FIGURE 35.1 The owner of this Honda thought that all it needed was an alignment.

FIGURE 35.2 Magnetic bubble-type camber/caster gauge.
FIGURE 35.3 Typical tire wear chart as found in a service manual.

FIGURE 35.4 Measuring points for ride (trim) height vary by manufacturer.

FIGURE 35.5 Measuring to be sure the left and right sides of the vehicle are of equal height.
FIGURE 35.6 The bulge in this tire was not noticed until it was removed from the vehicle as part of a routine brake inspection.

FIGURE 35.7 Equal outer cv joint angles produce equal steer torque (toe-in).

FIGURE 35.8 Broken or defective engine or transaxle mounts can cause the powertrain to sag, causing unequal drive axle shaft cv joint angles.
FIGURE 35.9 This alignment chart indicates the preferred setting with a plus or minus tolerance.

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<tr>
<th>WHEEL ALIGNMENT SPECIFICATIONS</th>
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<td>RADIAL</td>
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FIGURE 35.10 Using the alignment rack hydraulic jacks, raise the tires off the rack so that they can be rotated as part of the compensating process.

FIGURE 35.11 An optical-type wheel sensor. Compensation is achieved by simply rolling the vehicle backward and forward.
FIGURE 35.12 If toe for an oversize tire is set by distance, the toe angle will be too small. Toe angle is the same regardless of tire size.

FIGURE 35.13 The protractor scale on the front turn plates allows the technician to test the turning radius by turning one wheel to an angle specified by the manufacturer and observing the angle of the other front wheel.

FIGURE 35.14 By checking the SAI, camber, and included angle, a damaged suspension component can be determined by using this chart.
FIGURE 35.15 In this example, both SAI and camber are far from being equal side to side.

FIGURE 35.16 This is the same vehicle as shown in FIGURE 35.15, except now the frame (cradle) has been shifted over and correctly positioned.

FIGURE 35.17 Geometric-centerline-type alignment sets the front toe readings based on the geometric centerline of the vehicle and does not consider the thrust line of the rear wheel toe angles.
FIGURE 35.18 Thrust line alignment sets the front toe parallel with the rear-wheel toe.

FIGURE 35.19 Four-wheel alignment corrects for any rear wheel toe to make the thrust line and the geometric centerline of the vehicle both the same.

FIGURE 35.20 The rear camber is adjustable on this vehicle by rotating the eccentric cam and watching the alignment machine display.
FIGURE 35.21 Some vehicles use a threaded fastener similar to a tie rod to adjust camber on the rear suspension.

FIGURE 35.22 Aftermarket alignment parts or kits are available to change the rear camber.

FIGURE 35.23 Full-contact plastic or metal shims can be placed between the axle housing and the brake backing plate to change rear camber, toe, or both.
FIGURE 35.24 The rear toe was easily set on this vehicle. The adjusting nuts were easy to get to and turn. Adjusting rear toe is not this easy on every vehicle.

FIGURE 35.25 By moving various rear suspension members, the rear toe can be changed.

FIGURE 35.26 The use of these plastic or metal shims requires that the rear wheel as well as the hub assembly and/or backing plate be removed.
Many struts allow camber adjustment at the strut-to-knuckle fasteners. Some struts require modification of the upper mount for caster adjustment. An example of the many methods that are commonly used to adjust front caster and camber.
FIGURE 35.30 If there is a nut on both sides of the strut rod bushing, then the length of the rod can be adjusted to change caster.

FIGURE 35.31 Placing shims between the frame and the upper control arm pivot shaft is a popular method of alignment for many SLA suspensions.

FIGURE 35.32 The general rule of thumb is that a 1/8 inch shim added or removed from both shim locations changes the camber angle about 1/2 degree.
FIGURE 35.33 Some SLA-type suspensions use slotted holes for alignment angle adjustments.

FIGURE 35.34 When the nut is loosened and the bolt on the eccentric cam is rotated, the upper control arm moves in and out.

FIGURE 35.35 Many procedures for setting toe specify that the steering wheel be held in the straight-ahead position using a steering wheel lock, as shown.
**FIGURE 35.36** Adjusting toe by rotating the tie rod on a vehicle equipped with rack-and-pinion steering.

**FIGURE 35.37** Toe is adjusted on a parallelogram-type steering linkage by turning adjustable tie rod sleeves.

**FIGURE 35.38** Special tie rod adjusting tools should be used to rotate the tie rod adjusting sleeves.
FIGURE 35.39 Most vehicles have alignment marks made at the factory on the steering shaft and steering wheel to help the service technician keep the steering wheel in the center position.

FIGURE 35.40 A puller being used to remove a steering wheel after the steering wheel retaining nut has been removed.

FIGURE 35.41 The toe-in on the right wheel creates a turning force toward the right.
FIGURE 35.42 An aftermarket camber shim can be added to change the front camber on this Honda.

FIGURE 35.43 An aftermarket kit for this Ford is installed at the top of the strut tower and allows more camber and caster adjustment than is possible with the factory adjustment.

FIGURE 35.44 A typical tire temperature pyrometer. The probe used is a needle that penetrates about 1/4 inch (7 mm) into the tread of the tire for most accurate readings.
FIGURE 35.45 Jig holes used at the assembly plant to locate suspension and drivetrain components.

FIGURE 35.46 A typical analog-type steering angle sensor that uses a variable voltage as the steering wheel is rotated.

FIGURE 35.47 The output of a typical digital steering angle sensor.
Begin the alignment procedure by first driving the vehicle onto the alignment rack as straight as possible.

Position the front tires in the center of the turn plates. These turn plates can be moved inward and outward to match a vehicle of any width.

Raise the vehicle and position the alignment rack following the rack manufacturer’s instructions.
Check and adjust tire pressures and perform the pre-alignment checks necessary to be assured of proper alignment.

Select the exact vehicle on the alignment machine.

Securely mount the alignment heads or target wheels.
If mounting a transmitter-type alignment head, be sure to attach the retaining wire to the tire valve.

After installation of the heads, follow the specified procedure for compensation, which allows accurate alignment readings.

Rolling compensation is used on machines that use lasers and wheel targets.
An alignment reading is displayed even though caster has not yet been measured.

Before performing a caster sweep, install a brake pedal depressor to keep the front wheels from rotating when the steering wheel is turned.

Perform the caster sweep by turning the front wheels inward, and then outward following the instructions on the screen.
Most alignment machines will display where to make the alignment correction and will often include drawings and live action videos that show the procedure.

The rear toe is being adjusted by rotating the eccentric cam on the lower control arm while watching the display.

The alignment machine display indicates that front caster is not a factory-adjustable angle.
Adjusting the front toe on this vehicle involves loosening the jam nut (left wrench) and rotating the tie rod using the right wrench.

One last adjustment of the left front toe is needed to achieve a perfect alignment.

After disconnecting all of the attachments, reinstalling the valve caps, and removing the steering wheel holder, the vehicle should be test-driven to check for proper alignment before returning it to the customer.