

How to Check Wheel Camber & Toe-In

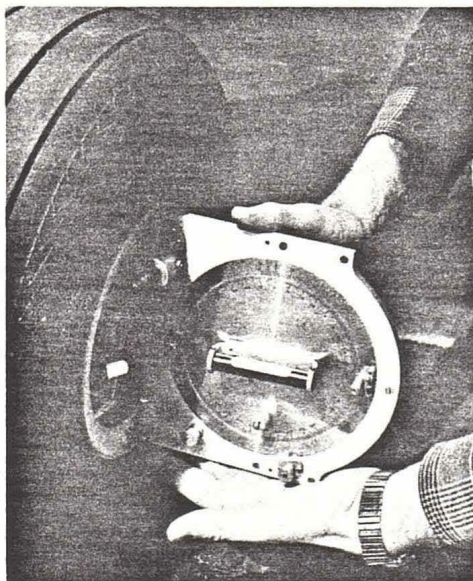
Have you noticed funny (lopsided) wear patterns on your tires on walk-around inspection lately? (You *are* checking for this, aren't you?) A dragging brake will produce uneven wear (on nose tires as well as mains), but as often as not, wheel alignment is to blame. If you have keen eyes, you can see this for yourself as you walk down the ramp at the local airport. Half the Bonanzas and Barons in the world, it seems, are out of alignment bad enough to be noticeable with the naked eye.

Your service manual may or may not cover how to check wheel alignment, and may or may not give specs for toe-in and camber. (Camber refers to a tire's deviation from perpendicular to *terra firma*.) The procedure, in any case, isn't difficult: All you need is a perfectly straight length of angle iron, aluminum channel, or wood; a carpenter's square; and a pencil.

If you're a high-wing Cessna owner, start by rounding up four metal plates approximately 18 inches across. Mash the plates together in pairs, with a heavy coating of bearing grease between the plates—then taxi your plane up onto the plates. The idea here is to relieve some of the spring tension in the landing gear legs and allow toe-in to manifest itself. (Tomahawk owners and others with bowed MLG legs should also adhere to this procedure.) Rock the wheels to make sure they are in a true neutral position.

Now lay your I-beam, angle iron, or other straightedge (long enough to reach from one main gear to the other) in front of each main gear tire. Be sure both tires have been serviced to the proper inflation. (Piper recommends that Cherokee owners also raise the plane on wing jacks just high enough so that the torque knee scissor bolt is 6.5 inches from the shiny part of the oleo.) Raise the straightedge as necessary so that the top surface of it is approximately at axle nut height.

Next, lay your carpenter's square against the straightedge and wheel. Align the "wheel" edge with the rim just at or below axle nut height. You should be able to tell at a glance whether the tire is toed-in or toed-out (or perfectly square with the straightedge). If the wheel is toed *in*, butt the carpenter's square against the straightedge, then against the wheel rim, making pencil marks on the

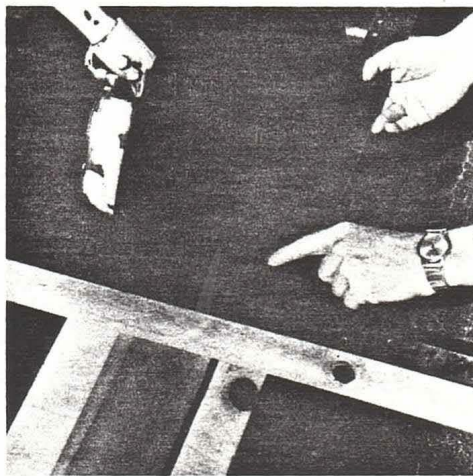


Camber is measured by placing a protractor against the wheel and taking a direct observation.

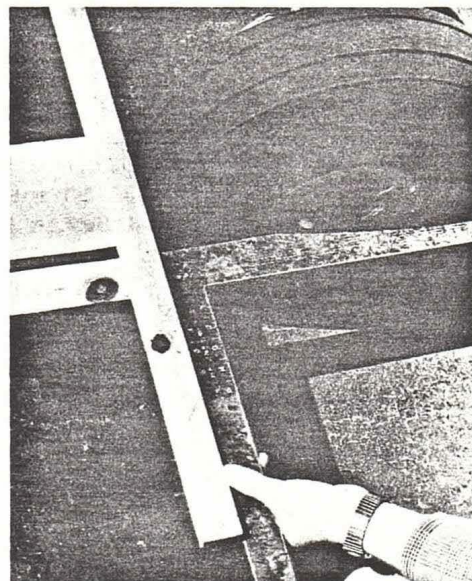
straightedge as needed to get a physical measurement of toe-in.

Repeat the foregoing procedure for the opposite main wheel. (If measurements appear questionable, roll the aircraft forward or backward slightly and repeat the procedure. Out-of-round tires will affect the accuracy of your measurements.)

Remember that it is possible to have one main that's toed *out* and the other one toed *in* (resulting in zero net toe-in). More than likely, however, both gear will be toed-in, one slightly more than the other. The *total* allowable toe-in for 1977 and later single-engine Cessnas (with round spring-steel gear



A carpenter's square is butted against the wheel rim to check toe-in, which should be equal for both wheels.



Measuring toe-in requires placing a straightedge (here, a piece of wood) across the front of each MLG tire.

legs) is zero to .180-inch maximum. For flat-leg (Wittman-style) Cessna 150s, 172s, and 182s (i.e., pre-1977), you want a total toe-in of less than .060-in.; 180s and 185s, up to .120-in. total. (Other aircraft models: Check your service manual.)

Incidentally, earlier (Wittman-legged) Cessna singles can be shimmed at the leg attachment to correct toe-in and camber problems. Late-style Cessnas with tubular steel gear legs cannot be adjusted (Cessna wants you to buy new gear legs); see your banker for details.

Oleo-strutted aircraft can be corrected for toe-out/in by suitable addition of washers at the torque knee scissor joint. On Piper PA-28 types, one AN960-416 washer (.062 thick) is good for about half a degree of adjustment in or out. When adding or removing washers to the knee joint, remember to remove or add a corresponding number of washers at the ends of the bolt to keep the bolt's "working length" the same. Most Cherokees left the factory with one AN960-416 washer under the head of the scissors bolt, and three such washers under the nut. So when adding one washer to the joint, remove a washer from the nut end of the bolt. (Use common sense, in other words.)

With a Cherokee, it should never be necessary to add or subtract more than three washers total. If you need

PHOTOS BY MICHAEL L. STOCKHILL

Place grease plates under wheels and rock wings before checking wheel alignment.

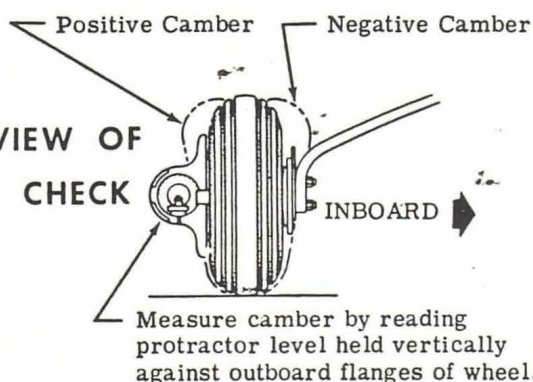
Block straightedge against tires just below axle height.

Aluminum plates approximately 18" square

Grease between plates

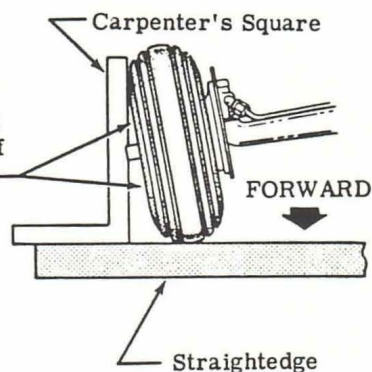
Place carpenter's square against straightedge and let it touch wheel just below axle nut.

FRONT VIEW OF CAMBER CHECK



Measure toe-in at edges of wheel flange. Difference in measurements is toe-in for one wheel (half of total toe-in).

TOP VIEW OF TOE-IN CHECK



Setting toe-in and camber in accordance with the chart while the cabin and fuel tanks are empty will give approximately zero toe-in and zero camber at gross weight. Ideal setting is zero toe-in and zero camber at normal operating weight. Therefore, if normal operation is at less than gross weight and abnormal tire wear occurs, realign the wheels to attain the ideal setting for the load condition under which the airplane normally operates.

The maximum accumulated shim thickness, measured at the thickest corner (do not include any speed fairing plates or cover plates), is .22 inch for all except the Model 182. Refer to sheet 3 for shim combinations permitted on the Model 182. Always use the least number of shims possible to obtain the desired result.

AIRPLANE MODEL	TOTAL TOE-IN	POSITIVE CAMBER
150	0" to .06"	4° to 6°
172	0" to .06"	3° to 5°
P172	0" to .06"	3° to 5°
180	0" to .12"	4° to 6°
182	0" to .06"	5° to 7°
185	0" to .12"	4° to 6°

Wheel alignment specifications for 1963-68 Cessna 100-series aircraft.

more correction than that, flip the torque links over (put the connection point on the other side), reversing the polarity of your takeup adjustment.

Taildragger owners will be amazed how much better their trusty steed handles on the ground with both tires facing dead-ahead (or toe-in the same amount). Nothing makes a taildragger harder to tame than helter-skelter gear legs.

Camber is checked by laying a pro-

tractor vertically against the wheel rim and reading the tilt (in degrees) directly. Single-engine Cessnas are typically designed to have 3 to 6 degrees of *positive* camber (top of tire leaning away from fuselage); more, in some cases. (Check your service manual.) Again, older models can be shimmed to adjust single-gear-leg problems.

Note that all of the foregoing measurements will vary (to some

degree) with aircraft ramp weight. Ideally, you want zero toe-in and near-zero camber *at normal operating weight*. That weight will vary for different operators, naturally. Let tire wear be your guide. If your tires' outer edges are scrubbing off every 100 hours, reset toe-in and camber to lower values. If inner edges are wearing, go to higher toe-in and camber. (And in the meantime, flip your tires over to even up the wear.)