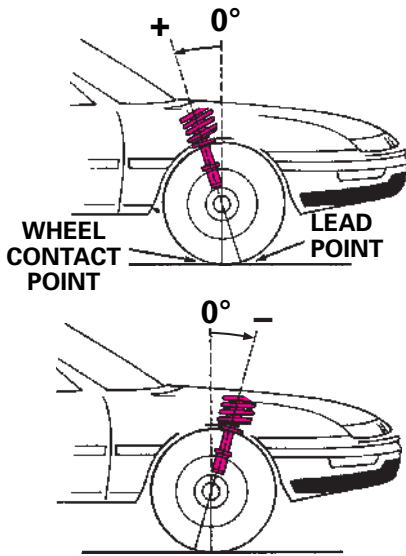


ALIGNMENT TERMS

APPLICATIONS

Caster



DEFINITION: The forward or backward tilt of the upper ball joint, or top of the strut, relative to the lower ball joint.

PURPOSE: Caster affects steering stability and steering wheel returnability.

METHODS OF CASTER ADJUSTMENT:

(1) Shims	(2) Cams	(3) Slotted Frame
(4) Strut Rod	(5) Strut Rotation	(6) Cradle Movement
(7) Offset Ball Joint	(8) Sliding Ball Joint	

0 CASTER: The upper ball joint or top strut bearing and lower ball joint are in the same plane as viewed from the side of the vehicle.

POSITIVE CASTER: The upper ball joint or top strut bearing is toward the rear of the vehicle in relation to the lower ball joint as viewed from the side of the vehicle.

NEGATIVE CASTER: The upper ball joint or top strut bearing is toward the front of the vehicle in relation to the lower ball joint as viewed from the side of the vehicle.

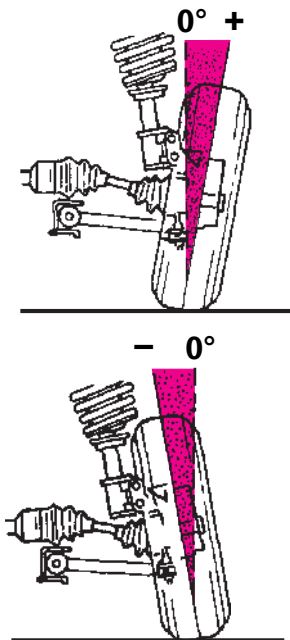
SYMPTOMS OF NEG. CASTER:

- (1) Steering wheel shows lack of "returnability" after a turn.
- (2) Steering is touchy at high speed (wander and weave).

Effect: Vehicle pulls to the side with the Lowest Caster.

Example: Left front set at 1/2° positive Caster, right front set at 1-1/2° positive Caster. This vehicle will pull to the left.

Camber



DEFINITION: Inward or outward tilt of the top of the wheel.

PURPOSE: Adjustment centers the vehicle's load on the tire, eliminating pull. Proper adjustment reduces camber tire wear and pulling.

METHODS OF CAMBER ADJUSTMENT:

(1) Shim	(5) Wedges	(9) Eccentrics
(2) Cams	(6) Ball Joint Rotation	(Offset Bushings)
(3) Slotted Frame	(7) Offset Bearing Plates	(10) Offset Ball
(4) Strut Rotation	(8) Cam Bolts	Joins

0 CAMBER: When wheel and tire assembly are in exact vertical position.

POSITIVE CAMBER: When the top of the wheel and tire assembly is tilted out, or away from the engine.

TOO MUCH POS. CAMBER CAUSES:

- (1) Wear on the outside of the tire.
- (2) Extra wear on the suspension parts with positive camber.
- (3) The vehicle will pull to the side with the **most positive** camber.

NEGATIVE CAMBER: The top of the wheel and tire assembly is tilted in, toward the engine.

TOO MUCH NEG. CAMBER CAUSES:

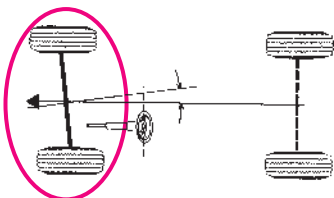
- (1) Wear on the inside portion of the tire.
- (2) Extra wear on the suspension parts with negative camber
- (3) The vehicle will pull to the side with the **most positive** camber.

UNEQUAL CAMBER From side to side causes:

(1) Vehicle to pull to the side with the more positive camber.

Example: Left front set at 1° positive. Right front set at 1/2°. This vehicle may pull left.

Setback



DEFINITION: One wheel set back further than the other.

SETBACK IS CAUSED BY:

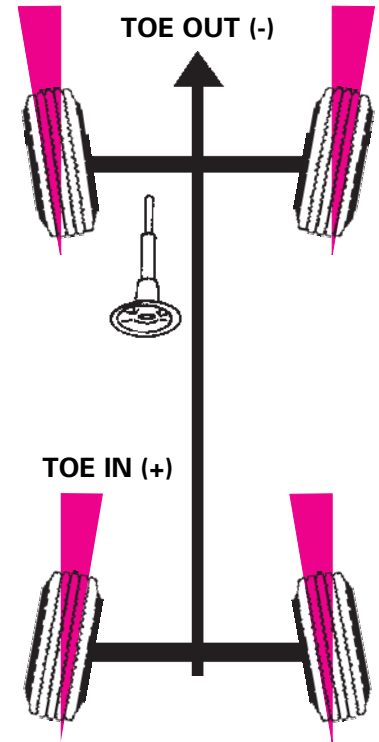
- (1) Manufacture. (Sometimes they build them this way).
- (2) Collision.

Normally up to .5" Setback will cause no problems other than steering wheel misalignment when using some types of alignment equipment.

Alignment Terms

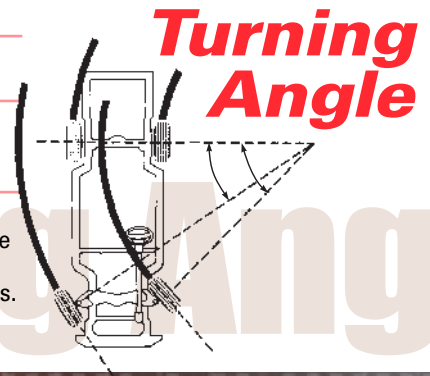
Toe

DEFINITION:	The difference between leading edges and trailing edges of the front of the wheel & tire assembly, measured at spindle height.
PURPOSE:	Minimize tire wear and rolling friction.
FRONT TOE ADJUSTMENTS:	(1) Tie Rod Adjusters
REAR TOE:	(1) Manufacturer's built-in adjuster (2) Cams (3) Cam bolts (4) Slots (4) Eccentrics (Offset Bushings) (6) Shims (7) EZ Arms XR™
0 TOE:	Distances across the front and trailing edges of the wheel and tire assemblies are equal.
TOE IN (+):	Distance across the front edges of the wheel and tire assemblies is less than across the trailing edges.
TOO MUCH TOE IN CAUSES:	(1) Rapid wear on outside edge of tire. (a) On radial tires too much Toe In resembles pos. camber wear. (b) Wear patterns are saw-toothed or scuffed . (c) Feeling sharp edges when rubbing your hand across the tire tread, from inside toward outside , reveals excessive Toe In . (2) Steering instability (extreme). (a) Wander (b) Shimmy
TOE OUT (-):	Distance across the front edges of the wheel and tire assemblies is wider than the trailing edges.
TOO MUCH TOE OUT CAUSES:	(1) Rapid tire wear-inside edge of tire. (a) On radial tires too much Toe Out resembles neg. Camber wear. (b) Wear pattern is saw-toothed or scuffing . (c) Feeling sharp edges when rubbing your hand across the tire tread, from outside to inside, reveals excessive Toe Out . (2) Steering instability (extreme). (a) Wander (b) Shimmy



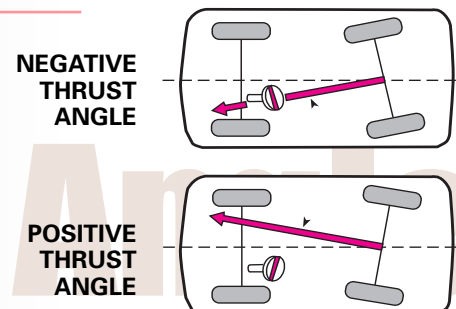
APPLICATIONS

DEFINITION:	The relative position of the front wheels during a turn.
REFERRED TO AS:	(1) Toe out on turns (2) Turning radius
PURPOSE:	To prevent tire side slip. To prevent excessive tire wear. To prevent tire squeal on turns.
DIAGNOSE FOR BENT PARTS:	If readings differ more than 1-1/2° from specifications on mos vehicles, and the tires squeal when cornering, the vehicle may have a bent steering arm. Most Turning Angles are non-adjustable angles but can be corrected by replacing bent parts.



DEFINITION:	The direction the rear wheels are positioned in reference to the vehicle centerline.
REAR WHEEL THRUST WILL CAUSE:	(1) Tire wear (2) Steering wheel misalignment (3) Car pulls (4) "Dog Tracking" (5) Crooked steering wheel
THRUST CAN BE CORRECTED BY:	(1) Adjustment of built in toe adjuster. (2) Installing tapered shims between spindle and hub. (3) Cams or other aftermarket adjusters. (4) Specialty Products Thrust Plate (#63020, #63030 Kits - page 54).

Thrust Angle

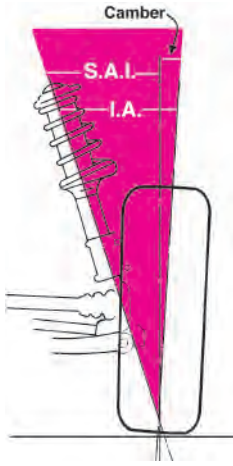




S.A.I.

I.A.

Scrub Radius



DEFINITION OF S.A.I. (Steering Axis Inclination):

The angle between a true vertical line starting at the center of the tire at the road contact point and a line drawn through the center of the strut (or upper ball joint) and lower ball joint. S.A.I. is a non-adjustable angle on most vehicles. OR...

The angle formed by the intersection of a line drawn through the upper and lower suspension mounting points (as viewed from the front of the vehicle) and true vertical. **NOTE:** A bent lower control arm can also change S.A.I. The strut suspension on a unibody vehicle has many variables and locating the damaged part may be difficult.

DEFINITION OF I.A. (Included Angle):

S.A.I. angle plus actual camber (positive) or minus actual camber (negative) is the included angle. When camber is positive, add it to the S.A.I. angle. If camber is negative, subtract it from the S.A.I. angle. This angle is used as a diagnostic tool to determine if structural misalignment is present or suspension parts are bent.

DEFINITION OF SCRUB RADIUS:

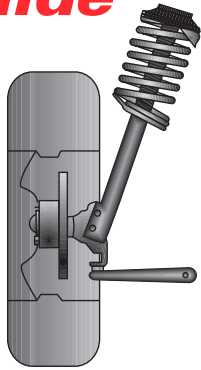
When compared at ground level, the distance between the S.A.I. line (drawn through the steering pivots) and the centerline of the tire tread is called the Scrub Radius. When this line is toward the inside of the tread, the vehicle is said to have Positive Scrub Radius. When the line is toward the outside of the tire tread, the vehicle is said to have Negative Scrub Radius.

NOTE: Negative Scrub Radius will be found on FWD MacPherson Strut vehicles.

PURPOSE:

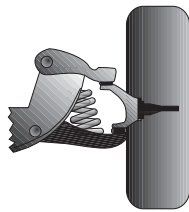
Directional Control Stability. • Steering Wheel Returnability. • Vehicle Load Placement. S.A.I., I.A. and Camber can be used to locate areas of the strut system on unibodies which may have damaged or misaligned parts. I.A. (Included Angle) is used to determine if there is a damaged spindle or strut tube. The S.A.I. (Steering Axis Inclination) is used to determine if the unibody is misaligned.

S.A.I. Diagnostic Guide



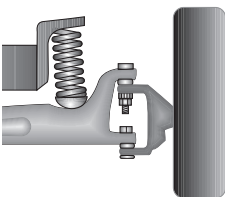
MACPHERSON STRUT SUSPENSIONS

SAI	CAMBER	INC. ANGLE	PROBABLE PROBLEM AREA
Within Spec	Less than Spec	Less than Spec	Bent Spindle Assembly and/or Bent Strut.
Within Spec	Greater than Spec	Greater than Spec	Bent Spindle Assembly and/or Bent Strut.
Less than Spec	Greater than Spec	Within Spec	Bent Control Arm, or Top of Strut Tower Pushed Outward, or Mis-Aligned Engine Cradle.
Greater than Spec	Less than Spec	Within Spec	Top of Strut Tower Pushed In, or Engine Cradle Mis-Aligned.
Less than Spec	Greater than Spec	Greater than Spec	Bent Control Arm, or Top of Strut Tower Pushed Out PLUS Bent Spindle Assembly and/or Bent Strut.
Less than Spec	Greater than Spec	Less than Spec	Bent Control Arm, or Top of Strut Tower Pushed Out PLUS Bent Spindle Assembly and/or Bent Strut.
Less than Spec	Less than Spec	Less than Spec	Bent Control Arm, or Top of Strut Tower Pushed Out PLUS Bent Spindle Assembly



SHORT/LONG ARM SUSPENSIONS

SAI	CAMBER	INC. ANGLE	PROBABLE PROBLEM AREA
Within Spec	Less than Spec	Less than Spec	Bent Spindle Assembly
Less than Spec	Greater than Spec	Within Spec	Bent Lower Control Arm or Bent Frame
Greater than Spec	Less than Spec	Within Spec	Bent Upper Control Arm or Bent Frame
Less than Spec	Greater than Spec	Greater than Spec	Bent Lower Control Arm, or Bent Spindle and/or Bent Strut.



FORD TWIN "I-BEAM" SUSPENSIONS

SAI	CAMBER	INC. ANGLE	PROBABLE PROBLEM AREA
Within Spec	Greater than Spec	Greater than Spec	Bent Spindle Assembly
Greater than Spec	Less than Spec	Within Spec	Bent "I" Beam
Less than Spec	Greater than Spec	Within Spec	Bent "I" Beam
Less than Spec	Greater than Spec	Greater than Spec	Bent "I" Beam & Bent Spindle Assembly