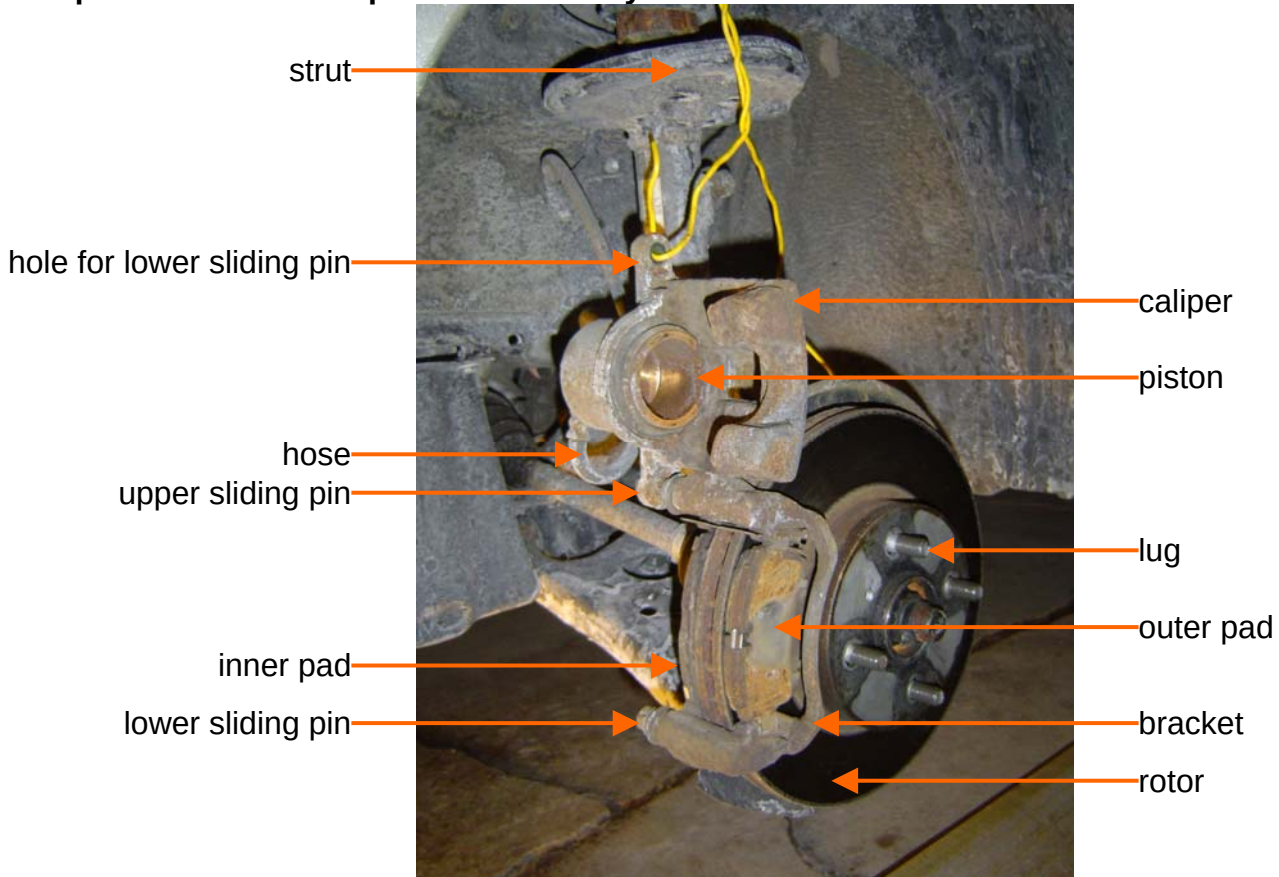
Put the jack stands under the frame at the points marked with notches. Lower the jack slowly onto the stands. Remove the lug nuts and pull off the wheels. (This is a good time to check the tires for foreign objects or uneven wear.)

Step 4: Remove the lower caliper bolt.



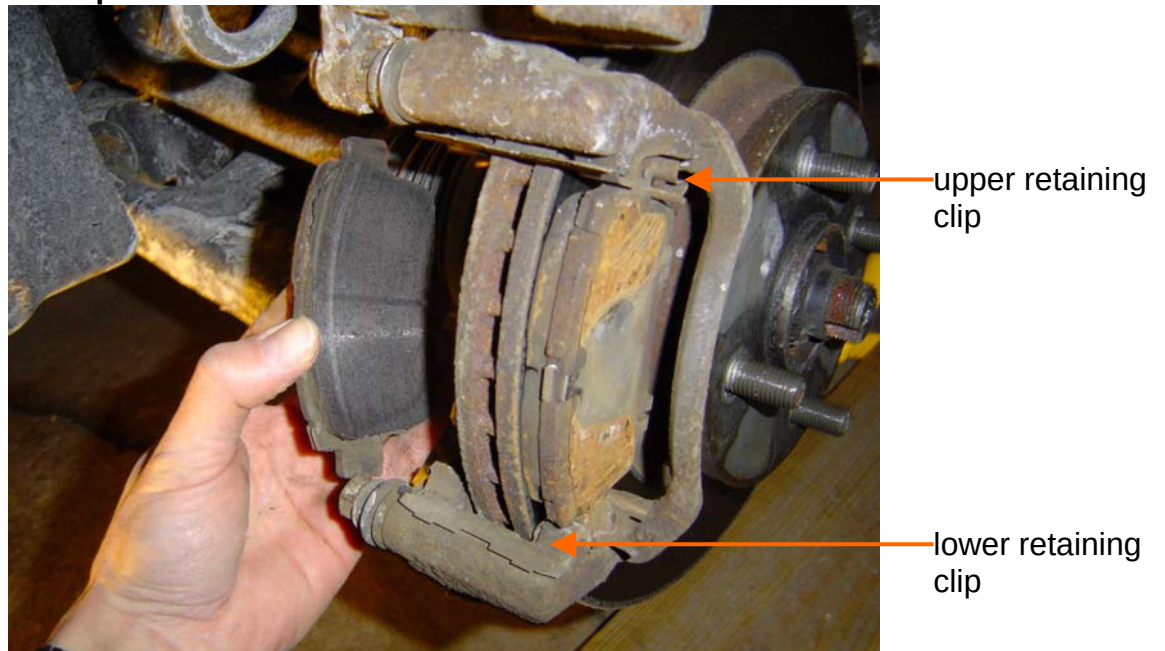
Use the open-ended wrench to keep the lower sliding pin from turning, and then loosen the bolt. It might be very tight, but don't rock the car on the jack stands. Instead, align the two wrenches so that the socket wrench is a little below the open-ended wrench, and then squeeze them like a scissors with both hands.

Step 5: Rotate the caliper out of the way.



If you're planning to replace the rotor, remove the upper caliper bolt in the same manner, slide the bracket off of the rotor, and then slide the rotor off the lugs. Otherwise, just rotate the caliper upwards on the upper sliding pin (shown here). In either case, use a piece of wire or string to hang the caliper from the strut. If you try to hold it throughout this procedure, you might drop it, which could damage the brake hose. Be gentle with the rubber boots on the sliding pins.

Step 6: Remove the old pads.



There are some springy retaining clips snapped onto the bracket. The pads slide into these clips. (If you remove the clips, be very sure they go back where they belong, because there are slight

differences between them.) Just wiggle the pads gently to get them out of the clips. If the clips are damaged, you should replace them before putting on the new pads.

Intermission: Parts of a brake pad.



A brake pad consists of a lining bonded to a backing plate. The lining is a friction material designed to be slowly worn away every time you apply the brakes. Clipped to the other side of the backing plate (only the clips are visible in this picture) are one or two anti-squeal shims. Attached to one of the backing plates is a wear indicator that is designed to rub against the rotor when the lining gets too thin, making a horrible screech that tells you to replace your brakes. In the center of the lining of each pad is a groove. If you can still see the groove, there's plenty of lining remaining. The stock pads originally had 11 mm of lining, and they should be replaced when there is 1 mm remaining.

Each of my pads has at least 5 mm of lining (i.e. 40% remaining), so why am I replacing them? I'm holding the answer in my hand. On both the left and right brakes, the lining of the inner pad delaminated, or separated from its backing pad. The parts of the caliper generally hold this loose lining in place, and it continues to work fine for a while, but it wears out faster, and eventually it crumbles and falls out. This will probably cause a catastrophic loss of braking and may damage the rotor and caliper. I don't know why two of my four pads delaminated, but I can guess they weren't designed for extended life.

On a normal car, the lining usually wears through in less than 50,000 miles. Mine still have plenty of material at 90,000 miles. This is because the Prius slows primarily by regenerative braking (i.e. spinning the main drive motor backwards, pushing electricity back into the battery). It really only uses the friction brakes when you stamp hard on the brakes, when the anti-lock brakes engage during a skid, or during the final slowing from 7 mph down to zero. Based on the wear on the linings, it appears as though my brakes have only seen the equivalent of about 20,000 miles, but the glue that binds the linings to the backing plates has actually been bouncing down the roads for 90,000 miles, and the vibration eventually shook them loose. That's why I'm putting on higher quality brake pads—I want the glue to last as long as the linings.

Step 7: Prepare the new pads.



Unclip each anti-squeal shim and apply a thin layer of disc brake grease to it (between the shim and the backing plate). Spread it around and clip it back on to the backing plate. If your brake pads have a sandwich of two anti-squeal shims on each side, put grease in two places: between the backing plate and the inner shim, and between the inner shim and outer shim. Be careful not to get any grease on the brake pad linings.

Step 8: Insert the pads.



Slide the new pads back into the retaining clips of the caliper. Orient the pads so that the wear indicator is on the upper side of the inner pad.

Step 9: Open the brake fluid cylinder.



We're about to push some hydraulic fluid back into the master cylinder. Theoretically, this could overflow the reservoir. Open the cap to relieve any pressure.

Step 10: Retract the piston.



Use a C clamp and a block of wood to force the piston back into the caliper to make room for the thicker pads. Do this slowly so you don't apply a lot of back pressure into the brake hose. Turn the clamp half a revolution, wait a few seconds, and repeat. Watch the master brake fluid cylinder to see if it overflows. When the wood reaches the caliper, remove the clamp and wood. It won't spring back right away.

Step 11: Grease the caliper.



Apply a thin layer of disc brake grease to the ring of the piston, which contacts the anti-squeal shim of the inner brake pad.



Then apply some grease to the two flanges of the caliper, which contact the anti-squeal shim of the outer brake pad. Be careful not to get any grease on the rotor.

Step 12: Reattach the caliper.



Rotate the caliper back down into position and reinstall the lower caliper bolt. (If you completely removed the caliper, reinstall both bolts.) You may need to wiggle the brake pads, rotor, and sliding pins a little to get the caliper to slide gently into place. Tighten the caliper bolt against the sliding pin (see picture in step 4). If you have a torque wrench, tighten the caliper bolts to 34 N-m (25 ft-lbf).

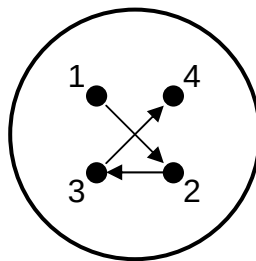
Step 13: Reattach the wheel.

Put on each lug nut only finger tight. Don't torque them while the car is still up on the jack stands.

Step 14: Lower the car.

(See picture in step 2.) Raise the car slightly with the jack under the center suspension bar. Remove the jack stands. Lower the jack slowly.

Step 15: Tighten the lug nuts.



Use a star pattern: first tighten one lug nut most of the way, then tighten the one across from it most of the way, then the one next to it, and then the final one across from it. Then repeat this star pattern to tighten them all the way. If you have a torque wrench, tighten the lug nuts to 103 N-m (76 ft-lbf).

Step 16: Repressurize the brakes.

Turn the ignition to "ON" and press the brake pedal all the way to the floor. There will be very little resistance from the pedal, but you will hear a hissing sound from under the hood as the brake fluid is pumped to each wheel to push the pistons back out. Do this a few times until you feel some resistance from the pedal. Now you can close the cap on the brake fluid cylinder (see picture in step 9). Make sure the brake fluid is between the full and empty marks. Check under the car to make sure there are no leaks.

Step 17: Break in the brakes.

Drive around some back streets slowly, and make about 20 full stops. At first, make gentle stops from 10 mph. Then gradually work up to harder stops from 20 mph and then 30 mph. This grinds off the rough surface of the new brake pad linings and conforms them to the shape of the rotor. Note: to eliminate regenerative braking and ensure you're actually using your new brake pads, get up to speed, shift to neutral, and then apply the brakes. It will take about 200 miles to fully break in the new pads, so try to avoid hard braking from high speeds for a while.